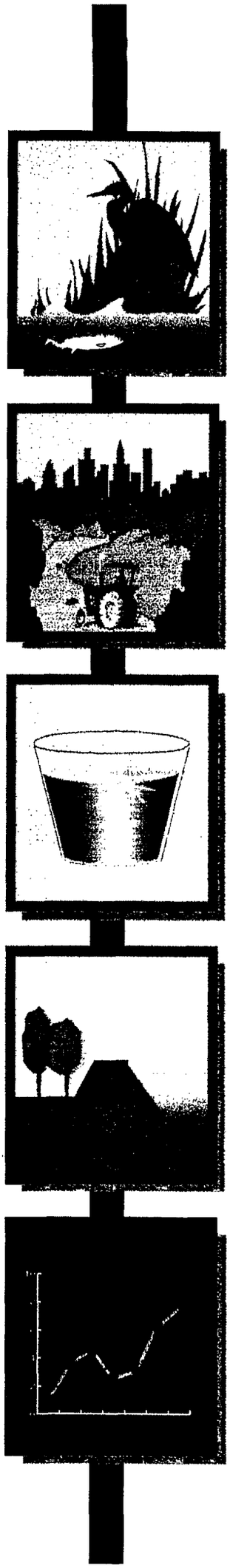

CALFED
BAY-DELTA
PROGRAM

Affected Environment and Environmental Impacts

Vegetation & Wildlife

Draft Technical Report
September 1997

CALFED/695

DRAFT TERRESTRIAL RESOURCES
TECHNICAL APPENDIX - AFFECTED ENVIRONMENT

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List of Acronyms

ACOE	U.S. Army Corps of Engineers
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DWR	(California) Department of Water Resources
ESA	Endangered Species Act
FRRAP	Forest and Rangeland Resources Assessment Program
GIS	Geographic Information System
NDDB	(California) Natural Diversity Data Base
NWI	National Wetlands Inventory
PEIS	Programmatic Environmental Impact Statement
SNA	Significant Natural Area
SWP	State Water Project
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHR	Wildlife Habitat Relationship

DRAFT TERRESTRIAL RESOURCES AFFECTED ENVIRONMENT EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This summary identifies vegetation and wildlife resources that could be affected with implementation of the CALFED Bay-Delta Program. It does not provide site-specific information on all plant and wildlife species potentially affected. Instead, information on a broad regional level is presented at a level of detail appropriate for a programmatic approach to environmental review. Special-status species of plants and wildlife and rare natural communities are emphasized because various federal and state agencies administer regulations and policies designed to preserve and protect these resources.

This summary includes a review of the data sources, a historical perspective of the study area, and recent biological conditions within the study area). Following these discussions, vegetation and wildlife resources are presented for five geographic regions: the Delta Region, Bay Region (North San Pablo Bay and Suisun Marsh), Sacramento River Region, San Joaquin River Region, and, State Water Project (SWP), and Central Valley Project (CVP) Service Areas outside the Central Valley. The level of detail provided is greatest for the Delta and Bay regions and less for other regions. The least amount of detail is provided for upper watersheds above storage facilities in each of the identified regions.

ES.2 SUMMARY OF DATA SOURCES

Summary of Data Sources for Historical Perspective Review

Information on historical (pre-1920s) through 1985 biological resource conditions and trends was obtained from documents describing changes in the condition and extent of major habitats and species in California over the last decades. Parts of this section were adapted from Appendix X of the *Sacramento River Service Area Water Contracting Program Draft Environmental Impact Statement* (U.S. Bureau of Reclamation [USBR] 1988).

The approximate extent of common habitat types in the study year immediately prior to the SWP and CVP was determined by planimetry of polygons within the study area from Wieslander's (1945) map of California vegetation. Other important sources of historical biological data include published results of environmental studies and planning efforts in the study area conducted by the California Department of Water Resources (DWR 1994), the California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS 1992), Cohen and Carlton (1995), and Madrone Associates (1980).

Summary of Data Sources for Existing Biological Resources

Descriptions of common natural communities were based on wildlife habitat descriptions published by the California Department of Forestry and Fire Protection (CDF) called *A Guide to the Wildlife Habitats of California* (Mayer and Laudenslayer 1988), supplemented with information from CDFG (Holland 1986), and the California Native Plant Society (CNPS 1993).

The distribution and acreage of common natural vegetation in the study area regions was estimated primarily from an unpublished, digitized habitat map of hardwood and other vegetation types prepared for CDF's Forest and Rangeland Resources Assessment Program (FRRAP). Additional sources used to improve mapping detail in agricultural and urban areas include a land-use study of the Delta (DWR 1993), various state maps showing city limits in large urban areas, and rectified Landsat Thematic Mapper imagery from August and September 1990 interpreted using GRASS image processing software from the U.S. Army Corp of Engineers (ACOE). Information on wildlife commonly associated with major habitats was obtained from Mayer and Laudenslayer (1988).

Information on the extent and types of riparian and wetland habitats in the study area was determined from existing published and unpublished data, including a land-use study of the Delta (DWR 1993), the USFWS National Wetlands Inventory (NWI) maps, USBR hydrographic data, DWR Land Use Mapping Program data (1987), Natural Diversity Data Base (NDDB) information (1997), and the land-cover layer of the California Gap Analysis Project (Biogeography Lab, University of California, Santa Barbara).

The extent of agricultural habitats was obtained from county agricultural commission reports (Land Use Summary). The extent of common habitat types at reservoirs was determined from an unpublished map of hardwood and other vegetation types prepared for FRRAP and a USBR report (1990).

Summary of Data Sources for Special-Status Plant Communities

Descriptions and information on general distributions of rare natural communities were based on unpublished data from CDFG (Holland 1986; NDDB 1997).

Summary of Data Sources for Significant Natural Areas

Significant natural areas (SNAs) have no legal status (unless they include designated critical habitat for endangered species); however, areas have been designated by the CDFG to increase awareness about California's natural diversity and identify opportunities to conserve these resources. Information on SNAs was obtained from the Natural Heritage Division of the CDFG.

Summary of Data Sources for Special-Status Species

Special-status species are plants and animals that are legally protected under state and federal Endangered Species Acts (ESAs) or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing. For the purpose of this study, special-status plants are species in the following categories: federal or state threatened,

endangered, or candidate for listing. Special-status animals are species in the following categories: federal or state threatened or endangered, federal candidates, state proposed.

A summary of the total number of sensitive species within each of the CALFED study area regions is presented in this report. This list is based on the Central Valley Project Improvement Act (CVPIA) Draft Programmatic Environmental Impact Statement (PEIS) (1997). For more information on the status, habitats, and distribution of special-status plants and wildlife in the project area refer to the Impact Assessment Technical Appendix.

ES.3 SUMMARY OF HISTORICAL BIOLOGICAL RESOURCES

Measurable, documentable changes in the natural landscape began soon after Spaniards first settled in California during the 1770s. Coastal grasslands changed with the introduction of European grasses and forbs to help feed cattle and sheep, first near the missions and later on more inland ranches.

Early reports from European explorers described the herds of grazing animals in the Central Valley as rivaling the bison of the central plains or the antelope of South Africa (McCullough 1971); waterfowl were widely distributed and abundant (CDFG 1983).

When Shasta Dam was constructed in 1944, many of California's natural habitats had been altered dramatically and irrevocably from their near-pristine conditions of 150 years earlier. Extensive herds of native grazing animals and their associated predators had been eliminated. Approximately 30 percent of all natural habitats had been converted to urban and agricultural lands.

Historical records indicate agriculture and irrigation development in the study area began in the mid-1800s. Prior to the extensive levee system and water development facilities in the study area, agriculture in the region consisted primarily of dryland farming or irrigated agriculture from artesian wells, groundwater pumping, and some creek canals. Following the completion of the levees in the Delta area in 1913, a series of human-made waterways and water development facilities were constructed. Water development facilities were constructed to ship water from the Delta to other parts of the State for agricultural, urban, and other uses (DWR 1993). Agricultural land-use acreage within the Central Valley in 1945 is estimated at approximately 8 million acres, slightly more than current estimates.

ES.4 SUMMARY OF EXISTING BIOLOGICAL RESOURCES IN THE CALFED STUDY AREA

An overview of plant communities and special-status species resources within the CALFED study area is provided below. Plant community resources are mapped and defined as either upland, wetland, agriculture, or urban. Plant community acreages within each study region are provided in Table ES-1. Upland plant communities within the CALFED study area include:

- Mixed conifer forest
- Montane hardwood
- Pinyon juniper
- Valley foothill hardwood
- Chaparral

TABLE ES-1 APPROXIMATE NATURAL COMMUNITY AND AGRICULTURAL CROP ACREAGES IN CALFED STUDY AREA REGIONS

	Study Area Region				
Habitat	Sacramento River	San Joaquin River	Bay[a]	Delta	All
Mixed conifer forest	3,690,000	1,053,000	0	0	5,342,000
Montane hardwood	370,000	103,000	0	0	623,000
Pinyon-juniper	2,000	0	0	0	139,000
Valley foothill hardwood	2,055,000	1,377,000	[b]	0	4,023,000
Chaparral	968,000	719,000	[b]	0	2,108,000
Sagebrush scrub	50,000	0	0	0	50,000
Alkali desert scrub and desert scrub	0	14,000	0	0	481,000
Grassland	1,066,000	1,073,000	170,000	0	3,089,000
Riparian	14,000	15,000	2,000	7,000	50,000
Freshwater and saline emergent wetland	157,000	138,000	66,000	25,000	352,000
Open water	122,000	52,000	126,000	56,000	240,000
Barren	242,000	8,000	13,000	0	253,000
Subtotal (Natural Habitats)	**8,736,000**	**4,552,000**	**377,000**	**88,000**	**16,750,000**
Agriculture					
Grains	601,000	436,000	[c]	97,000	1,480,000
Pasture	442,000	868,000	[c]	95,000	1,930,000
Rice	398,000	19,000	[c]	18,000	436,000
Orchards and vineyards	322,000	843,000	33,000	20,000	1,674,000
Vegetables	221,000	490,000	[c]	275,000	1,124,000
Cotton	0	484,000	[c]	0	1,185,000
Subtotal (Agriculture Habitats)	**1,984,000**	**3,140,000**	**45,000**	**505,000**	**7,829,000**
Urban and other					
Urban	252,000	188,000	51,000	46,000	709,000
Other	1,057,000	427,000	14,000[d]	61,000	2,029,000
Subtotal (Urban and Other)	**1,309,000**	**615,000**	**65,000**	**107,000**	**2,738,000**
Total (All Habitats)	**12,029,000**	**8,307,000**	**487,000**	**700,000**	**27,317,000**

Notes:
All acreages are rounded tothe nearest 1,000 acres.
Community types that do not occur in the Central Valley or Delta (i.e., coastal and desert communities) are not included in this table.
Riparian vegetation acreage for the Sacramento Valley is based on the *Sacramento River Environmental Atlas* (DWR 1978) and excludes an unquantified and possibly substantial amount of vegetation along tributaries to the Sacramento River.
Habitat classification for the Delta Region differs slightly from that used in other regions because of the different data source. Grasslands in the in the Delta Region are included in "Agriculture." "Freshwater emergent wetland" in the Delta includes all palustrine wetlands. "Saline emergent wetland" in the Delta includes all estuarine wetlands.
[A]Based on California Central Valley Wetlands and Riparian Geographic Information Service (CDFG 1997), Version 1.0 (includes Suisun Marsh and Bay, lower watersheds of Napa, Sonoma, Petaluma drainages; and San Pablo Bay)
[B] Not separately classified, part of the "Other" category.
[C]Not separately classified, part of the total Agricultural Habitats category.
[D] Includes chapparal, valley foothil hardwood, and residential trees.
Sources:
Natural Communities: CDF unpublished map (digital format).
Urban Areas: Landsat Thematic Mapper data (classified using GRASS software) and DWR (1993).
Agricultural Habitat: DWR (1993).
Delta: "Wetlands" coverage for Delta from Teale Data Center, Sacramento, CA, compiled from NWI maps.
"Other" Areas: Calculated as the difference between the total area within the region boundaries and the sum of all natural, agricultural, and urban habitats. "Other" includes a variety of industrial, small urban, and other Areas, including some natural habitats.

- Sagebrush
- Alkali desert scrub/desert scrub
- Grassland

Wetland plant communities within the CALFED study area include:

- Riparian (herb, scrub, forest, and woodland subtypes)
- Freshwater and saline emergent wetland
- Open water
- Barren

Although not a true habitat type, agricultural lands provide some resources to native wildlife. Agriculture types within the CALFED study area include:

- Grains
- Pasture
- Rice
- Orchards and vineyards
- Vegetables
- Cotton

Rare natural communities are recognized by state and federal agencies as important habitats because of their high species diversity and richness, high productivity, unusual nature, limited distribution, and declining status, or some combination of these qualities. The NDDB maintains a list of rare natural communities in California. The CALFED study area encompasses 24 rare natural communities.

The SNA Program is administered by CDFG and designed to encourage recognition of the state's most significant natural areas and to seek perpetuation of these areas (California Fish and Game Code, 1930-1933). SNAs have no legal status. They have been identified in response to a legislative mandate to raise the level of awareness about California's natural diversity and to identify opportunities for cooperative efforts to conserve important biological resources.

CDFG uses the NDDB to identify SNAs. The exact boundaries of SNAs have not been established because thorough field surveys have not been completed. SNAs have been identified on the basis of biological value alone; geological or cultural resource values have not been included in the inventory.

The distribution of SNAs varies within the CALFED study area and is further discussed by region.

Special-status species are plants and animals that are recognized as rare by state and federal agencies and conservation groups. They include federally listed and state-listed threatened or endangered species, and federal or state species of concern. The total number of sensitive species is further discussed by region. Complete descriptions, including legal status, distribution, and habitat requirements of special-status species, are provided in the Impact Assessment Technical Appendix. Tables ES-2 and ES-3 present numbers of special-status plants and wildlife in the study area.

ES.5 SUMMARY OF BIOLOGICAL RESOURCES IN THE DELTA REGION

Vegetation types within the Delta Region include both wetland- and riparian-type communities. Table ES-1 summarizes the area of each of these habitat types to the nearest 1,000 acres. Wetland and riparian-type communities occupy 32,000 acres, or 5 percent of the total land use in the region. Open water occupies another 56,000 acres, or 8 percent. One upland community, agriculture, also occurs in the Delta Region

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TABLE ES-2 NUMBERS OF SPECIAL-STATUS PLANTS BY STATUS LEVEL AND HABITAT IN EACH CALFED REGION[1]

Region/Status	Mixed Conifer Forest	Montane Hardwood	Pinyon-Juniper	Valley-Foothill Hardwood	Valley-Foothill Riparian	Inland Dunes	Montane Riparian	Chaparral	Alkali Desert Scrub	Desert Scrub	Sagebrush & Bitterbush Scrub	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh
Delta														
Federally listed or proposed						2						9		2
State-listed					1							2	2	1
Federal candidate														
Delta Totals					**1**	**2**						**11**	**2**	**3**
Bay														
Federally listed or proposed		2	3	4				1	5			12		
State-listed	1	1		1						1		1		
Federal candidate		1		1								1		
Bay Totals	**1**	**4**	**3**	**6**				**1**	**5**	**1**		**14**		
Sacramento River														
Federally listed or proposed	1	8		7				6	1			18	1	1
State-listed	2	2		2	1			2	1			3	3	1
Federal candidate		1		1				3						
Sacramento River Totals	**3**	**11**		**10**	**1**			**11**	**2**			**21**	**4**	**2**
San Joaquin River														
Federally listed or proposed		6	1	9				2	4			15		
State-listed	4	4		4	2			4				2	2	1
Federal candidate	1	2		3				2				1		
San Joaquin River Totals	**5**	**12**	**1**	**16**	**2**			**8**	**4**			**18**	**2**	**1**

NOTE: Coastal and desert habitats that do not occur in the Central Valley are not included in this table.

[1] See Terrestrial Resources Summary - Environmental Impacts for a complete list and description of individual sensitive species by region.

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TABLE ES-3 NUMBER OF SPECIAL-STATUS WILDLIFE SPECIES BY STATUS LEVEL AND HABITAT IN EACH CALFED REGION[1]

Region/Status	Mixed Conifer Forest	Montane Hardwood	Pinyon-Juniper	Valley-Foothill Hardwood	Valley-Foothill Riparian	Inland Dunes	Montane Riparian	Chaparral	Alkali Desert Scrub	Desert Scrub	Sagebrush & Bitterbush Scrub	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh	Lacustrine	Riverine	Irrigated Pasture	Row Crops	Grain Crops	Rice
Sacramento River																				
Federally listed or proposed	1				1							3	8		4	4	1		1	
State-listed					1		1					1	2	1	2	1		1	1	
Federal candidate												2	1				1		1	
Sacramento River Totals	**1**				**2**		**1**					**6**	**11**	**1**	**6**	**5**	**2**	**1**	**3**	
Delta																				
Federally listed or proposed						1							8	2	3	3	1		1	
State-listed					2		1						1	1		1	2	1	3	
Federal candidate					1								1		1		1		1	
Delta Totals					**3**	**1**	**1**						**10**	**3**	**4**	**4**	**4**	**1**	**5**	
San Joaquin River																				
Federally Listed or proposed	1				2				6	1		5	6		3	3	1		1	
State-listed				1	3		1					1	1		1			2	1	
Federal Candidate												2	1		1		1		1	
San Joaquin River Totals	**1**			**1**	**5**		**1**		**6**	**1**		**8**	**8**		**5**	**3**	**2**	**2**	**3**	
Bay																				
Federally listed or proposed	1				2				5			5	4		2	1				
State-Listed	1				3		1	1				1	1		1			2	1	
Federal candidate						1					1	2	2		1		1		1	
Bay Totals	**2**				**5**	**1**	**1**	**1**	**5**		**1**	**8**	**7**		**4**	**1**	**1**	**2**	**2**	

NOTE: Coastal and desert habitats that do not occur in the Central Valley are not included in this table.

[1] See Terrestrial Resources Technical Appendix - Environmental Impacts for a complete list and description of individual sensitive species by region.

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and occupies approximately 505,000 acres (72 percent) out of a total land area of 700,000 acres.

Several factors affect the wetland and terrestrial habitat conditions and productivity within the Delta. These factors include land subsidence of the Delta islands, habitat fragmentation, and the introduction and expansion of nonnative plant and animal species.

Special-Status Plants

Generally, the distribution of plant and animal species in the Delta Region is closely linked with the distribution of one or more habitat types on which a species is dependent. The largest number of special-status species occurs in grassland, which includes vernal pools. The second largest number of special-status species occurs in freshwater emergent wetland.

At least three plant species that were once present in the Delta Region are presumed to be extinct: Mount Diablo buckwheat, diamond-petaled California poppy, and caper-fruited tropidocarpum. The extinction of these three plants was most likely caused by agricultural and urban development of grassland and shrubland habitat. At least two special-status plant species, delta button-celery and Mount Diablo manzanita, once occurred in the Delta Region but currently occur only outside the Delta Region. The extent of both species has been reduced by urban and agricultural development.

Special-Status Wildlife

Most of the special-status wildlife species are associated with freshwater emergent wetlands, open water of marshes, and cereal and grain crops. Species such as the American peregrine falcon, bald eagle, Swainson's hawk, California least tern, California black rail, California red-legged frog, California tiger salamander, northwestern pond turtle, giant garter snake, and various fairy shrimp were probably common species in the Delta.

Several wildlife species that historically were present in the Delta Region are now extinct, including the California condor, grizzly bear, gray wolf, Antioch dunes katydid, Antioch weevil, Antioch Cophuran robber fly, yellow-banded andrenid bee, and Antioch sphecid wasp (Jones & Stokes Associates 1987). Habitat destruction and unregulated hunting and trapping were primary causes of species extinction (Storer and Tevis 1955).

Special-status wildlife species that once occurred in the Delta Region, but are now found only outside the Delta Region, include the San Joaquin dune beetle, western least bittern, western yellow-billed cuckoo, and greater western mastiff bat. Habitat loss and urban development are the primary reasons for their decline.

Vernal pools and other freshwater seasonal wetlands support several special-status invertebrates. For example, the Delta green ground beetle is known from two occurrences in Solano County; in the Delta Region, it occurs only at the Jepson Prairie Preserve. Few occurrences of special-status crustaceans have been documented in vernal pools, in part because routine surveys for these species have been conducted only since 1992. In particular, vernal pool fairy shrimp are a unique resource, many species of which are listed as threatented or endangered.

Although severely declining due to a dramatic shrinkage of suitable habitat, the valley elderberry longhorn beetle (federally listed as threatened) has been found in the Delta Region on McCormac-Williamson and New Hope tracts (CDFG 1995).

Grasslands and dryland-farmed fields in the southwestern portion of the Delta support the San Joaquin kit fox (federally listed as endangered, state-listed as threatened). Areas south of Brentwood, east and south of Clifton Court Forebay, and west of Tracy are considered the northernmost portion of the species range within the Delta Region (NDDB 1996). Several special-status invertebrates occur in the Antioch Dunes area. The Lange's metalmark butterfly (federally listed as endangered) is known to occupy 15 acres of open dune habitat in the Antioch Dunes National Wildlife Refuge and adjacent properties owned by Pacific Gas and Electric Company. Six other insect species endemic to the Antioch Dunes are considered species of concern by USFWS.

The greater sandhill crane (state-listed as threatened) winters in the Central Valley and forages in the Delta in harvested cornfields and pastures, as well as in wetlands and flooded fields. In the Delta, greater sandhill cranes traditionally roost near Thornton, on Black Tract, Canal Tract, and Staten Island and at scattered locations on other islands (CDFG 1995; Miriam Green Associates 1996).

The Aleutian Canada goose (federally listed as threatened) winters in the Central Valley near Colusa and along the San Joaquin River from Modesto to Los Banos. These geese have also been observed in the Delta, but probably only during migration where they forage in agricultural fields (CDFG 1995).

Significant Natural Areas

A total of 29 SNAs in the Delta Region protect fresh, brackish, and salt marsh; inland dune; and valley sink scrub habitats. For example, a small but biologically important remnant native grassland is present at the Jepson Prairie Preserve in the northwestern part of the Delta. Antioch Dunes, another SNA, is a small area of inland dune habitat near Antioch, in Contra Costa County, and provides important habitat for legally protected plant and invertebrate species, including Antioch Dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly.

Waterfowl and Shorebirds

The Central Valley portion of California is the most important waterfowl wintering area on the Pacific Flyway, annually supporting approximately 60 percent of the Flyway's waterfowl population (Central Valley Habitat Joint Venture [CVHJV] 1990). Approximately 10 percent (or 6 percent of the flyway's waterfowl population) of California's wintering waterfowl population occurs in the Delta (CVHJV 1990). Between 1969 and 1990, estimates of the wintering waterfowl population in the Bay-Delta area ranged from a high of 1.3 million in 1977 to a low of 109,000 in 1982. The average wintering population between 1981 and 1990 was estimated to be 390,500 (DWR 1994). Important foraging habitats include permanent saline, brackish and freshwater marshes, seasonal wetlands and agricultural croplands (CVHJV 1990).

ES.6 SUMMARY OF BIOLOGICAL RESOURCES IN THE BAY REGION

Natural and Agricultural Communities and Associated Wildlife

Natural communities in the Bay Region include tidal flats, and freshwater and emergent wetlands. The portion of the Bay Region that would be the focus of CALFED activities includes northern San Pablo Bay and Suisun Marsh and receives waters through the Delta, draining 40 percent of the state. Suisun Bay supports large areas of tidal flats that provide important foraging habitat for shorebirds. Suisun Marsh supports mostly saline emergent wetland, which provides habitat for salt marsh species that prefer infrequently flooded, salt marsh habitat. The nonleveed lowlands in the region support species' range within the Delta Region (NDDB 1996). wetlands that change in character from salt marsh around Suisun Marsh to brackish marsh on the major nonleveed channel islands, such as Browns Island.

The animal and plant species composition of the tidal wetlands changes as the salinity gradient decreases from west to east. The 112,900-acre Suisun Marsh contains more than 10 percent of the remaining wetlands in California and is one of the largest contiguous brackish marshes in the U.S. (DWR 1984). Approximately 89 percent (53,000 acres) of the wetlands consist of leveed marshlands that support mostly saltgrass, pickleweed, alkali bulrush, and tule (CVPIA 1997). Adjacent to the wetlands is upland habitat including grassland, shrub, riparian, and agricultural communities (DWR 1984).

Special-Status Plants

Table ES-2 lists the legal status, distribution, and habitat of special-status plants in the Bay Region. Thirty-five special-status plants have known occurrence, six special-status plants have potential to occur, and six species have been extirpated from the Bay Region (Skinner and Pavlik 1994; NDDB 1996). The status of state-listed and federally listed species and species proposed for listing is described below.

The saline emergent marsh habitat of Suisun Marsh supports populations of two plant species that are proposed for federal listing as endangered: Suisun thistle and soft bird's-beak. The latter species also occurs in saline emergent marshes in northern Contra Costa County.

Palmate-bracted bird's-beak (federally listed and state-listed as endangered) occurs in alkaline scrub and grasslands. It is presumed extirpated from the Bay Region but has potential to occur in its alkaline habitats. Mason's lilaeopsis (state-listed as rare, no federal listing status) occurs in brackish or freshwater tidal marshes of Suisun Bay/Marsh.

Special-Status Wildlife

Table ES-3 presents a summary of 41 special-status wildlife species and their associated habitats that could potentially occur in the Bay Region. The majority of these species are associated with upland grasslands and freshwater emergent wetlands and are restricted in their range because of the fragmentation and low diversity of habitats. Species such as bald eagles and peregrine falcons are seasonal visitors to the Bay. Two federally listed and state-listed endangered species occur in saline emergent wetlands of the Bay Region: the salt marsh harvest mouse and the California clapper rail. The salt marsh yellowthroat and salt marsh song sparrow subspecies use the tall emergent vegetation that grows in the more brackish areas. California brown pelicans, snowy plover, and California least tern also occur in this region.

Waterfowl and Shorebirds

The Bay Region is an important waterfowl area that may contain more than 1 million birds during migration with more than 70 percent of the waterfowl (or 86 percent of the Pacific Flyway's total waterfowl population) on the Pacific Flyway moving through this area (USFWS 1989). Mid-winter waterfowl surveys in 1991 estimated nearly 268,700 waterfowl in the Bay Region, including approximately 265,000 ducks, primarily scaups, scooters, canvasbacks, ruddy ducks, and pintails.

The Bay Region is a particularly important area for shorebirds, supporting more shorebirds than all other California coastal wetlands combined (Page et al. 1992). An estimated 300,000 to 400,000 shorebirds in fall and 600,000 to 1 million shorebirds in spring can be found in this region (Page et al. 1992).

Significant Natural Areas

A total of 32 SNAs in the Bay Region protect brackish marsh, salt marsh, open water, vernal pools, and native grassland habitat. Some of the larger SNAs include Dozier Vernal Pools, Peytonia Slough, Pelican Point Marsh, Napa Slough, and Chain Island.

ES.7 SUMMARY OF BIOLOGICAL RESOURCES IN THE SACRAMENTO RIVER REGION

Natural and Agricultural Communities and Associated Wildlife

The ten natural terrestrial community types in the Sacramento River Region occupy nearly 8.7 million acres, or 72 percent, out of a total land area of 12 million acres. They include mixed conifer forest, montane hardwood, valley foothill hardwood, montane riparian, valley foothill riparian, chaparral, sagebrush scrub, grassland, and freshwater and saline emergent wetlands (marsh). Table ES-1 summarizes the area of each of these habitat types to the nearest 1,000 acres.

Special-Status Plants

Table ES-2 lists 65 special-status plants that occur in the Sacramento River Region. The largest number of special-status species in this region occurs in grassland, which includes vernal pools. The next largest number of special-status species occurs in chaparral and montane hardwood.

Special-Status Wildlife

Table ES-3 identifies a total of 39 special-status wildlife species that could occur in the Sacramento River Region and their preferred habitats. The majority of these species are associated with grasslands, freshwater emergent wetlands, lakes, and rivers on the valley floor, and the 12 reservoirs that occur in this region. Many of these species have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects. Grain crops also provide important habitat for species such as the Aleutian Canada goose, Swainson's hawk, ferruginous hawk, greater sandhill crane, and loggerhead shrike.

Significant Natural Areas

The Sacramento River Region has 188 designated SNAs. Many of these are along the Sacramento River and contain habitats such as Fremont cottonwood riparian, valley oak riparian, mixed riparian, and Great Valley willow scrub. These habitats support riparian-dependent, special-status wildlife

species, such as western yellow-billed cuckoo, bank swallow, and valley elderberry longhorn beetle.

Waterfowl and Shorebirds

Private duck clubs and state and federal refuges in the Sacramento Valley provide essential habitat for wintering waterfowl and shorebirds. Approximately 55 percent of the waterfowl (or 92 percent of the Pacific Flyway waterfowl populations) that winter in the Central Valley use Sacramento Valley wetlands (CVHJV 1990). Midwinter waterfowl surveys in 1991 estimated 2,127,800 waterfowl in the valley, including approximately 1,432,000 ducks and 572,800 geese. Additionally, there were more than 25,000 swans and 25,000 American coots in the valley. Sacramento Valley wetlands also provide important habitat for shorebirds, with more than 140,000 shorebirds counted in the valley during winter 1992-1993 (Shuford et al. 1993).

ES.8 SUMMARY OF BIOLOGICAL RESOURCES IN THE SAN JOAQUIN RIVER REGION

Natural and Agricultural Communities and Associated Wildlife

The natural terrestrial community types in the San Joaquin River Region occupy approximately 4.6 million acres out of a total land area of 8.3 million acres. The natural communities include mixed conifer forest, montane hardwood, valley foothill hardwood, montane riparian, valley foothill riparian, chaparral, grassland, and freshwater and saline emergent wetlands. Table ES-1 summarizes the area of each of these habitat types to the nearest 1,000 acres.

Special-Status Plants

Sixty-nine special-status plant species occur in the San Joaquin River Region. The largest number of special-status species (18) occurs in grassland. The second largest number of special-status species (16) occurs in valley foothill woodland.

Special-Status Wildlife

Forty-six special-status wildlife species could occur in the San Joaquin River Region. Most of these species are associated with grasslands, freshwater emergent wetlands, lakes, and rivers that occur on the valley floor. Many of the species have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects. Grain crops do, however, provide important habitat for species such as Aleutian Canada goose, Swainson's hawk, ferruginous hawk, greater sandhill crane, and loggerhead shrike.

Significant Natural Areas

The 77 SNAs in the San Joaquin Valley are scattered throughout the region but are concentrated in the grasslands and also in freshwater marsh, valley sink scrub, and grassland vernal pool habitats.

Waterfowl and Shorebirds

The San Joaquin River Region supports approximately 25 percent of the Central Valley waterfowl and shorebird populations and up to 30 percent of the wintering duck population (CVHJV 1990; Shuford et al. 1993). Winter shorebird numbers in 1992-1993 were estimated at 66,700 birds (Shuford et al. 1993). Between 100,000 and 1 million birds were estimated during annual spring staging during 1988-1992 (Page et al. 1992).

ES.9 SUMMARY OF BIOLOGICAL RESOURCES IN THE SWP AND CVP SERVICE AREAS OUTSIDE THE CENTRAL VALLEY

The SWP and CVP Service Areas include the Central Coast, South Coast, and San Francisco regions. It is not known specifically how the CALFED Project would affect these service areas; therefore, resources within these service areas are described in very general terms.

Natural Plant Communities

The natural communities occurring in the Service Areas vary by region. The Central Coast Region is dominated by mixed conifer and mature hardwood forest; valley hardwood and valley foothill riparian forests and woodlands; chaparral, coastal sage scrub, and desert alkali; scrub habitats; coastal beaches and cliffs; grassland; freshwater emergent wetland; and open water on reservoirs, lakes, and rivers. Dominant natural communities within the South Coast Region include grassland, chaparral, sage scrub, and riparian habitats.

Natural communities in the San Francisco Region are dominated by chaparral with pockets of mixed conifer forest, montane hardwood, valley foothill riparian, coastal scrub, inland dunes, coastal beaches and cliffs, grassland, and freshwater and emergent wetlands.

Rare Natural Communities

Most of the natural communities previously listed occur within the Services Areas (Central Coast and San Francisco regions) with the addition of the following 13 communities: central foredunes, central maritime scrub, Monterey cypress forest, Monterey pygmy cypress forest, central dune scrub, maritime coast range ponderosa forest, Monterey pine forest, northern Bishop pine forest, northern claypan vernal pool, northern foredune grassland, northern interior cypress forest, northern maritime chaparral, and northern vernal pool.

DRAFT TERRESTRIAL RESOURCES TECHNICAL APPENDIX - AFFECTED ENVIRONMENT

I. INTRODUCTION

This technical appendix identifies vegetation and wildlife resources that could be affected with implementation of the CALFED Bay-Delta Program. It does not provide site-specific information on all plant and wildlife species potentially affected. Instead, information on a broad regional level is presented at a level of detail appropriate for a programmatic approach to environmental review. Special-status species of plants and wildlife and rare natural communities are emphasized because various federal and state agencies administer regulations and policies designed to preserve and protect these resources. Readers should note that species common names are used instead of scientific names to ease readability of the document.

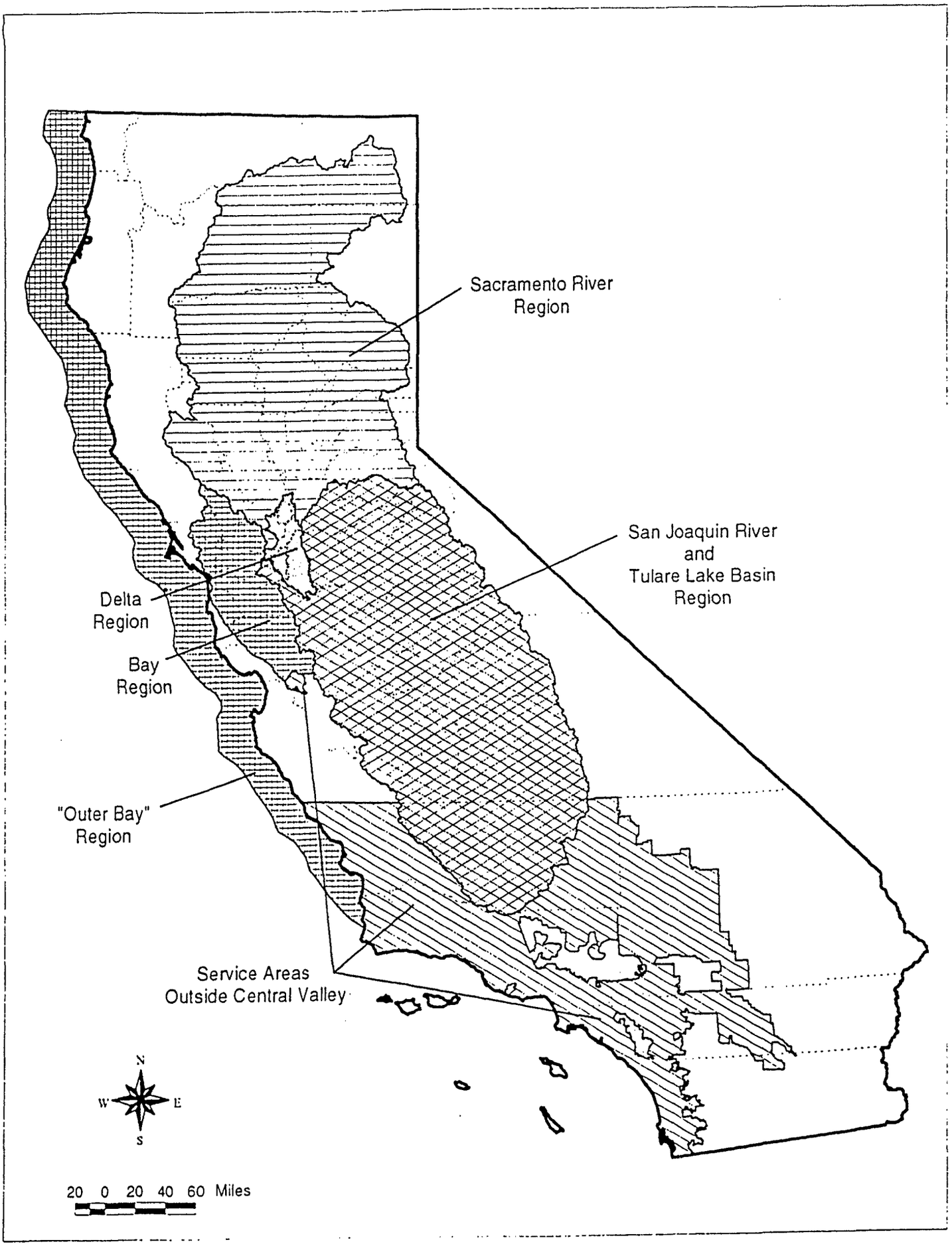
This technical appendix includes a review of the data sources (Chapter II), a historical perspective of the study area (Chapter III), and recent biological conditions within the study area (Chapter IV). Following these discussions, vegetation and wildlife resources are presented for five geographic regions: the Delta Region, Bay Region (North San Pablo Bay and Suisun Marsh), Sacramento River Region, San Joaquin River Region, and State Water Project (SWP) and Central Valley Project (CVP) Service Areas outside the Central Valley. The level of detail provided is greatest for the Delta and Bay regions and less for other regions. The least amount of detail is provided for upper watersheds above storage facilities in each of the identified regions. Figure I-1 shows the boundaries for each of the regions comprising the study area.

II. DATA SOURCES

A. Historical Perspective

Information on historical (pre-1920s) through 1985 biological resource conditions and trends was obtained from documents describing changes in the condition and extent of major habitats and species in California over the last decades. Parts of this section were adapted from Appendix X of the *Sacramento River Service Area Water Contracting Program Draft Environmental Impact Statement* (U.S. Bureau of Reclamation [USBR] 1988). Current status and historical trends for several species that illustrate overall trends in the study area were summarized from a variety of published sources.

The approximate extent of common habitat types in the study year immediately prior to the SWP and CVP was determined by planimetry of polygons within the study area from Wieslander's (1945) map of California vegetation. This map is a highly generalized synthesis of more detailed maps prepared for U.S. Geological Survey (USGS) topographic quadrangles throughout the state. Results of the planimetry were rounded to the nearest 10,000 acres to indicate the approximate nature of these data. Habitat classifications for the 1945 and existing habitat acreages were correlated where possible; however, direct comparison of 1945 and existing acreages for trend analysis is not possible for all habitats and should be attempted only with great caution, if at all. This problem results from the very generalized nature of statewide habitat mapping and differences in historical and modern habitat classifications



CALFED
BAY-DELTA
PROGRAM

Figure 1-1
Study Area

(the wildlife habitat relationships [WHR] habitat classification system did not exist in 1945). Some categories in Wieslander's classifications were combined to match the current classification.

Other important sources of historical biological data include published results of environmental studies and planning efforts in the study area conducted by the California Department of Water Resources (DWR 1994), the California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS 1992), Cohen and Carlton (1995), and Madrone Associates (1980).

B. Recent Conditions

1. Plant Communities and Associated Wildlife

Descriptions of common natural communities were based on wildlife habitat descriptions published by the California Department of Forestry and Fire Protection (CDF) (Mayer and Laudenslayer 1988), supplemented with information from CDFG (Holland 1986) and the California Native Plant Society (CNPS 1993).

The distributions and acreages of common natural vegetation in the study area regions were estimated from a Geographic Information System (GIS) of hardwood and other vegetation types prepared for CDF's Forest and Rangeland Resources Assessment Program (FRRAP), modified and supplemented with data from additional sources. The CDF map incorporates mapping from CALVEG (Matyas and Parker 1980) and more recent hardwood mapping by CDF (Greenwood et al. 1993). Additional sources used to improve mapping detail in agricultural and urban areas include a land-use study of the Delta (DWR 1993), various state maps showing city limits in large urban areas, and rectified Landsat Thematic Mapper imagery from August and September 1990 interpreted using GRASS image processing software from the U.S. Army Corp of Engineers (ACOE).

Information on wildlife commonly associated with major habitats was obtained from Mayer and Laudenslayer (1988), other available literature cited below, and contacts with knowledgeable individuals.

Riparian And Wetland Habitats

Information on the extent and types of riparian and wetland habitats in the study area was determined from existing published and unpublished data, including a land-use study of the Delta (DWR 1993), the USFWS National Wetlands Inventory (NWI) maps, USBR hydrographic data, DWR data (1987), and Natural Diversity Data Base (NDDB) information (1997).

References to the Delta and Bay land-cover maps and habitat acreages were derived from USFWS's NWI, the DWR's Land Use Mapping Program data, and the land-cover layer of the California Gap Analysis Project (Biogeography Lab, University of California, Santa Barbara). NWI data are based on 1985 aerial photographs and mapped at a scale of 1 inch to 24,000 inches. DWR data are based on 1991 Delta and 1994 Suisun Marsh documentation of aerial photograph interpretation (1:24,000 scale). The California Gap Analysis Project data were derived from 1991 Landsat imagery (approximately 1:250,000 scale).

- Plants listed or proposed for listing by the State of California as threatened or endangered under the California ESA (14 California Code of Regulations [CCR] 670.5)

Land-cover maps were created by first reclassifying NWI data layers, then deleting upland and farmed wetland land-cover categories and replacing them with DWR land-use data for urban, agricultural, and native vegetation land-use categories because NWI agricultural and other upland land-cover categories were too general. DWR land-use data for native vegetation categories were further refined by incorporating data from the California Gap Analysis Project.

Land-use data were used assuming that average land-use patterns would not change between the date of data acquisition and 1995, although land use on individual parcels may change. Whenever possible, the most up-to-date land-use data available were used. Although changes in land cover probably have occurred between the date of mapping and 1995, this difference is not expected to substantially affect the impact assessment.

Agricultural Habitats

The extent of agricultural habitats was obtained from county agricultural commission reports (Land Use Technical Appendix). The value of these managed habitats to wildlife was described using existing literature.

Reservoirs

The extent of common habitat types at reservoirs was determined from a map of hardwood (Greenwood et al. 1993) and other vegetation types (CALVEG: Matyas and Parker 1980) prepared by FRRAP. Estimates of shoreline extent for various habitat types were based on estimates of the relative abundance of each common habitat type along the shoreline and data on shoreline mileage from USBR (1990a). Vegetation was not mapped in detail for the reservoir watersheds.

2. Special-Status Plant Communities

Descriptions and information on general distributions of rare natural communities were based on unpublished data from CDFG (Holland 1986; NDDB 1997).

3. Significant Natural Areas

Significant natural areas (SNAs) have no legal status (unless they include designated critical habitat for endangered species); however, areas have been designated by the CDFG to increase awareness about California's natural diversity and identify opportunities to conserve these resources. Information on SNAs was obtained from the Natural Heritage Division of the CDFG.

4. Special-Status Species

Special-status species are plants and animals that are legally protected under state and federal Endangered Species Acts (ESAs) or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing. For the purpose of this programmatic study, special-status plants are species in the following categories:

- Plants listed or proposed for listing as threatened or endangered under the federal ESA (50 Code of Federal Regulations [CFR] 17.12 [listed plants]

and various notices in the Federal Register [proposed species])

- Plants that are candidates for possible future listing as threatened or endangered under the federal ESA (61 Federal Register 40, February 28, 1996)

Special-status animals are species in the following categories:

- Animals listed or proposed for listing as threatened or endangered under the federal ESA (50 CFR 17.11 [listed animals] and various notices in the Federal Register [proposed species])

- Animals that are candidates for possible future listing as threatened or endangered under the federal ESA (61 Federal Register 40, February 28, 1996)

- Animals listed or proposed for listing by the State of California as threatened or endangered under the California ESA (14 CCR 670.5)

For more information on the status, habitats, and distribution of special-status plants and wildlife in the project area refer to the Central Valley Project Improvement Act (CVPIA) Draft Programmatic Environmental Impact Statement (EIS) (1997). The special-status plant and animal information contained in the CVPIA EIS is based on printed and electronic (database) versions of the CNPS Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavlik 1994) and from proposed and final rules on species listings in the Federal Register. Information on some species was supplemented with data from CDFG's NDDB (1997). Additional species of concern (former Candidate Category 2 species, species identified by the CNPS and other species the USFWS believes are declining) were considered in the CVPIA analysis.

A summary of the total number of sensitive species within each of the CALFED study area regions is presented in this report. This list is based on the CVPIA EIS Draft Technical Appendix (1997). Specific literature reviews and field surveys for sensitive species will be conducted prior to the implementation of any CALFED project facility. Appropriate documentation for agency submittal will also occur on a project-by-project basis.

III. HISTORICAL PERSPECTIVE

The study area contains some of the most varied natural habitats and highest biodiversity anywhere in North America (Barbour et al. 1991, 1993). Many of these resources have been severely reduced or degraded by human settlement, population growth, and economic development since the mid-19th century, but they remain a prominent part of California's natural and cultural landscapes. This historical perspective of the CALFED study area is based on the CVPIA Draft EIS (1997).

A. Overview of Historical Trends

Measurable, documentable changes in the natural landscape began soon after Spaniards first settled in California during the 1770s. Coastal grasslands changed with the introduction of European grasses and forbs to help feed cattle and sheep, first near the missions and later on more inland ranches.

Early reports from European explorers described the herds of grazing animals in the Central Valley as rivaling the bison of the central plains or the antelope of South Africa

(McCullough 1971); waterfowl were widely distributed and abundant (CDFG 1983). When Shasta Dam was constructed in 1944, many of California's natural habitats had been altered dramatically and irrevocably from their near-pristine conditions of 150 years earlier. Extensive herds of native grazing animals and their associated predators had been eliminated. Approximately 30 percent of all natural habitats had been converted to urban and agricultural lands (Table III-1).

Case studies, as presented in the CVPIA Draft EIS (1997), are provided for three habitats: riparian, freshwater emergent wetlands, and grasslands. These habitats were selected because they have been affected substantially by development in the study area. Each characterization provides a description of changes in vegetation and changes in distribution or status of selected species of plants and wildlife associated with that habitat.

B. Riparian Habitat and Associated Wildlife

The Sacramento and San Joaquin valley floodplains originally supported vast riparian woodlands along their major rivers. Historical maps and accounts indicate the existence of continuous forests up to 5 miles wide along the Sacramento River, plus extensive forests on high terraces even farther from the river. The riparian forests were diverse in composition and structure and were often dominated in size and number by valley oaks (Thompson 1961).

Estimates of the presettlement extent of riparian vegetation along the Sacramento River range from 800,000 (Roberts et al. 1977; Katibah 1984) to 1,000,000 acres (Thompson 1961; USFWS 1984, 1987), not including the extensive forests along some tributaries. Katibah (1984) estimated that another 50,000 acres of riparian habitat occurred in the San Joaquin Valley.

At least three-quarters of the Central Valley's original riparian forest was lost before the federal and state water projects were constructed (see Figure III-1). On the Sacramento River, riparian forests were extensively cleared within a few decades of the discovery of gold. Trees were cut to fuel boats; build and heat towns; and make way for levees, farms, and harbors. Massive erosion from hydraulic mines in the Sierra Nevada filled the rivers and Delta with sediment; when the rivers were dredged to permit navigation, the spoils were deposited as levees in the riparian zone. During the first half of this century, more forests were lost to large-scale placer mining using dredges (Katibah 1984; Thompson 1961).

Levee building was nearly continuous in the Sacramento and San Joaquin valleys, except during the Great Depression of the 1930s. By 1939, the amount of woody riparian habitat in these valleys had been reduced to approximately 65,400 acres (Frayer et al. 1989), nearly a 90 percent reduction. By 1944, the Sacramento Valley Flood Control Project was nearly complete, with 980 miles of levees, 438 miles of channels and canals, and 95 miles of bypasses (Kahrl 1979).

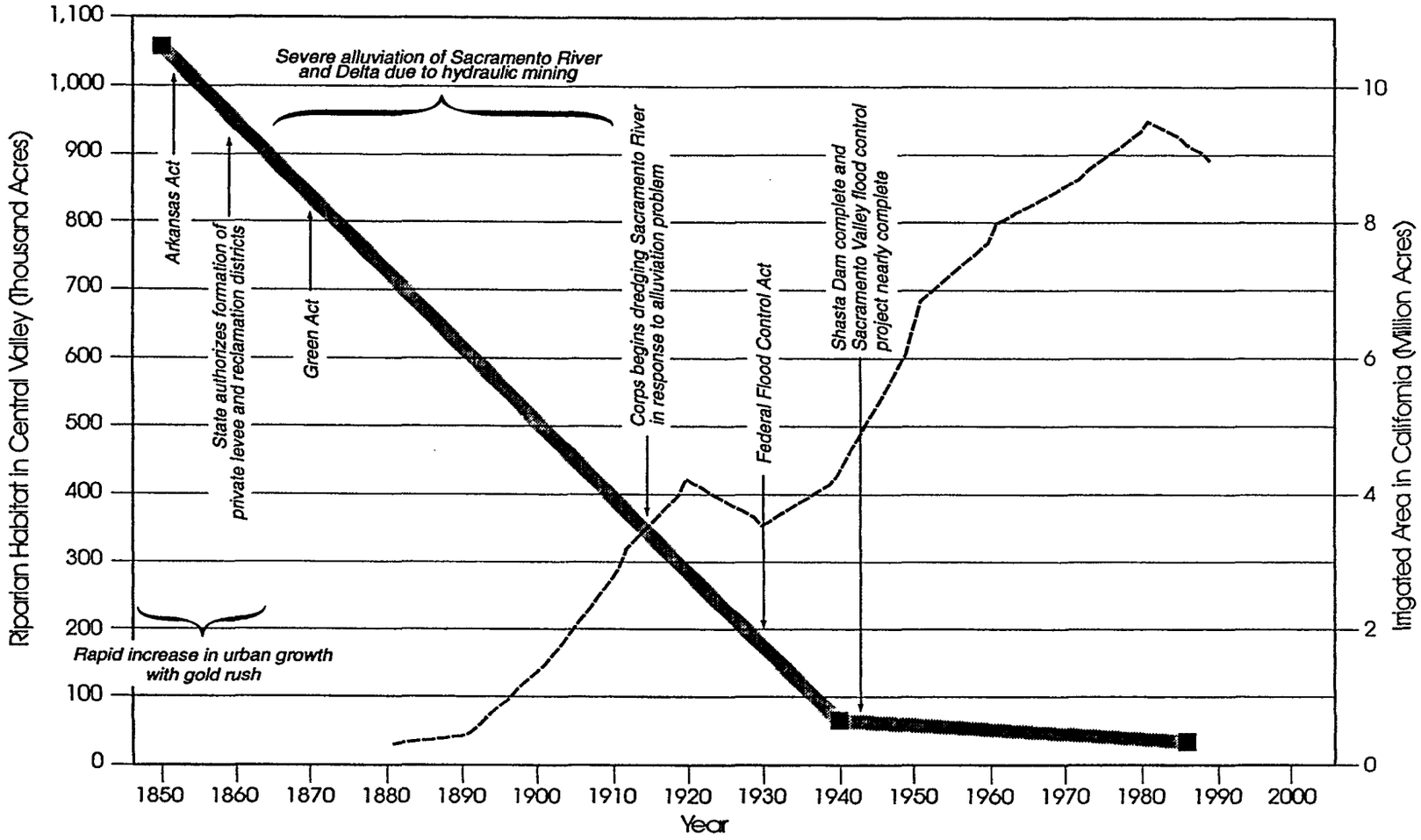
In the mid-1980s, the area of mature riparian forest in the entire Sacramento and San Joaquin valleys was estimated to total about 34,600 acres (Frayer et al. 1989). Along the Sacramento River, an estimated 2 percent of the estimated historical riparian forest remained (McGill 1979; McCarten and Patterson 1987). Today, the cumulative loss of historical Central Valley riparian habitat may exceed 90 percent.

TABLE III-1 HABITAT AREAS IN CALFED REGIONS IN 1945

Habitat Type	Delta	Sacramento River West	Sacramento River East	San Joaquin River West	San Joaquin River East	Total
Mixed conifer forest	0	540,000	2,910,000	0	850,000	4,580,000
Juniper	0	0	40,000	10,000	0	190,000
Valley foothill hardwood	0	1,260,000	1,710,000	280,000	1,440,000	5,650,000
Grassland	50,000	500,000	700,000	1,060,000	1,340,000	5,790,000
Chaparral	0	710,000	500,000	140,000	310,000	2,000,000
Desert scrub and alkali desert scrub	0	0	0	10,000	0	660,000
Coastal scrub	0	0	0	60,000	0	90,000
Freshwater emergent wetland	10,000	120,000	30,000	0	0	230,000
Agricultural and urban	670,000	1,620,000	1,340,000	810,000	2,040,000	8,020,000
Total	**730,000**	**4,750,000**	**7,230,000**	**2,370,000**	**5,980,000**	**27,210,000**

NOTES:

1. See Table IV-2 for 1993 acreages.
2. Areas planimetered from Wieslander (1945) map of California vegetation and rounded to nearest 10,000 acres (apparent inaccuracies are due to rounding error).
3. Uncertainties of total habitat acreages are estimated to be ±15 percent. Uncertainties of most individual habitat acreages are variable (estimated at ±10-20 percent) and are caused by minor errors in planimetry and habitat mapping. Wetland acreages are least accurate because only a few large wetland sites were included in Wieslander's statewide map.
4. Mixed conifer forest includes Wieslander's "Pine," "Fir," "Pine-Douglas Fir-Fir," and "Lodgepole Pine-Whitebark Pine" categories.
5. Juniper includes Wieslander's "Pinyon Pine" and "Juniper" categories.
6. Valley foothill hardwood includes Wieslander's "Woodland (hardwoods)" and "Woodland-Grass" categories.
7. Fresh emergent wetland includes Wieslander's "Marsh" and "Lakes" categories for the Delta Region.
8. Wildlife habitat relationship habitat types in the Central Valley not distinguished by Wieslander (1945) include montane hardwood, valley foothill riparian, montane riparian, inland dunes, and some freshwater emergent wetlands. See text on following page for riparian habitat acreages.



SOURCES:
Frayer et al. 1989; USFWS 1987; California State Water Resources Control Board 1955; California Department of Finance 1970–1991.

FIGURE III-1

RIPARIAN HABITAT TRENDS IN THE CENTRAL VALLEY
(SACRAMENTO AND SAN JOQUIN RIVER REGIONS)

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Factors contributing to this loss include continued conversion of nonirrigated land to irrigated agricultural land, levee construction and maintenance, bank erosion, bank protection, groundwater extraction, and flow regulation. Dams have flooded riparian vegetation in their impoundments and degraded it downstream by altering flows and geomorphic processes. Flood control has interfered with natural processes that affect forest regeneration.

C. Emergent Wetlands and Associated Wildlife

In normal rainfall years, vast portions of the Central Valley flooded as winter and spring runoff collected in the low areas. Extensive wetlands formed behind natural river levees, especially in the Butte Creek sink, Colusa basin, and the Delta. The Sacramento and San Joaquin rivers merged in an inland Delta containing more than 60 islands and more than 700 miles of waterways. Most of the Delta islands were marshy and some had a shrub overstory (CDFG/USFWS 1980).

Seasonal wetlands, such as vernal pools, alkali meadows, and valley sink scrub were widespread in the Sacramento Valley. Montane meadows were common in canyon bottoms along rivers and creeks.

Estimates of the original extent of California's wetland and open-water habitats range from 2 to 5 million acres (Dennis and Marcus 1984; CDFG 1983; Frayer et al. 1989). The Central Valley contained an estimated 4 million acres of permanent, seasonal, and tidal wetlands (Frayer et al. 1989; Dennis and Marcus 1984). Marsh occupied approximately 500,000 acres, 60 percent in the Delta (Kahrl 1979; CDFG 1983). These estimates do not include areas of vernal pool, alkali meadow, alkali sink scrub, and montane meadow habitat.

By 1939, Central Valley wetlands had declined from about 4 million to approximately 483,000 acres (Frayer et al. 1989), an 88 percent loss (Figure III-2). Statewide, the highest rate of wetland loss occurred between 1906 and 1922 (Dennis and Marcus 1984). The many reasons for these declines parallel those described earlier for riparian habitats. The largest declines occurred early in this century, when reclamation and flood control combined to accelerate conversion of wetlands to irrigated agricultural land.

The area of freshwater emergent wetlands in the Central Valley declined from about 483,000 acres in 1939 to about 243,000 acres in 1985 (Frayer et al. 1989). In the San Joaquin Valley, an estimated 92 percent of the historical permanent and seasonal wetlands have been drained and reclaimed for agriculture; only 85,000 to 91,000 acres of managed wetlands remain. The cumulative loss in the Central Valley now exceeds 90 percent. In addition, Holland (1978) estimated that 70 to 95 percent of historical vernal pool wetlands have been lost. Some of the loss can be attributed to agricultural and urban conversions.

Historically, 4 million acres of seasonal and permanent wetlands in the Central Valley provided habitat for numerous species of wildlife, including many millions of wintering waterfowl. By 1920, approximately 70 percent of the wetlands had been reclaimed, and the wintering waterfowl population had been cut in half. Within the next 20 years, 88 percent of the wetlands were drained, and the wildlife species were substantially reduced.

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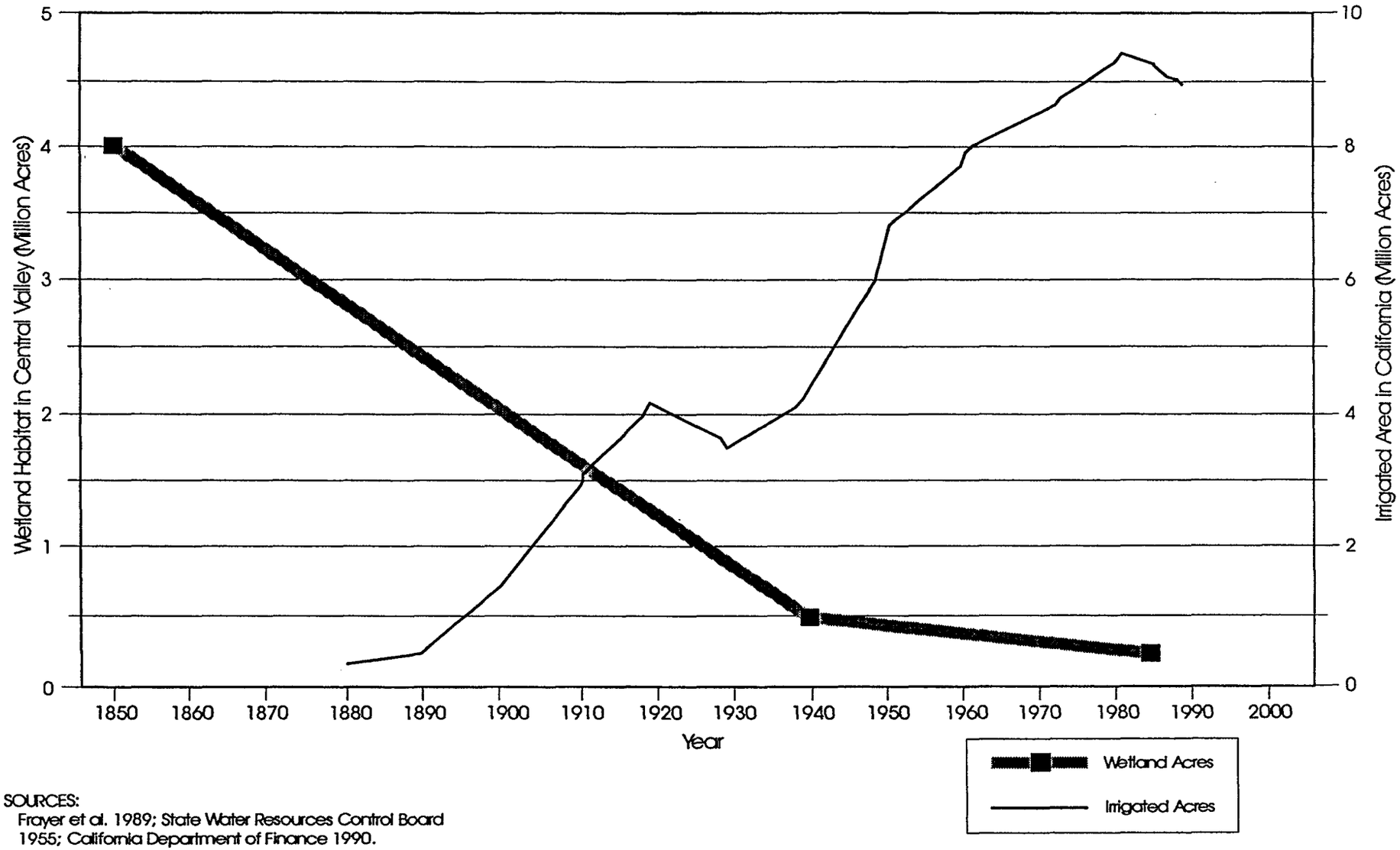

SOURCES:
Frayer et al. 1989; State Water Resources Control Board 1955; California Department of Finance 1990.

FIGURE III-2

FRESHWATER EMERGENT WETLAND TRENDS IN THE CENTRAL VALLEY
(SACRAMENTO AND SAN JOAQUIN RIVER REGIONS)

May 1997

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The loss of many wildlife species was slowed, however, by the establishment of wildlife refuges and private hunting areas and, in some cases, by the development of suitable agricultural uses, that provided habitat value for many of those species.

D. Grasslands and Associated Wildlife

Grasslands once covered more than 14 million acres in California (Barbour et al. 1991). They were dominated by a wide variety of native species, including many perennial bunchgrasses, such as needlegrass, wild rye, melic grass, alkali sacaton, and deer grass. Native wildflowers and other herbs were also abundant. Some ecologists believe that nearly all of the state's original grasslands were dominated by perennial needlegrasses; others argue that annual grasses and wildflowers were dominant in many areas (Barry 1972; Bartolome and Gemmil 1981; Wester 1981). In either case, grasslands were composed entirely of indigenous species until the late 1700s.

Changes in the composition of California's grasslands began in the 1770s, when Spanish settlers introduced a wide variety of annual grasses and forbs from the Mediterranean region. Throughout the 1800s and up to the present, hundreds of nonnative plants arrived in the state from around the world. Many were aggressive enough to out-compete the native species and settle permanently into the California landscape. Grasslands were particularly hard hit by the introduction of nonnatives, especially during times of heavy grazing and drought. By 1945, most of California's grasslands were no longer dominated by native plants.

Jensen (1947) estimated that grasslands of all types occupied about 10.4 million acres throughout the state in 1945, a decline of 26 percent from presettlement times. Most of this decline resulted from the expansion of croplands. Wieslander's (1945) map of California vegetation shows about 5.8 million acres of grassland in the Central Valley (Table III-1), indicating that the Central Valley included approximately 55 percent of California's grassland habitat.

Today grasslands occupy about 8.7 million acres statewide (Barbour et al. 1991), a 38 percent decline from historical times. Much of this decline occurred in the Central Valley. The loss of grasslands dominated by native bunchgrasses has been much greater; only a few small remnants of this type remain. Grassland losses have continued to result from urban expansion and conversion to irrigated croplands. The degradation of grassland quality has also continued, especially on heavily grazed rangelands.

Prior to European settlement, Central Valley grasslands supported vast herds of tule elk and pronghorn antelope similar to the great herds of bison that once occurred in the Midwest (Doldmann 1964). The composition of these grasslands began to change with the introduction of Spanish livestock. Market hunting nearly eliminated the vast herds of the Central Valley's large grazing animals. By 1945, a substantial portion of the Central Valley's grasslands had been converted to agricultural crops.

E. Agricultural Lands and Associated Wildlife

Historical records indicate agriculture and irrigation development in the study area began in the mid-1800s. Prior to the extensive levee system and water development facilities in the study area, agriculture in the region consisted primarily of dryland farming or irrigated agriculture

from artesian wells, groundwater pumping, and some creek canals. Following the completion of the levees in the Delta area in 1913, a series of human-made waterways and water development facilities were constructed. Water development facilities were constructed to ship water from the Delta to other parts of California for agricultural, urban, and other uses (DWR 1993). Agricultural land-use acreage within the Central Valley in 1945 (see Table III-1) is estimated at approximately 8 million acres, slightly more than current estimates.

For more details regarding agricultural development within the CALFED study area, see the Land Use and Agricultural Economics Technical Appendices associated with this report.

F. Historical Uses of the Delta and Bay Regions.

The habitats of the Delta Region have changed dramatically since prehistoric times (Bingham 1996). Much of the ancient Delta was covered by tidal freshwater and brackish marsh, with riparian forest and scrub at higher elevations. Following European settlement, sedimentation as the result of hydraulic mining, levee construction, and draining of wetlands behind flood control levees resulted in great losses of natural habitat (Bingham 1996). Wetland and terrestrial habitats in the Delta and Bay regions have undergone extensive changes as a result of marsh reclamation for agriculture, water diversions, flood control efforts, and the effects of sedimentation caused by hydraulic mining. Changes in the condition of the Delta/Bay region have resulted in the decline of many species and the federal government and the state have taken the action of listing species as threatened or endangered under the federal and state ESAs in an attempt the save the species.

Before 1850, the Delta consisted of approximately 400,000 acres of tidal marshland surrounded by 200,000-300,000 acres of land at slightly higher elevation behind natural alluvial berms that supported shallow backswamps. The extent of tidal marshland was reduced from approximately 400,000 to 18,000 acres by 1985 (based on USFWS NWI data) (see Figure III-2). During spring, tides and runoff from the Sacramento and San Joaquin river watersheds turned the Delta into a large inland lake, which supported dense stands of tules and riparian vegetation.

The region supported more than 250 species of birds and mammals and was one of the most important waterfowl wintering areas in the state. Furbearers and other large mammals, including river otter, bobcat, grizzly bear, antelope, tule elk, and deer, were present in the Delta and surrounding uplands. Wildlife populations were not substantially affected by Europeans until the mid- to late 1800s. Trapping had greatly reduced furbearer populations by 1856, and elk and antelope herds were almost eliminated by 1880 as a result of market hunting and habitat destruction in the Delta/Bay regions (Madrone Associates 1980; USFWS 1992).

Reclamation of Delta wetlands for agricultural use was accelerated during and after the gold rush. In 1850, the Federal Swamp and Overflow Act deeded Delta lands to the state, spurring reclamation efforts. The first documented levee was constructed in 1852. Because early levees were no more than low earthen mounds and soil subsidence was common in wetland areas, reclaimed lands flooded frequently.

Approximately 100,000 acres had been reclaimed by 1880. Construction of larger, more substantial levees was initiated during the 1890s, and by 1900 about half of the historic Delta had been reclaimed. By 1930, reclamation of the Delta was largely completed with the creation of about 60 islands covering approximately 450,000 acres (Madrone Associates 1980; USFWS 1992).

Large areas of riparian forest along the Sacramento River were cut during the 1800s for fuelwood. The advent of steamboat transportation along the Sacramento River in the 1840s created a lucrative market for firewood to fuel the steamboat boilers and the easiest place to get this wood was along the river. By the turn of the century, only remnants of this riparian forest remained, primarily on channel islands (Bingham 1996).

Extensive hydraulic mining in the Delta's watershed during the late 1800s resulted in the deposition of millions of cubic yards of sediment and debris into the Delta channels and San Francisco Bay. Because sedimentation raised channel bottoms by as much as 15 vertical feet, levees were raised to reduce flood risk. Between 1913 and 1924, the Sacramento River was dredged, allowing channels to scour and largely restore streambed elevations after hydraulic mining ceased (Madrone Associates 1980; USFWS 1992).

Saltwater Intrusion. Saltwater intrusion, particularly into the western Delta, was a problem noted before large-scale reclamation of the Delta; however, as water diversions and reclamation efforts proceeded, saltwater intrusion became more frequent and extensive. The greatest intrusion occurred in 1931, when an estimated 74 percent of the Delta's water supply became unusable because of elevated salinity. The CVP was initiated in 1933 primarily to use water more efficiently and, to a lesser degree, to address problems in the Delta. The SWP, authorized in 1959, was designed to provide a greater degree of flood control and additional water for agricultural and urban use. In the same year, the Delta Protection Act was authorized to provide salinity control in the Delta and provide an adequate supply of water to Delta users. (Madrone Associates 1980.)

Waterfowl and Shorebirds. Early accounts by settlers and explorers suggest that the Central Valley once supported a substantially larger waterfowl population than in recent times. Populations of ducks in the San Francisco Bay-Delta regions are estimated to have been 40 times more abundant in the mid-19th century than in the 1920s (DWR 1994). Declines in waterfowl populations from pre-1900 levels have been attributed to extensive hunting and loss of wetlands in both the Central Valley and other breeding grounds. Large-scale reclamation of tidal marshes in the Delta occurred between 1860 and 1910. By 1930, when diking was completed, 450,000 acres of tidal wetlands had been converted to agricultural use (Madrone Associates 1980; DWR 1994). Shifts in agricultural cropping patterns since the 1970s have increased the quality of waterfowl foraging habitat in the Delta. Winter flooding of cornfields and other croplands to leach salts from the soil and control weeds has created favorable waterfowl foraging conditions. As a result, populations of waterfowl in the Delta have increased because of increasing forage availability (Madrone Associates 1980; DWR 1994).

Historic shorebird population levels in the Delta Region and elsewhere in California are not well known. Other than waterfowl, shorebirds are the most abundant group of aquatic bird species that depend on wetlands (Point Reyes Bird Observatory 1992). Consequently, the extensive loss of tidal wetlands in the Delta Region to reclamation for agriculture, and the overall loss of approximately 95 percent of historic wetlands throughout the Central Valley, suggest that shorebirds may have been more abundant before widespread settlement.

IV. RECENT CONDITIONS

A. Introduction

The purpose of this section is to provide a description of plant communities and special-status resources currently existing in the study area. Plant community descriptions are provided as background material to assist the reader in more accurately evaluating the conditions and resources within each CALFED region (as presented in Section V).

B. Plant Communities and Associated Wildlife

Common natural communities are vegetation/habitat types that cover relatively large areas and are not significantly threatened or declining (e.g., most conifer forest, chaparral, and annual/nonnative grassland communities). The following natural community descriptions are based on those in *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988). See Attachment A for a comparison of vegetation types used in this document to those of the CNPS, CDFG (Holland 1986), and Wieslander (1945) map types. Table IV-1 summarizes existing acreages of natural communities and agricultural crops in study area regions in the Sacramento River, San Joaquin River, Delta, and Bay regions.

Plant and animal common names are used throughout this document. For a complete list of both scientific and common names refer to the CVPIA (1997) Appendix for Vegetation and Wildlife. The scientific nomenclature for plants follows Hickman (1993), except for some rare species that follow Skinner and Pavlik (1994).

1. Upland Communities

Mixed Conifer Forest. Mixed conifer vegetation is an assemblage of conifer and hardwood species that forms a multilayered forest. Canopies often approach 100 percent closure. Where openings are present, the forest floor is often covered with an assemblage of shrubs and small trees. Conifer species often found in mixed conifer forest include white fir, Douglas fir, ponderosa pine, sugar pine, and incense cedar. Black oak, bush chinquapin, and canyon live oak are typical hardwood species. Mixed conifer forest is found in the Sierra Nevada from 2,700 to 4,000 feet in elevation in the north and from 4,000 to 10,000 feet in the south and in the Coast and Klamath ranges in elevations from 4,500 to 6,900 feet.

The structural complexity of mixed conifer communities makes them important for a variety of wildlife species. Conifers provide excellent nesting platforms for raptors, including northern goshawks and California and northern spotted owls. Woodpeckers, jays, crossbills, kinglets, and grouse are common. Mule deer, black bear, squirrels, voles, and chipmunks are common mammals that find forage and cover in

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TABLE IV-1 APPROXIMATE NATURAL COMMUNITY AND AGRICULTURAL CROP ACREAGES IN CALFED STUDY AREA REGIONS

	Study Area Region				
Habitat	Sacramento River	San Joaquin River	Bay[a]	Delta	All
Mixed conifer forest	3,690,000	1,053,000	0	0	5,342,000
Montane hardwood	370,000	103,000	0	0	623,000
Pinyon-juniper	2,000	0	0	0	139,000
Valley foothill hardwood	2,055,000	1,377,000	[b]	0	4,023,000
Chaparral	968,000	719,000	[b]	0	2,108,000
Sagebrush scrub	50,000	0	0	0	50,000
Alkali desert scrub and desert scrub	0	14,000	0	0	481,000
Grassland	1,066,000	1,073,000	170,000	0	3,089,000
Riparian	14,000	15,000	2,000	7,000	50,000
Freshwater and saline emergent wetland	157,000	138,000	66,000	25,000	352,000
Open water	122,000	52,000	126,000	56,000	240,000
Barren	242,000	8,000	13,000	0	253,000
Subtotal (Natural Habitats)	**8,736,000**	**4,552,000**	**377,000**	**88,000**	**16,750,000**
Agriculture					
Grains	601,000	436,000	[c]	97,000	1,480,000
Pasture	442,000	868,000	[c]	95,000	1,930,000
Rice	398,000	19,000	[c]	18,000	436,000
Orchards and vineyards	322,000	843,000	33,000	20,000	1,674,000
Vegetables	221,000	490,000	[c]	275,000	1,124,000
Cotton	0	484,000	[c]	0	1,185,000
Subtotal (Agriculture Habitats)	**1,984,000**	**3,140,000**	**45,000**	**505,000**	**7,829,000**
Urban and other					
Urban	252,000	188,000	51,000	46,000	709,000
Other	1,057,000	427,000	14,000[d]	61,000	2,029,000
Subtotal (Urban and Other)	**1,309,000**	**615,000**	**65,000**	**107,000**	**2,738,000**
Total (All Habitats)	**12,029,000**	**8,307,000**	**487,000**	**700,000**	**27,317,000**

Notes:

All acreages are rounded to the nearest 1,000 acres.

Community types that do not occur in the Central Valley or Delta (i.e., coastal and desert communities) are not included in this table.

Riparian vegetation acreage for the Sacramento Valley is based on the *Sacramento River Environmental Atlas* (DWR 1978) and excludes an unquantified and possibly substantial amount of vegetation along tributaries to the Sacramento River.

Habitat classification for the Delta Region differs slightly from that used in other regions because of the different data source. Grasslands in the Delta Region are included in "Agriculture." "Freshwater emergent wetland" in the Delta includes all palustrine wetlands. "Saline emergent wetland" in the Delta includes all estuarine wetlands.

[a] Based on California Central Valley Wetlands and Riparian Geographic Information Service (CDFG 1997), Version 1.0. (Includes Suisun Marsh and Bay; lower watersheds of Napa, Sonoma, Petaluma drainages; and San Pablo Bay).

[b] Not separately classified, part of the "Other" category.

[c] Not separately classified, part of the total Agricultural Habitats category.

[d] Includes chapparal, valley foothill hardwood, and residential trees.

Sources:

Natural Communities: CDF unpublished map (digital format).

Urban Areas: Landsat Thematic Mapper data (classified using GRASS software) and DWR (1993)

Agricultural Habitat: DWR (1993).

Delta: "Wetlands"coverage for Delta from Teale Data Center, Sacramento, CA, compiled from NWI maps.

"Other" Areas: Calculated as the difference between the total area within the region boundaries and the sum of all natural, agricultural, and urban habitats. "Other" includes a variety of industrial, small urban, and other areas, including some natural habitats.

coniferous forests. Common amphibian and reptile species include the black salamander, ensatina, garter snake, and Pacific treefrog.

Montane Hardwood. Montane hardwood vegetation typically consists of a well-defined tree layer composed predominantly of broad-leaved tree species. The shrub layer is usually poorly developed, with a sparse herb layer beneath. In dense stands, tree canopies may actually close but rarely overlap. A number of species are common in montane hardwood communities in the Sierra Nevada Mountains and foothills: black oak, Pacific madrone, tan oak, interior live oak, and blue oak and foothill pine in the lower elevations. Elevations for the community can vary from 300 feet near the Pacific Ocean to near 9,000 feet in northern California.

Montane hardwood habitat is used by a variety of reptiles, birds, and mammals. Acorns produced by oak trees provide forage for mule deer, black bears, squirrels, turkeys, jays, woodpeckers, and pigeons. Common amphibians and reptiles include ensatina, western fence lizard, sagebrush lizard, kingsnake, sharp-tailed snake, rubber boa, and western rattlesnake.

Pinyon-Juniper. Pinyon-juniper vegetation is typically an open woodland of relatively low, bushy trees. The shrub layer may be dense or nearly absent, and herbaceous vegetation is typically fairly sparse. Dominant species in the southern Sierra Nevada and Transverse ranges include single-leaf pinyon, California juniper, Mormon tea, desert bitterbrush, rabbitbrush, and sagebrush. The pinyon-juniper community typically occurs on steep, rocky, or well-drained soils mostly outside the study area, in the Great Basin, Mojave Desert, and Peninsular ranges.

Pinyon seeds and juniper berries are important food sources for many wildlife species. Animals characteristic of this community include the pinyon mouse, bushy-tailed wood rat, pinyon jay, plain titmouse, and bushtit.

Valley Foothill Hardwood. Valley foothill hardwood vegetation, which varies considerably depending on site conditions, is composed of three subtypes: valley oak woodland, blue oak woodland, and blue oak/foothill pine woodland. Valley foothill hardwood vegetation generally has a tree layer dominated by one or more species of oak. The shrub layer is often absent at lower elevations but consists of scattered clumps of several species at higher elevations. The herbaceous layer of all three subtypes consists mostly of nonnative annual grasses and forbs.

The valley oak subtype varies from savannah-like with an open canopy to forest-like with a nearly closed canopy at lower elevations and on sites with deep soils. Above the valley floor and on sites with shallower soils, blue oak intergrades with valley oak and becomes the dominant tree in the overstory. Generally, the blue oak subtype forms a woodland with scattered trees, but given favorable conditions, canopy closure may approach 100 percent.

Valley foothill hardwood habitat provides shade, shelter, nesting, and foraging habitat for many wildlife species. Studies indicate that hardwood ecosystems, such as oak woodlands, support a larger number of breeding wildlife species than any other nonriparian California woodland community (Mayer and Laudenslayer 1988).
The blue oak/foothill pine woodland subtype is found intergrading with blue oak woodland at higher elevations and is diverse

both in structure and composition. Blue oak and foothill pine compose the overstory of this habitat, with blue oak being more abundant.

Primary cavity-nesting birds (e.g., acorn woodpecker) excavate nest holes in living and dead trees, and these cavities are subsequently used by other (secondary) cavity-nesting species, such as hawks, owls, flycatchers, nuthatch, titmouse, and bluebirds. Oak foliage and bark attract flycatchers, pewees, wrens, and vireos. The gopher snake, bullfrog, western toad, and Pacific tree frog are common. Other common species include raccoon, opossum, and woodrat.

Chaparral. Chaparral is characterized by the presence of woody, often hard-leaved shrubs in a nearly impenetrable thicket. Shrub heights and densities range from 3 to 20 feet. Chaparral can be divided into three general types: montane, mixed, and chamise-redshank.

Montane chaparral varies from prostrate to tree-like forms, depending on site conditions. It generally occurs throughout the coniferous forest zone from 3,000 to 9,800 feet in elevation in northern California and above 7,000 feet in southern California. Species that characterize montane chaparral include snow bush, greenleaf manzanita, snowbrush ceanothus, pinemat manzanita, and bitter cherry.

Mixed chaparral generally occurs below 5,000 feet in elevation and usually forms dense, nearly impenetrable thickets with shrub cover approaching 80 percent. Scrub oak, ceanothus, and manzanitas are common mixed chaparral species.

At elevations below 4,000 feet and on drier sites, chamise-redshank chaparral becomes more common. Mature chamise-redshank chaparral is generally single-layered with little or no herbaceous layer. Chamise-redshank chaparral often occurs as nearly pure stands of chamise or redshank, with the purest stands on the driest slopes. On more moist sites, toyon, sugar bush, poison oak, and spiny redberry are commonly associated with chamise.

Chaparral habitat lacks the structural diversity of forests and woodlands but provides forage and cover to a variety of wildlife. Common wildlife species are the brush rabbit, black-tailed deer, gray fox, western rattlesnake, and several species of birds, including California quail, wrentit, orange-crowned warbler, rufous-sided towhee, and California towhee.

Coastal Scrub. Coastal scrub is typified by low to moderately sized shrubs with soft leaves and flexible branches arising from a woody base. Coastal scrub is usually found within 20 miles of the ocean in the north and up to 50 miles from the ocean in the south. Elevations of coastal scrub range from sea level to nearly 3,000 feet.

Northern coastal scrub between Humboldt and San Mateo counties varies from a low patchy cover of nearly prostrate shrubs interspersed with grassland to a dense cover of shrubs, subshrubs, and perennial herbs, with shrubs reaching 7 feet in height. Bush lupine, many colored lupine, coyote brush, blue-blossom ceanothus, bush monkeyflower, poison oak, California sagebrush, and blackberry are common northern coastal scrub species.

Southern coastal scrub from about San Mateo County south is often called southern sage scrub due to the dominance of California sagebrush or various sage species. In wetter areas within southern coastal sage scrub, black sage and California buckwheat are codominants.

Common wildlife species occurring in coastal scrub include the western fence lizard, orange-crowned warbler, California thrasher, California quail, brush rabbit, Heerman's kangaroo rat, mule deer, gray fox, and coyote.

Alkali Desert Scrub. Alkali desert scrub is generally characterized by a dominance of chenopods (members of the Goosefoot family) or other halophytes and is often thought of as existing in two distinct phases: xerophytic (drought-tolerant plants) and halophytic (salt-tolerant plants). In the study area, it occurs at low elevations in the western San Joaquin Valley.

The xerophytic phase is represented by open stands of widely spaced, low (0.8 foot) to moderately high (7 feet) grayish, spiny, and small-leaved shrubs and subshrubs. Allscale, fourwing saltbush, Parry saltbush, shadscale, and big saltbush are common shrubby saltbush species of this phase.

The halophytic phase is characterized by closely spaced, not very woody, and more or less succulent plants that tolerate periodic flooding. Common shrubs and subshrubs found in this phase include arrow weed, greasewood, alkali goldenbush, kochia, iodine bush, and alkali rubber rabbitbrush.

Common birds in the alkali desert scrub include roadrunners, mourning doves, blue-grey gnatcatchers, common ravens, sage sparrows, white-crowned sparrows, finches, and gold finches. Common mammals include pocket gophers, California ground squirrels, desert cottontail, deer mouse, voles, Heermann's kangaroo rat, hares, skunk, badger, and coyote. Reptiles, such as side-blotched lizards, western whiptails, western fence lizards, and western rattlesnakes are common.

Desert Scrub. Desert scrub vegetation is characterized by the presence of scattered assemblages of broad-leaved-evergreen or deciduous microphyllous shrubs usually less than 6.5 feet in height. Canopy cover from these shrubs is usually less than 50 percent, with bare ground often between plants.

Creosote bush is often considered the dominant plant in desert scrub probably due to its tall relative stature rather than its numbers. Other plants common to desert scrub are burro bush, bladderpod, desert agave, brittlebush, California barrel cactus, Engelmann's hedgehog cactus, desert globemallow, ocotillo, beavertail cactus, rubber rabbitbrush, and Mojave yucca. Scattered among the shrubs are forbs and grasses, such as basket evening primrose, galleta, big galleta, and bur-marigold.

Desert scrub is the most widespread vegetation in the Mojave and Colorado deserts and is generally found below 4,000 feet in elevation. Desert scrub provides habitat for a variety of wildlife species, especially reptiles and rodents. Typical species found in desert scrub include Couch's spadefoot toad, horned lizard, desert iguana, sidewinder, kingsnake, mice, kangaroo rat, coyote, bobcat, flycatcher, sparrow, Gambel's quail, and greater roadrunner.

Sagebrush and Bitterbrush Scrub. Sagebrush and bitterbrush scrub vegetation is typified by large, open stands of big sagebrush or bitterbrush of fairly uniform height. Depending on site conditions, other species may become locally dominant. Sagebrush scrub vegetation occurs along the eastern and northeastern borders of California on dry slopes and flats from an elevation of about 1,600 to 10,500 feet.

Sagebrush and bitterbrush scrub provide foraging habitat for mule deer and pronghorn antelope and are a major winter-range type used by migrating deer. Sagebrush and bitterbrush scrub are essential habitat for nesting sage and blue grouse, sage thrasher, and sagebrush vole. Other common species include black-tailed jackrabbit, cottontail rabbit, California ground squirrel, least chipmunk, woodrat, mice, kangaroo rat, pocket mice, coyote, bobcat, mountain lion, magpie, flycatcher, jay, hawk, owl, and falcon. Western fence lizard and rubber boa also reside in this plant community.

Inland Dunes. Inland dunes (i.e., Antioch Dunes and Monvero Residual Dunes) are mostly dominated by herbaceous plants with a scattering of low shrubs or coast live oak. The low shrubs are usually less than waist high and provide less than 10 percent cover (Holland 1986). Plants characteristic of inland dune vegetation include California croton, California matchweed, telegraph weed, Contra Costa wallflower, and Antioch Dunes evening-primrose. Coyote, gray fox, striped skunk, deer mouse, red-tailed hawk, savannah sparrow, American pipit, horned lark, and western fence lizard are common wildlife species that occur in or visit inland dune habitats.

Coastal Beaches and Cliffs. The vegetation of coastal beaches and cliffs is exposed to a nearly continual salt-laden, moist wind off the Pacific Ocean. Coastal beaches and their associated dunes are dominated by herbaceous plants, whereas cliffs are generally dominated by shrubs. When coastal beaches and dunes are vegetated, they are dominated by an assemblage of grasses, forbs, and small shrubs. Common plants occupying northern coastal beaches and dunes include European sea-rocket, coastal sand-verbena, beach-bur, European beachgrass, fig-marigold, beach morning glory, and beach rye grass.

Coastal cliffs are vegetated with low shrubs, herbaceous perennials, and annual grasses and forbs. Plants commonly encountered on northern coastal cliffs include yellow hairgrass, sea-pink, coast buckwheat, seaside daisy, lizard tail, many colored lupine, live-forever, and seaside plantain. Southern cliffs have plant species like those of the north with the addition of saltbush, goldenbush, fig-marigold, and giant coreopsis. Coastal beach and cliff vegetation can be found from sea level to about 650 feet in elevation. Common wildlife species include shorebirds, seabirds, sparrows, squirrels, deer mouse, and red fox.

Grassland. This community is characterized by a predominance of annual or perennial grasses forming an open grassland. Most of the grassland in California is dominated by naturalized annual grasses with perennial grasses existing in relictual prairies or on sites with conditions unfavorable for annual grasses, such as serpentine. Grassland vegetation as a whole has relatively high species diversity when compared to other California plant communities.

Annual grasses found in grassland vegetation include wild oat, soft chess, ripgut grass, medusa head, wild barley, red brome, and slender fescue. Perennial grasses found in grassland vegetation are purple needlegrass, Idaho fescue, and California oatgrass. Forbs commonly encountered in grassland vegetation include long-beaked filaree, redstem filaree, dove weed, clover, Mariposa lily, popcornflower, and California poppy. Vernal pools found in small depressions with an underlying impermeable layer are isolated wetlands within grassland vegetation. Vernal pools are discussed in further detail in the "Rare Natural Communities" section. Grassland vegetation occurs from sea level to about 3,900 feet in elevation.

Grassland communities are important foraging areas for hawks, falcons, yellow-billed magpie, loggershead shrike, sparrows, doves, blackbirds, and swallows. Birds such as killdeer, ring-necked pheasant, western kingbird, western meadowlark, and horned lark nest in this plant community.

Grasslands also provide important foraging habitat for the coyote and badger because they support large populations of small prey species, such as the deer mouse, California vole, pocket gopher, and California ground squirrel. Common reptiles and amphibians of grassland habitats include western fence lizard, common kingsnake, western rattlesnake, gopher snake, common garter snake, western toad, and western spadefoot toad.

Ruderal. Ruderal habitats are early successional communities and are created when farmed, developed, or disturbed sites are allowed to revert to a natural state. The plant species associated with ruderal habitats are site-specific and depend largely on past land-use practices and surrounding habitats. (Madrone Associates 1980). The extent of use by wildlife is dependent on the type of vegetation present and adjacent land-use. These habitats can support high populations of small mammals such as house mice, California voles, and pocket gophers. Mammalian predators include the gray fox, weasel, raccoon, and striped skunk. Common reptiles include the western fence lizard and gopher snake; if water is present, toads, Pacific treefrogs, and bullfrogs may also occur (Madrone Associates 1980).

Barren Areas. Barren areas are defined for the purpose of this Programmatic EIS as sparsely vegetated or unvegetated lands. Within the study area, barren habitat occurs mostly in lava fields and other volcanic terrain. The sparse vegetation and wildlife in barren areas are generally representative of that in grassland, sagebrush, mixed conifer forest, or other habitats occurring on better developed soils nearby.

2. Riparian Communities

Riparian communities occur along creeks and rivers, and are found throughout the study area. These communities have adapted to wide yearly and seasonal fluctuations in flow volumes, an abundance of floodplain moisture, and a dynamic erosion-deposition cycle. Riparian communities are usually in a constant successional state because of the dynamic nature of topography and hydrology (Campbell and Green 1968). The resulting successional processes are responsible for the variation in structure (number of relative heights of vegetation layers) and species composition of vegetation types in riparian habitats.

Fluvial processes such as flooding, with its resulting sediment deposition and bank

erosion, create three characteristic riparian landforms: gravel point bars, low terraces, and high terraces. Each landform has a different hydrology because of its physical relationship to the aquifer and flooding. Floods deposit nutrient-rich sediments that contribute to terrace formation by increasing elevations above the floodplain. Floods also break and abrade vegetation on gravel bars and low terraces, create anaerobic (i.e., without oxygen) soil conditions during flood events, erode riverbanks, and deposit entrained sediment on point bars.

Riparian vegetation is important because of its scarcity and resource values. This plant community supports several legally protected plant and animal species. Riparian habitats serve humans directly by forming a buffer between rivers and streams and intensively managed farmlands and urban landscapes, enhancing water quality through filtration of surface runoff, stabilizing streambanks, and moderating floodflows (Murray et al. 1978; Brice 1977; Groenveld and Gripentrog 1985).

Riparian communities typically support a great diversity of wildlife species because they present a unique combination of surface water and groundwater, fertile soils, high nutrient availability, and vegetation layering, all of which form a variety of microclimates (Warner 1979). For example, breeding birds restricted to riparian vegetation (obligates) may outnumber obligates of other habitats such as grasslands sevenfold (Tubbs 1980); at least 65 bird species are known to nest in riparian habitats of the Sacramento Valley (Gaines 1974a). The linear nature of riparian corridors is another ecological factor responsible for the high species diversity and abundance in these habitats; the "edge effect" of transitions between two habitat zones such as riparian and annual grassland promotes greater wildlife diversity than in either habitat alone (Odum 1978).

Riparian communities are divided into seven subgroups. However, for the level of detail required in the impact analyses and natural community acreage tables, the following seven subcommunity descriptions are lumped together as one community-type: riparian.

Valley Foothill Riparian. Valley foothill riparian vegetation occurs in valleys and bottomlands bordered by gently sloping alluvial fans and dissected terraces and coastal plains. Valley foothill riparian vegetation generally consists of woodlands or forests of broad-leaved winter-deciduous hardwood trees as the overstory, with a variety of shrubs and vines composing the midstory, and a few grass and forb species in combination with vines composing the understory. The floodplains of valley foothill riparian communities are usually well developed.

Willow Scrub/Willow-Cottonwood Forest. Two vegetative communities, willow scrub and willow-cottonwood forests, develop on gravel bars. Gravel bar habitats are subject to seasonal flooding and are sensitive to changes in flow volumes, timing, and rates of change in flow volumes. Plant species that occur on gravel bars require coarse mineral substrates that are wetted during seed dispersal and during the establishment phase. Willow scrub vegetation is the "pioneering" vegetation in two topographic locations, point bars and creek edges, where dense thickets of one or more willow species (e.g., sandbar, red, arroyo, black willow) develop, and canal slough banks and low river terraces, where dense willow thickets also contain small amounts of cottonwood, white alder, and mule fat, with occasional

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interior live oak and elderberry along the upper edges.

Willow-cottonwood forests form dense sapling stands or forests to 60 feet in height. Black willow, arroyo willow, and cottonwood dominate the canopy. Older stands typically have a midstory of willows and box elder or thickets of California wild grape, blackberry, and poison oak. Herbaceous vegetation can be sparse or dense and includes species such as cocklebur, mugwort, umbrella-sedge, and horseweed.

Wildlife species that forage on seeds and foliage in scrub and herb habitats along creeks and rivers include squirrel, gopher, vole, quail, dove, starling, goldfinch, and blackbird. Aquatic areas within the river channel provide foraging areas for carnivores and omnivores such as river otter, waterfowl, and gulls.

Unvegetated vertical banks along the rivers provide nesting substrates for a variety of specially adapted species. The bank swallow, belted kingfisher, northern rough-winged swallow, and owls depend on vertical banks for nesting.

Because willow scrub habitat frequently grows in dense clumps, it offers cover to a variety of wildlife species. Beavers preferentially feed on young willow shoots, and many small birds and mammals feed on willow seeds. Willows support an abundance of insect prey that feed on fresh foliage and stems during the growing season. These insects in turn support a high density and diversity of migratory and resident insectivorous birds and bats. Some species have declined or been eliminated from the valley floor as nesting species, among them the willow flycatcher, yellow warbler, and yellow-breasted chat (Remsen 1978).

Mature Cottonwood Riparian Forest/ Alder-Willow Forest. Mature cottonwood riparian forest/alder-willow forest habitats occurring on low terrace habitats develop as sediment accumulates on gravel bars and elevates them above the floodplain. Communities of this habitat are sensitive to floodplain water-level fluctuations and changes in flood intensity or duration. The communities are typically inundated only during floodflows.

Mature cottonwood forests develop from young-growth willow-cottonwood forests. Forest heights can exceed 100 feet with a canopy of cottonwood or cottonwood-black willow. A midstory of black willow, box elder, Oregon ash, and Northern California black walnut is typical of stands not choked by California wild grape, and a dense herb-vine growth often forms an impenetrable understory.

Alder-willow forests are primarily associated with canals, sloughs, and channelized rivers where steep gravel, rock, or riprap banks extend to the shoreline defined by sustained summer water levels. Alder-willow forests typically form narrow bands along the shoreline that often overhang the water. The 10- to 40-foot-tall canopy is dominated by white alder, arroyo willow, black willow, and red willow, with some Fremont cottonwood and Oregon ash. Higher adjacent ground supports other riparian communities.

Large trees in these forests provide habitat elements required by a number of wildlife species. Cottonwood trees provide adequate nesting support for larger birds such as hawks, owls, American crow, great egret,

and great blue heron. Cavity-nesting species such as woodpeckers, wood duck, bats, western gray squirrel, raccoon, and ringtail require mature stands. The typically narrow, linear nature of the alder-willow forest favors forms of wildlife that forage in adjacent herbland or agricultural habitats, including black-shouldered kite, American kestrel, and western kingbird. It also provides perches and cover for species that forage in or over the water, including double-crested cormorant, green-backed heron, belted kingfisher, violet-green swallow, tree swallow, black phoebe, beaver, river otter, and various bat species.

Mixed Riparian Herb/Scrub. The mixed riparian herb/scrub community is located on riverbanks, berms, and terraces; this vegetation occupies sites where disturbance from levee maintenance and farming practices prevents the development of mature riparian forests. Herbaceous dominants include weedy annual grasses, sedges, rushes, and numerous forbs such as horsetails, mustards, and thistles. The scrub layer consists of shrub, vine, and tree saplings of willow, mule fat, blackberry, California wild grape, California wild rose, box elder, Fremont cottonwood, and Oregon ash. Riparian herb/scrub is associated with banks protected from erosion by riprap and levees, channel islands, and natural berms that are not protected by riprap, such as those found at the margins of some Delta islands, and with unmaintained agricultural ditches in the interior of Delta islands. Riparian herb/scrub habitats typically are disturbed periodically for levee maintenance. In the absence of disturbance or frequent inundation from highest tides, most sites supporting riparian scrub in the Delta area, for example, would eventually develop into riparian woodland (Madrone Associates 1980).

The mixed riparian scrub community provides a variety of resources used by wildlife. Many plants within this habitat produce fruits that are important to wildlife. Common wildlife species in mixed scrub areas include those dependent on nectar, fruits, and seeds, such as Anna's hummingbird, sparrow, finch, scrub jay, black-headed grosbeak, lazuli bunting, rufous-sided towhee, Virginia opossum, raccoon, striped skunk, and gray fox. The mixed scrub habitat also supports many insectivorous bird species.

Mixed Riparian Forest/Valley Oak Riparian Forest. Mixed riparian forest and valley oak riparian forest typify high terrace riparian communities. High terrace habitats are inundated during peak storm runoff events only and are not subject to severe physical battering or erosion (aside from bank erosion) or long-term flooding. Mixed riparian forests develop from mature cottonwood forests as terrace elevations increase and cottonwoods senesce and die, thereby "releasing" midstory trees from the inhibition of overstory shading. This community is characterized by lush, multilayered 150-foot-tall gallery forests. The canopy includes Fremont cottonwood, western sycamore, Oregon ash, Northern California black walnut, and valley oak. Midstories include black willow, box elder, and young trees of canopy species. Shrub understories include often impenetrable vine thickets of California wild grape, blackberry, poison oak, California wild rose, and California pipestem clematis. These vines drape over the midstory and canopy layers, imparting a jungle-like appearance. Herb layers are typically dense.

Mixed riparian forests support the densest and most diverse wildlife communities in the Central Valley. The diversity of plant

species and growth forms provide a variety of foods and microhabitat conditions for wildlife. Many of the mixed riparian plants provide valuable fruits, nuts, or seeds. Wildlife present include most of the species that occur in cottonwood forest and riparian scrub habitats. Oaks and walnuts support certain species that infrequently occur in the other habitats, such as acorn woodpecker, plain titmouse, white-breasted nuthatch, and western gray squirrel.

Valley oak riparian forests develop on the highest terraces where flooding is least frequent and short in duration. Valley oak riparian forest develops from mixed riparian forests where dense California wild grapevines have not prevented establishment of oak seedlings. The sparse-to-dense canopy consists of valley oak occasionally interspersed with Northern California black walnut. The sparse midstory consists of tree saplings, California wild grape, poison oak, blue elderberry, and blackberry. A lush grass or sedge-dominated herbaceous layer is typical.

Oak forests provide nesting sites for hawks, herons, and egrets that require sturdy nesting sites and an open canopy for easy nest access. Valley oak stands also provide the best habitat for the acorn woodpecker, plain titmouse, and western gray squirrel. The open oak canopy provides perch sites for aerial foraging species such as the Lewis' woodpecker, ash-throated flycatcher, and western wood-pewee. It also offers perch sites for species that search for prey on the ground, such as the western bluebird and northern flicker. The furrowed bark on older oaks provides foraging habitat for species such as the Nuttall's woodpecker and white-breasted nuthatch that probe and peck for insects.

Riparian Woodland. Riparian woodlands typically occur along unmaintained, narrow channelbanks (DWR 1994). Common overstory tree species in riparian woodlands include Fremont cottonwood, western sycamore, white alder, valley oak, box-elder, ash, and several willow shrub and tree species. Typical understory and midstory species include blackberry, buttonbush, wild rose, and mugwort. The species composition and structure of riparian woodlands in the Delta Region vary widely depending on stand age, soil type, disturbance factors, and elevation above sea level (Madrone Associates 1980).

Riparian woodland supports the greatest diversity of bird species in California. The combination of the multilayered woodland canopy structure, groundcover, understory vegetation, presence of snags, and proximity to water provides the habitat elements required by many species (Madrone Associates 1980). Tree snags provide cavities for hole-nesting species such as woodpeckers, tree swallows, and wood ducks. Insects in and adjacent to the canopy provide forage for flycatchers and vireos, and species such as nuthatches and titmice glean insects from bark surfaces. Tall trees found in woodlands provide nest sites for high-canopy nesters, including great blue herons and several raptor species (Madrone Associates 1980).

Ground litter accumulates beneath the canopy and provides habitat for insects and other invertebrates, reptiles and amphibians, and small mammals that are prey species for predators such as bats, raccoons, skunks, and minks. Fruits of riparian vegetation, including acorns, rose hips, and berries, are important seasonal food sources for herbivorous and omnivorous species (Madrone Associates 1980).

Montane Riparian. The riparian communities of mountainous (i.e., montane) areas differ from valley foothill communities in extent and composition because the floodplain is constricted to narrow canyon bottoms, which limits river meandering and the lateral extent of the floodplain aquifer.

Because of the narrow floodplain, montane riparian vegetation is confined to a narrow band along the water's edge and to low terraces and gravel bars within the channel. The multilayered vegetation is nearly continuous along the bank, with Fremont cottonwood, white alder, willows, western sycamore, valley oak, and Oregon ash prevailing as common canopy species. A relatively dense shrub layer of willows, buttonbush, spicebush, creek dogwood, mule fat, and poison oak is typical. Because it is near woodlands and forests, dogwood, bigleaf maple, canyon live oak, Douglas fir, and incense cedar are often intermixed.

Narrow bands of montane riparian habitat provide valuable wildlife habitat despite their small areal extent. These areas are typically cooler, moister, and more productive than surrounding habitats.

Insectivorous species occurring in these habitats include vireos, warblers, and a variety of shrew species. Herbivores and omnivores that frequent streamside vegetation include towhees, fox sparrows, black-tailed deer, and western gray squirrels.

3. Wetland Communities

Wetland communities develop in the presence of hydrologic conditions that create seasonal or year-round inundation or saturated soils. They are also characterized by specific vegetation types and nonoxidizing soils. Wetland communities are important because they provide habitat for dependent plant and wildlife species and because they are scarce. Each wetland community type is adapted to specific hydrologic situations and is, therefore, sensitive to changes in water-table elevations. Two broad categories of wetland communities occur in the study area: freshwater emergent wetlands (permanent, seasonal, and managed-types) and saline emergent wetlands. Open-water and tidal flat communities are generally unvegetated but are associated with wetland communities and are also described under the wetland community-type.

Freshwater Emergent Wetlands. Freshwater emergent wetlands are characterized by the presence of erect, rooted, herbaceous plants that require or are tolerant of saturated or flooded soils. Freshwater emergent wetlands are inundated or saturated for a sufficient period to create anaerobic conditions in the root zone. Vegetation in these wetlands can vary from small isolated clumps within a body of water to large uninterrupted expanses covering many acres. Three types of freshwater emergent wetlands are described below: freshwater marshes, vernal pools, and managed wetlands; however, these subgroups are combined as one community type in the natural community acreage table and in the impact analysis.

Freshwater marshes (permanent wetlands) develop where fine-textured sandy and silty soils are permanently inundated or saturated. The community is intolerant of quickly flowing water, water depths exceeding 5 feet, rapid or wide fluctuations in water level, and saltwater. This community is restricted to ponds, canals, sloughs, river backwaters, and similar habitats.

Freshwater marshes in the study region are dominated by dense growths of tule and cattail, with occasional verbena, smartweed, rose mallow (California hibiscus), and various rush and sedge species. Open water in and near freshwater marshes and along rivers, oxbows, and quiet backwaters is dominated by floating and submerged aquatic species including pondweed, water-milfoil, waterweed, duckweed, bladderwort, and waterlily. Freshwater marshes provide important habitat for waterfowl and a variety of other wildlife species, including grebe, heron, egret, bittern, coot, shorebirds, rail, hawk, owl, muskrat, raccoon, opossum, and beaver. Many other upland species such as ring-necked pheasant, California quail, black-tailed hare, and desert cottontail take cover and forage at the margins of wetland habitats. Many reptiles and amphibians such as common garter snake, aquatic garter snake, Pacific treefrog, and bullfrog also breed and feed in freshwater habitats of the region.

Many wildlife species associated with saline emergent marshes also use freshwater marshes. Permanent freshwater marshes provide habitat for a great diversity of wildlife, and the density of emergent vegetation is a major determinant of species use. Dense stands of tule and cattail provide cover and nesting habitat for the American coot, pied-billed grebe, several species of rails, long-billed marsh wren, and common yellowthroat. More open stands of tule and cattail, in association with open water and mudflats, provide foraging habitat for shorebirds, wading birds, and waterfowl. Songbirds nest, forage, and find cover in willows and other marsh-associated shrubs. Beavers and muskrats are common aquatic mammals associated with marshes, and California voles and other small mammals are associated with areas of higher elevation within and adjacent to marshes (Madrone Associates 1980).

Vernal pools (seasonal wetlands) develop in shallow basins that form in flat-to-hummocky terrain. Soil durapans underlying the basins prevent water infiltration and the nearly level terrain inhibits surface runoff. Saturated soil conditions cause the water table to become exposed because it is "perched" on the durapan. Hence, surface water accumulates in the basins, forming a seasonal wetland.

Vernal pools are important communities because of their current scarcity. Holland (1978) estimated that 5 to 30 percent of California's vernal pools are intact today; the figure for the Central Valley is about 5 percent. They support an ephemeral flora dominated by terrestrial/endemic annual species, with perennial and aquatic species often contributing significant cover. Vernal pool species flower throughout the spring, resulting in conspicuous zonation patterns formed by consecutively blooming species around drying pool margins. Characteristic dominant plants include popcornflower, low barley, downingia, coyote-thistle, goldfield, meadowfoam, owl's clover, pogogyne, woolly marble, and navarretia. Many of these plant species are endemic and specialized to vernal pools.

Although vernal pools are an ephemeral aquatic habitat, invertebrates and amphibians also have adapted to and in some cases, endemic and specialized to this resource. When standing water is available, California tiger salamander, western spadefoot toad, and Pacific treefrog may use the pools for egg-laying and for the development of young. Aquatic invertebrates, such as fairy shrimp, tadpole shrimp, clam shrimp, cladoceran, copepod,

and crawling water beetle, may also inhabit vernal pools. In winter and spring, water birds may use vernal pools for resting and foraging grounds. Kingbirds and phoebes feed on flying insects above vernal pools.

Managed wetlands (seasonal/permanent wetlands) are used on federal and state refuges to maximize habitat suitability for waterfowl and other wetland-dependent wildlife. Managed wetlands can be broadly categorized into permanent wetlands, semi-permanent wetlands, seasonal wetlands, and moist soil plant areas.

Permanent wetlands are flooded throughout the year, with periodic drainage to control emergent vegetation and increase productivity. Water is maintained at a depth from 30 to 48 inches. Dominant vegetation includes cattails, tules, and pondweeds. Semipermanent wetlands are frequently the low portions of seasonal wetlands that remain flooded after seasonal wetlands have dried or are drained. This type of wetlands management maintains water on the site for 8 to 12 months annually and provides important summer water and brood ponds for resident waterfowl, sandhill cranes, and shorebirds, and foraging habitat for wading birds, other water birds, and raptors. Common mammals associated with managed/seasonal wetlands include, for example, the California vole, striped skunk, and coyote (USFWS 1992). Seasonal wetlands are flooded in fall and maintained through winter or spring but are drained or allowed to dry through summer.

Moist soil plant areas are seasonal wetlands managed for high production of preferred waterfowl forage plants and invertebrates. These areas may be irrigated during summer to stimulate plant growth. Water regimes are selected for specific plant associations, including swamp timothy, watergrass, or smartweed.

Saline Emergent Wetlands. Saline emergent wetland vegetation is dominated by water-seeking vegetation living in brackish or saline waters or soils. Vegetation is mostly composed of perennial grass-like plants and forbs. Forbs in saline emergent vegetation are usually succulent and not very woody. Mats of algae often carpet moist soils and plant stems. Component plants are present in zones or patches relating to elevational gradients above the mean water level, and vegetative cover is generally complete except where creeks or ponds exist.

Characteristic species of lower, and consequently more saline, sites are cord grass, pickleweed, saltwort, fleshy jaumea, California sea-blite, and alkali heath. Typical species of more brackish sites include bird's-beak, sea-lavender, African brass-buttons, saltmarsh dodder, tules, slender cattail, silverweed, and slough sedge. Saline emergent wetland vegetation occurring in the upper intertidal zone (from about mean lower high water to extreme high water) is about 10 feet above mean lower low water and includes some freshwater-tolerant species.

Saline emergent wetlands provide habitat for approximately 200 species of birds, mammals, reptiles, and amphibians (ACOE 1994). Birds that commonly use this habitat include salt marsh yellowthroat, song sparrow, marsh wren, Virginia rail, American coot, and shorebirds, including duck, heron, egret, and swallow, and resident and migratory waterfowl. Raccoon, opossum, striped skunk, red fox, and coyote forage along the edges of saline emergent wetlands.

Saline emergent wetlands are frequently diked, as observed most frequently in the Suisun Bay/Marsh.

Open Water. Open-water areas include river channels, lakes, reservoirs, estuaries, sloughs, flooded islands, ponds, and bays. Deep open-water areas are largely unvegetated; beds of aquatic plants occasionally occur in shallower open-water areas. Typical aquatic plant species include water hyacinth (a nonnative noxious weed), water milfoil, and yellow water weed. (DWR 1994). Gulls, terns, kingfishers, ospreys, and bald eagles hunt for fish and invertebrates in open water. Insectivorous birds and bats feed over open water. Common mammals in open water include muskrats, beavers, and river otters (Mayer and Laudenslayer 1988). This habitat provides resting and foraging areas for diving ducks, gulls, grebes, and other open water birds.

Tidal Flats. Tidal flats include shoals, sandy mud bars, and portions of streambeds that are exposed at low tide. Tidal flats are largely unvegetated, although some emergent vegetation may be present. Exposed tidal flats provide resting and foraging habitat for several bird groups. Gulls use tidal flats as resting areas during spring and fall migration, and large numbers of shorebirds congregate to forage on invertebrates on the tidal flat substrate. Mammals such as raccoons and skunks also forage along tidal flats (Madrone Associates 1980; USFWS 1992).

4. Reservoir Habitats

Reservoirs created for the storage of water also provide habitat for wildlife, primarily waterbirds (e.g., gulls, waterfowl, wading birds, shorebirds, and coots and rails) during fall and winter. Most reservoirs are not optimum habitat because frequently fluctuating water levels do not allow establishment of vegetation along shorelines, and steep sides limit the amount of shallow-water habitat preferred by most species of waterbirds for resting, foraging, and nesting. Reservoir habitat includes three distinct zones: shoreline, shallow water, and open water.

Shoreline habitat includes the area above and below the high-water level. The habitat above the high-water level is the natural habitat that occurred in the area before inundation of the reservoir. Common habitats around reservoirs are mixed conifer forest, montane hardwood, valley foothill hardwood, chaparral, and grassland. These habitats were described in a previous section. The other portion of shoreline habitat occurs in the area between the high- and low-water elevations. The amount of shoreline varies within a year as the reservoir fills during winter and spring and is drained during summer and fall. The fluctuating water levels result in constant erosion and extended periods of inundation and exposure that inhibit the establishment of vegetation. Furthermore, the native soil is generally eroded by wave action and fluctuating water levels. Common vegetation along the shoreline may be ruderal annual forbs and grasses. Some reservoirs developed moderate amounts of willow scrub vegetation in their drawdown zones during the dry years from 1987 to 1993 (e.g., Folsom Lake contains scattered small patches of Goodding's black willow totaling approximately 65 acres).

Shorelines tend to have low value for most wildlife species because generally no vegetation exists to provide forage and cover for wildlife. Shorelines are used by small

numbers of shorebirds, wading birds, dabbling ducks, and American coots that feed on invertebrates, herbaceous vegetation, or seeds scattered along the shoreline. Additional species include raccoon, striped skunk, coyote, and Pacific treefrog.

Shallow-water wildlife habitat in a reservoir is the area with less than 1 foot of water. The extent of this habitat is generally limited because of the steep sides of most reservoirs. Vegetation is adapted to grow in an oxygen-deficient habitat. Plants such as milfoils and waterweeds become evident late in the growing season after drawdowns in the reservoirs have begun. Emergent aquatic plants, such as cattails, and tules, may establish in some shallow-water areas, but this vegetation rarely persists because of the variations in water levels.

Shallow-water habitat is optimal foraging depth for dabbling ducks, coots, and wading birds. These animals feed on aquatic invertebrates, small fish, amphibians, and aquatic plants. Shallow-water shorelines may also be used by muskrats, raccoons, and skunks.

Open-water wildlife habitat is any portion of the water that is deeper than 1 foot. This habitat is generally devoid of vegetation because of the lack of oxygen, light, and cold temperatures that limit the photosynthesis capabilities of plants. This habitat provides resting and foraging areas for diving ducks, gulls, grebes, and other water birds.

5. Agricultural Lands

Although natural communities provide the highest value for wildlife, many of these natural habitats have been replaced by agricultural habitats with varying benefits to wildlife. Six agricultural types were identified in the study area: pasture, orchard-vineyard, row crops, grain, rice, and cotton. The intensive management of agricultural lands, including disking, grazing, crop rotation, and the use of chemicals, reduces the value of these habitats for wildlife. However, many wildlife species have adapted to particular crop types and now use them for foraging and nesting. Compared to other agricultural crops, rice and grain crops are considered of high value for wildlife because of the importance of waste grain to foraging wildlife species, and flooded ricefields provide habitat similar to some natural wetlands. In contrast to rice and grains, pasture and row crops provide moderate-quality habitat due to limited cover and foraging opportunities. Orchard-vineyard and cotton crops provide low-quality wildlife habitat due to frequent disturbance, resulting in limited foraging opportunities, and lack of cover. Table IV-1 summarizes the acreage of natural communities and agricultural crops in study area regions.

Pasture. Pastures consist of irrigated and nonirrigated lands that are dominated by grasses and legumes. The vegetation composition of pastures varies with management practices, affecting the abundance and composition of wildlife resources. Native wildlife species utilize irrigated pasture as a wetland resource; however, the frequent harvesting reduces habitat quality for ground-nesting wildlife. Irrigated pastures also provide foraging and roosting opportunities for many shorebirds and wading birds. Lightly grazed, nonirrigated pastures may have value similar to that of annual and perennial grasslands, providing forage for seed-eating birds and small mammals when the seeds ripen.

Alfalfa grown in irrigated pastures provides high-quality foraging habitat for rodents.

Small mammals occupying pasture habitat include California vole, Botta's pocket gopher, and California ground squirrel. Raptors are common and prey upon rodents. Areas where alfalfa or wild oats have been recently harvested provide high-quality foraging habitat for raptors. Ground-nesting birds, such as ring-necked pheasant, waterfowl, and western meadowlark, occupy pasture habitat if adequate residual vegetation is present.

Orchard-Vineyard. Orchard-vineyard habitat consists of cultivated fruit or nut-bearing trees and grape vines. This habitat is planted in a uniform pattern and intensively managed. Understory vegetation is usually sparse; however, in some areas, grasses are allowed to grow between vineyard rows to reduce erosion. Wildlife species associated with vineyards include the deer mouse, mourning dove, and black-tailed hare. The nut crop from orchards provides feed for the American crow, scrub jay, northern flicker, Lewis' woodpecker, and California ground squirrel. The fruit crops from orchards provide additional food for the yellow-billed magpie, American robin, northern mockingbird, black-headed grosbeak, gray squirrel, raccoon, and mule deer. For the most part, this habitat provides only limited foraging opportunities and very little roosting or breeding habitat.

Row Crops. Row crops include tomatoes, broccoli, artichokes, lettuce, sugar beets, and strawberries. Intensive management and the use of chemicals to control pests in row crops greatly limit their use by wildlife. Rodent species that forage in row crops include the California vole, deer mouse, and California ground squirrel. These rodent populations are preyed upon by hawks and kites.

Grain. Grain crops include barley, wheat, corn, and oats. Many of these crops are planted in fall and harvested in spring. Grain crops are intensively managed, and chemicals are often used to control pests and diseases. This management strategy reduces their value to wildlife; however, the young green shoots of these crops provide important foraging opportunities for such species as greater white fronted geese, tundra swans, wild pigs, and tule elk. Other species, including blackbirds, pheasants, waterfowl, and western harvest mice, feed on the seeds produced by these plants.

Rice. Cultivated rice in the study area has some of the attributes found in seasonal wetlands; however, the intensive management of this habitat reduces many of the benefits found in natural wetlands. Flooded rice fields provide nesting and foraging habitat for waterfowl and shorebirds. The grain produced by this crop provides important forage for many wildlife species. After harvest, waste grain is fed upon by waterfowl, California voles, and deer mice. Raptors feed upon rodents in this habitat. Irrigation ditches used to flood rice fields often contain dense cattail vegetation. These ditches provide habitat for wildlife species, such as Virginia rails, American bitterns, egrets, marsh wrens, common yellowthroats, and sparrows. Irrigation ditches are routinely cleared of vegetation, therefore, the habitat provided is temporary.

Cotton. Cotton is of limited value to wildlife because of the intensive management of this crop and the use of chemicals to control pests and disease. Mourning doves and house mice are found in this crop type. During irrigation when

vegetation is short and sparse, additional wildlife, including killdeer, American pipet, and horned lark, may be attracted.

C. Rare Natural Communities

Rare natural communities are recognized by state and federal agencies as important habitats because of their high species diversity and richness, high productivity, unusual nature, limited distribution, and declining status, or some combination of these qualities. The NDDB maintains a list of rare natural communities in California. Table IV-2 lists rare natural communities known or with potential to occur in the Delta, Bay, Sacramento River, and San Joaquin River Regions of the study area.

The following descriptions, based on Holland (1986) and CNPS (1993), focus on rare natural communities that occur in the study area regions.

Valley Oak Woodland. Valley oak woodland is an open-canopied community dominated almost exclusively by valley oak. Valley oak is California's largest broad-leaved tree, attaining heights from 50 to 115 feet. An herbaceous understory exists and few shrubs, if any, are present.

Valley oak woodland occurs in the Sacramento and San Joaquin valleys adjacent to the Sierra Nevada foothills and in the valleys of the Coast Ranges from Lake County to western Los Angeles County. This community is found at elevations from sea level to 2,540 feet, occurring in all the study area regions except the Delta and Bay. Large areas of this community have been eliminated by woodcutting and conversion of habitat to agricultural and urban lands.

Valley Oak Riparian Forest. This community is similar to the valley oak woodland community described earlier, but it is characterized by a closed canopy dominated primarily by valley oak. Valley oak riparian forest is restricted to higher sections of floodplains that are away from the active river channels, yet still receive annual inputs of silty alluvium and have a shallow-water table.

Once extensive along the major streams of the Sacramento and northern San Joaquin valleys, this community has suffered extensive losses due to conversion to agriculture and harvesting of firewood. Valley oak riparian forest occurs in all of the study area regions, with the exception of the Bay Region.

Fremont Cottonwood Riparian Forest. This community is similar to the valley oak riparian forest community but is characterized by a dense tree layer codominated by Fremont cottonwood and black willow. It occurs on sites along perennial or nearly perennial streams that receive frequent flooding. These sites are inundated during winter and spring and receive subsurface irrigation from a shallow-water table during the remainder of the year.

Historically abundant along major streams throughout the Central Valley, Fremont cottonwood riparian forest now occurs only in small, scattered, isolated patches. Major losses to this community have resulted from flood control, water diversion, agricultural development, and urban expansion. It occurs in all regions of the study area, with the exception of the Bay Region.

TABLE IV-2 RARE NATURAL COMMUNITIES KNOWN OR WITH POTENTIAL TO OCCUR IN THE CALFED STUDY AREA

	Study Area Regions			
Rare Natural Community	**Sacramento River**	**San Joaquin River**	**Bay**	**Delta**
Alkali meadow and seep	x	x		x
Bog and fen	x	x		
Cismontane alkali marsh	x	x		x
Coastal and valley freshwater marsh	x	x		x
Coastal brackish marsh	x		x	x
Elderberry savanna	x	x		
Fremont cottonwood riparian forest	x	x		x
Great Valley mesquite scrub		x		
Great Valley willow scrub	x	x		x
Ione chaparral	x	x		
Mixed riparian forest	x	x		x
Monvero residual dunes		x		
Northern basalt flow Vp.	x	x		
Northern claypan vernal pools	x	x	x	x
Northern coastal salt marsh			x	x
Northern hardpan Vp.	x	x		
Serpentine bunchgrass grassland	x		x	
Stabilized interior dunes				x
Sycamore alluvial woodland		x		
Valley needlegrass grassland	x	x	x	x
Valley oak riparian forest	x	x		x
Valley oak woodland	x	x		
Valley sacaton grassland		x		
Valley sink scrub		x	x	x
Wildflower field	x	x		x
Total in each region	**17**	**19**		**11**

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Mixed Riparian Forest. This community is similar to the riparian forest communities described earlier. It is a closed canopy forest dominated by any of several species, including box elder, northern California black walnut, western sycamore, Fremont cottonwood, black willow, yellow willow, and red willow. Mixed riparian forest occurs on relatively fine-textured alluvium slightly back from the active river channel. Overbank flooding usually occurs annually. This community may intergrade with Fremont cottonwood riparian forest closer to the river channel and valley oak riparian forest farther from the river.

Mixed riparian forest is found most abundantly along low-gradient streams throughout the Sacramento and San Joaquin valleys. Clearing for agriculture, flood control, and urban expansion has severely reduced the abundance of this community. Mixed riparian forest occurs in all of the study area regions, with the exception of the Bay Region.

Sycamore Alluvial Woodland. Sycamore alluvial woodland is a broad-leaved riparian woodland community dominated by moderately spaced western sycamore trees.

California buckeye and blue elderberry are common components of the subcanopy. An understory of annual grasses and mule fat is typical.

Sycamore alluvial woodland is found along braided, depositional channels of intermittent streams that are usually characterized by cobbly or boulder substrates. This community is found in the San Joaquin River Region.

Great Valley Willow Scrub. Great Valley willow scrub is an open to dense streamside community that forms a shrubby thicket dominated by any of several willow species. An herbaceous understory of naturalized and native annual grasses and forbs exists in more open-canopied stands.

Great Valley willow scrub occurs along the major rivers and many smaller streams in the Central Valley, typically below 1,000 feet. It has the potential to occur in the Sacramento River, San Joaquin River, and Delta regions.

Great Valley Mesquite Scrub. This community is an open woodland or savanna dominated by mesquite, a phreatophyte (i.e., a plant that sends roots down to the water table), and allscale. An understory of naturalized annual grasses is typical. Great Valley mesquite scrub occurs on sandy loam soils in areas with hot, dry summers and moist, foggy winters.

This community was once common in the southern San Joaquin Valley from Bakersfield to the inner South Coast Range at Tupman and Buena Vista Lake. The NDDB also cites this community as occurring farther north. It has been virtually extirpated by flood control, agricultural development, and groundwater pumping. Great Valley mesquite scrub occurs in the San Joaquin River Region.

Elderberry Savanna. Elderberry savanna is a community of early successional stages dominated by open stands of blue elderberry. The understory is characterized by naturalized annual grasses and forbs. This community occurs on deep alluvial soils removed from the active river channel and is subject to occasional flooding during high rainfall events.

Elderberry savanna is patchily distributed among riparian stands throughout the Sacramento River and northern San Joaquin

River regions, as far south as Merced County.

Ione Chaparral. This community is characterized by Ione manzanita as the sole or dominant shrub in the canopy layer. Occasional trees, such as canyon live oak or foothill pine, are present. Other associates of the shrub layer include deer weed, scrub oak, and sticky whiteleaf manzanita. Only a sparse ground layer exists.

Ione chaparral is restricted to the foothills of Amador and Calaveras counties, in the Sacramento River and San Joaquin River regions.

Valley Sink Scrub. This succulent shrubland community is dominated by alkali-tolerant species, such as iodine bush and bush seepweed. Soft chess and other annuals may sparsely vegetate the understory.

Valley sink scrub occurs on heavy saline or alkaline clay soils of lakebeds or playas with high groundwater supplies in the Central Valley. It once surrounded the San Joaquin Valley lakes and was prevalent around water bodies in the Sacramento Valley. This community has been virtually extirpated by flood control, agricultural conversion, and groundwater pumping. Valley sink scrub occurs in the San Joaquin River Region.

Stabilized Interior Dunes. This is an open community characterized by a scattering of annual and perennial herbs, grasses, and low-growing shrubs. Common species include Antioch Dunes evening-primrose, California croton, California matchweed, Contra Costa wallflower, auriculed barestem buckwheat, and telegraph weed. Individuals of coast live oak may also be present.

Stabilized interior dunes form a riverbank community occurring on the lower reaches of the San Joaquin River at Antioch. The dunes were formed from glacial outwash of the Pleistocene Sierra Nevada. Historically very limited, this community has been further reduced by agricultural and industrial development, road building, and sand quarrying. Stabilized interior dunes occur in the Delta Region.

Monvero Residual Dunes. This open community is dominated by two shrubs: desert tea and narrowleaf goldenbush. An understory of grasses, such as desert needlegrass and Indian ricegrass, and several forbs characteristic of the Colorado and Mojave deserts occur in the Monvero residual dunes.

This community is found on hilltop sand accumulations that have weathered in place from Miocene sandstones. It is restricted to the lower inner south Coast Range in western Fresno County, from approximately 1,500 to 3,000 feet in elevation. Monvero residual dunes occur on the western side of the San Joaquin River Region.

Valley Needlegrass Grassland. This community is dominated by the tussock-forming purple needlegrass; naturalized annual forbs and grasses are also common. It is found on fine-textured soils that receive ample water during winter. This community is much reduced in its historical range, which includes the Sacramento, San Joaquin, and Salinas valleys and the Los Angeles Basin. Valley needlegrass grassland occurs in the study area regions.

Serpentine Bunchgrass Grassland. Serpentine bunchgrass grassland is a perennial bunchgrass community dominated by several native grasses and forbs, such as foothill needlegrass, nodding needlegrass,

California melic grass, California lotus, and California poppy. It is restricted to serpentine sites primarily in the Coast Ranges but is also found in limited extent in the Sierra Nevada and southern California mountains. Serpentine bunchgrass grassland also occurs in the Sacramento River and Bay regions.

Valley Sacaton Grassland. This tussock-forming community is dominated by alkali sacaton. It occurs on fine-textured, poorly drained, alkaline soils. Seasonally high water tables are typical in this community. Once extensive in the San Joaquin Valley north to Stanislaus and Contra Costa counties, this community is now much reduced. Valley sacaton grassland occurs in the San Joaquin River Region.

Wildflower Field. Wildflower field is a herbaceous community with a conspicuous display of any number of wildflower species, such as California poppy, bicolored gilia, tidy tips, bicolored lupine, and owl's clovers. Wildflower field is found in the valleys and foothills of most of the California Floristic Province, generally the area west of the Pacific divide possessing a Mediterranean-type climate. This community occurs below 2,000 feet in elevation in the north and from about 4,000 to 5,000 feet in the south and is found in the Sacramento River, San Joaquin River, and Delta regions.

Vernal Pool. Vernal pools are shallow, seasonal water bodies that accumulate water during winter and spring due to the presence of an impermeable subsurface layer. Annual herbs bloom after water evaporates in late spring. Species composition varies among pools, but may include downingia, coyote-thistle, goldfield, popcornflower, and woolly marble.

Vernal pools occur in the Central Valley, southern central coast, south coast, and Modoc Plateau of California from sea level to 3,610 feet. They also occur in the Sacramento River and San Joaquin River regions.

Northern Claypan Vernal Pool. Northern claypan vernal pools are similar to the vernal pool habitat as described above. They are shallow, seasonal water bodies that accumulate water during winter and spring due to very acidic, cemented hardpan soils. Species composition varies often including popcornflower, goldfield, alkali weed, alkali heath, and button celery. Soils are often more or less saline , and occur on lower terraces and basin rims in the Bay Region.

Coastal and Valley Freshwater Marsh. This wetland community occurs on permanently flooded sites with slow-moving freshwater, where deep, peaty soils tend to accumulate. It is dominated by densely spaced perennial, emergent grass-like plants. Bulrushes and cattails dominate individually or together.

Coastal and valley freshwater marsh is extensive in the upper Delta and common in the Sacramento and San Joaquin valleys in floodplain areas such as river oxbows. It also occurs along the fringes of perennially flooded drainage ditches, canals, ponds, and lakes and in coastal valleys near river mouths. This community is found in the Sacramento River, San Joaquin River, and Delta regions.

Cismontane Alkali Marsh. This community is characterized by densely spaced perennial emergent plants including saltgrass and rushes. Soils are perennially inundated or saturated and are alkaline due to high evaporative pressures and low freshwater inputs. Cismontane alkali marsh

occurs along lakebeds and other floodplains of the Sacramento and San Joaquin river regions and in the Delta Region.

Alkali Meadow and Seep. These communities are composed of perennial grasses, sedges, or herbs. Species richness is typically low and may include plants, such as alkali sacaton, saltgrass, ditchgrass, and rushes. Sites supporting alkali meadows and seeps are more or less permanently moist and are characterized by alkaline or saline soils.

Alkali seeps are found primarily in the desert regions of California and less commonly in other areas. Alkali meadows occur mainly in valley bottoms and on the lower portions of alluvial slopes from 3,500 to 7,000 feet, they are also scattered throughout the California Floristic Province (Hickman 1993). Alkali meadows and seeps occur throughout the Central Valley in the Sacramento and San Joaquin river regions.

Bogs and Fens. Bogs are characterized by a dense growth of herbaceous perennials and low-growing shrubs. Fens are similar to bogs, but with a richer flora that includes larger shrubs. Common species may include sedges, roundleaf sundew, California pitcher plant, Labrador tea, Douglas' false-willow, and sphagnum moss.

Bogs are found scattered in the Klamath and Coast ranges, Sierra Nevada, and Cascade Range. They inhabit cold, acidic, poorly drained, low-nutrient areas. NDDB occurrences of bogs and fens have been reported for the Sacramento River Region and the eastern side of the San Joaquin River Region.

Coastal Brackish Marsh. Coastal brackish marsh is similar to coastal and valley freshwater marsh with the addition of species, such as saltgrass and pickleweed, that are more tolerant of higher salinities. Salinities tend to vary considerably with changes in the tide.

This community typically occurs at the interior of coastal bays and estuaries where freshwater and saltwater intermix, and in coastal lagoons. It is well developed at Suisun Bay. Coastal brackish marsh is found in the western side of the Sacramento River, Bay, and Delta regions.

Northern Coastal Salt Marsh. This highly productive community is dominated by salt-tolerant hydrophytes (i.e., water-loving plants). Pacific cord grass grows nearest to the open water, and pickleweed grows farther away on slightly higher elevations. A more diverse mix of species occurs at the transition with the adjacent upland community.

This community is found along the sheltered fringes of bays, lagoons, and estuaries, with regular saltwater tidal inundation. Northern coastal salt marsh is distributed along the coast from the Oregon border south to Point Conception. In the study area, northern coastal salt marsh is found in the Bay, Delta, and Sacramento River regions.

D. Significant Natural Areas

The SNA Program is administered by CDFG and designed to encourage recognition of the state's most significant natural areas and to seek perpetuation of these areas (California Fish and Game Code, 1930-1933). SNAs have no legal status. They have been identified in response to a legislative mandate to raise the level of awareness about California's natural diversity and to identify opportunities for cooperative efforts to conserve important biological resources.

CDFG has used only the NDDB to identify SNAs. The exact boundaries of SNAs have not been established because thorough field surveys have not been completed. SNAs have been identified on the basis of biological value alone; geological or cultural resource values have not been included in the inventory. To qualify as an SNA, a site must meet one of the following four criteria:

- The species or community (element) is extremely rare.
- An assemblage of three or more rare elements is present.
- The element is the best example (relatively undisturbed condition).
- The element is a center of high diversity.

SNAs are used in this document to geographically portray the location of special-status species and rare natural areas. Their distribution is described separately for each CALFED study area region in Chapter V of this technical appendix.

E. Special-Status Species

Special-status species are plants and animals that are recognized as rare by state and federal agencies and conservation groups. They include federally listed and state-listed threatened or endangered species, and federal or state species of concern. Complete descriptions, including legal status, distribution, and habitat requirements of special-status species, are provided in CVPIA (1997) Appendix for Vegetation and Wildlife. Table IV-3 presents numbers of special-status plants and wildlife in the study area.

The rich biological heritage in California includes more than 750 native vertebrate species, 6,800 plant species, and 25,000 native insect species. More than one-third of the plant and freshwater fishes are endemic to California. Because of this rich biological diversity, the number of species with limited distributions and high sensitivity is large.

Tables IV-4 and IV-5 list the numbers of special-status plant and wildlife species, respectively, by status level and habitat in each region.

V. RESOURCES IN EACH CALFED STUDY REGION

This section describes the biological resources in each of the CALFED study regions: the Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and the SWP and CVP Service Areas (Figure I-1).

The plant and wildlife resources and condition of habitats are reviewed for each region. A separate section for describing waterfowl and shorebird resources is also provided of each region. A summary of the total number of SNAs by region is included. In addition, a summary of the total number of special-status plant and wildlife species within each region is provided for each habitat type. See the Environmental Impacts Technical Appendix for a list of special-status species names and the names of individual SNAs for each region.

A. Delta Region

1. Natural and Agricultural Communities and Associated Wildlife

Vegetation types within the Delta Region include both wetland and riparian-type communities as shown on Figure V-1. Table IV-2 summarizes the area of each of these habitat types to the nearest 1,000 acres.

TABLE IV-3 NUMBERS OF SPECIAL-STATUS PLANT AND WILDLIFE SPECIES THAT OCCUR IN THE CALFED STUDY AREA[1]

Listing Status	Plants	Animals
Federally listed as threatened or endangered	28	22
Proposed for federal listing as threatened or endangered	18	0
State-listed as threatened, endangered, or (for plants only) rare	15	9
Federal candidate	5	4
Total	**66**	**35**

NOTE: Many species have a federal and state status. However, in this table, each species was assigned to the highest-ranked category of legal protection (federally listed = highest, state-listed = lowest) and counted only once.

[1] See Impact Assessment Technical Appendix - Vegetation and Wildlife for a complete list and description of individual sensitive species by region.

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TABLE IV-4 NUMBERS OF SPECIAL-STATUS PLANTS BY STATUS LEVEL AND HABITAT IN EACH CALFED REGION[1,2]

Region/Status	Mixed Conifer Forest	Montane Hardwood	Pinyon-Juniper	Valley-Foothill Hardwood	Valley-Foothill Riparian	Inland Dunes	Montane Riparian	Chaparral	Alkali Desert Scrub	Desert Scrub	Sagebrush & Bitterbush Scrub	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh
Delta														
Federally listed or proposed						2						9		2
State-listed					1							2	2	1
Federal candidate														
Delta Totals					1	2						11	2	3
Bay														
Federally listed or proposed		2	3	4				1	5			12		
State-listed	1	1		1						1		1		
Federal candidate		1		1								1		
Bay Totals	1	4	3	6				1	5	1		14		
Sacramento River														
Federally listed or proposed	1	8		7				6	1			18	1	1
State-listed	2	2		2	1			2	1			3	3	1
Federal candidate		1		1				3						
Sacramento River Totals	3	11		10	1			11	2			21	4	2
San Joaquin River														
Federally listed or proposed		6	1	9				2	4			15		
State-listed	4	4		4	2			4				2	2	1
Federal candidate	1	2		3				2				1		
San Joaquin River Totals	5	12	1	16	2			8	4			18	2	1

NOTE: Coastal and desert habitats that do not occur in the Central Valley are not included in this table.

[1] See Terrestrial Resources Technical Appendix - Vegetation and wildlife for a complete list and description of individual sensitive species by region.
[2] When a species was both state- and federally listed, it was only counted once as federally listed and not as state-listed.

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TABLE IV-5 NUMBER OF SPECIAL-STATUS WILDLIFE SPECIES BY STATUS LEVEL AND HABITAT IN EACH CALFED REGION[1]

Region/Status	Mixed Conifer Forest	Montane Hardwood	Pinyon-Juniper	Valley-Foothill Hardwood	Valley-Foothill Riparian	Inland Dunes	Montane Riparian	Chaparral	Alkali Desert Scrub	Desert Scrub	Sagebrush & Bitterbush Scrub	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh	Lacustrine	Riverine	Irrigated Pasture	Row Crops	Grain Crops	Rice
Delta																				
Federally listed or proposed						1							8	2	3	3	1		1	
State-listed					2		1						1	1		1	2	1	3	
Federal candidate					1								1		1		1		1	
Delta Totals					**3**	**1**	**1**						**10**	**3**	**4**	**4**	**4**	**1**	**5**	
Bay																				
Federally listed or proposed	1				2				5			5	4		2	1				
State-Listed	1				3		1	1				1	1		1			2	1	
Federal candidate						1					1	2	2		1		1		1	
Bay Totals	**2**				**5**	**1**	**1**	**1**	**5**		**1**	**8**	**7**		**4**	**1**	**1**	**2**	**2**	
Sacramento River																				
Federally listed or proposed	1				1							3	8		4	4	1		1	
State-listed					1		1					1	2	1	2	1		1	1	
Federal candidate												2	1				1		1	
Sacramento River Totals	**1**				**2**		**1**					**6**	**11**	**1**	**6**	**5**	**2**	**1**	**3**	
San Joaquin River																				
Federally Listed or proposed	1				2				6	1		5	6		3	3	1		1	
State-listed				1	3		1					1	1		1			2	1	
Federal Candidate												2	1		1		1		1	
San Joaquin River Totals	**1**			**1**	**5**		**1**		**6**	**1**		**8**	**8**		**5**	**3**	**2**	**2**	**3**	

NOTE: Coastal and desert habitats that do not occur in the Central Valley are not included in this table.

[1] See Impact Assessment Technical Appendix - Vegetation and Wildlife for a complete list and description of individual sensitive species by region.

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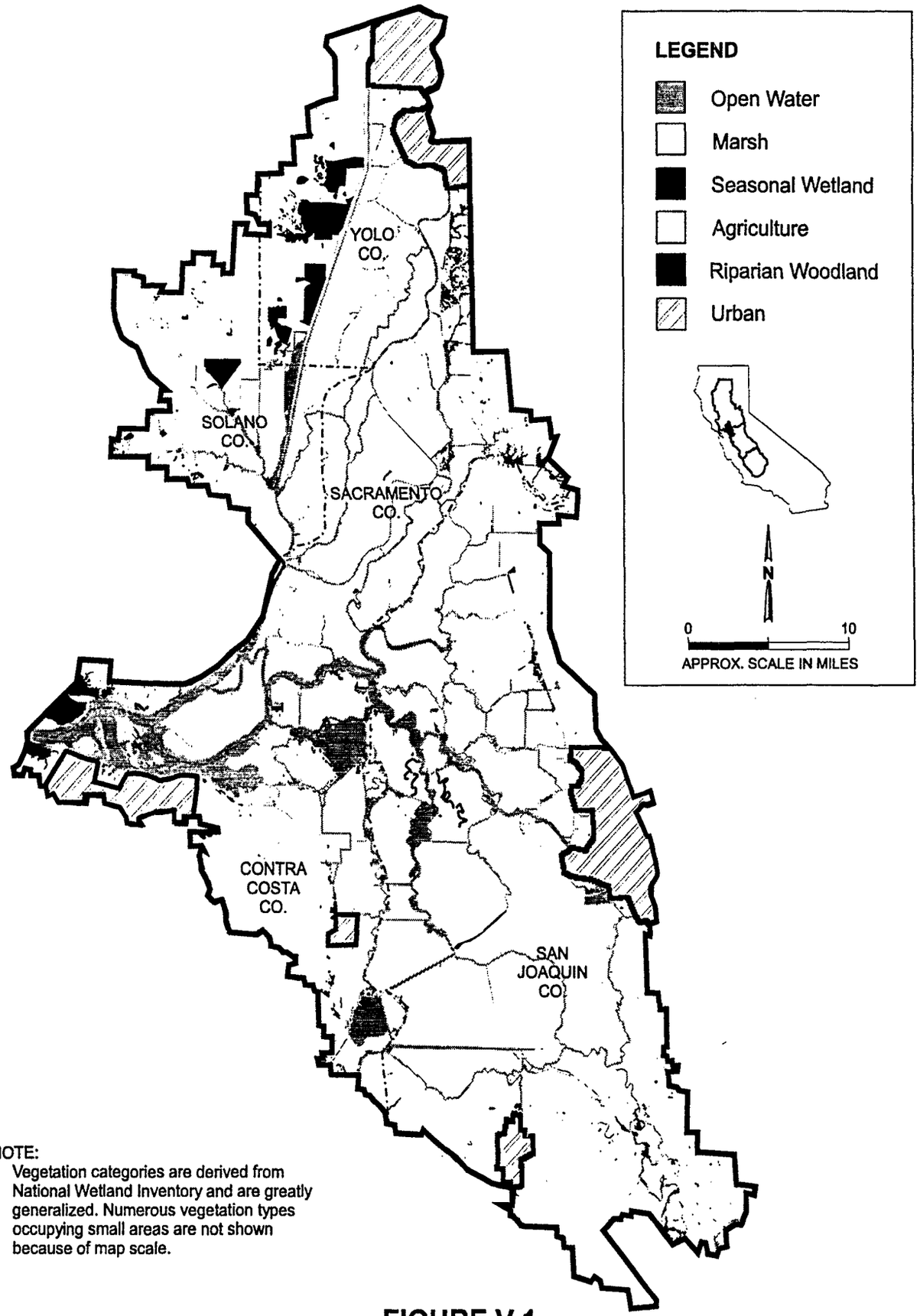


NOTE:
Vegetation categories are derived from National Wetland Inventory and are greatly generalized. Numerous vegetation types occupying small areas are not shown because of map scale.

FIGURE V-1

GENERAL VEGETATION TYPES OF THE DELTA REGION

Wetland and riparian-type communities occupy 32,000 acres, or 5 percent of the total land area in the region.

Open water occupies another 56,000 acres, or 8 percent. One upland community, agriculture, also occurs in the Delta Region and occupies approximately 505,000 acres (72 percent) out of a total land area of 700,000 acres of the Delta Region. Figure V-1 presents the distribution of habitats in the Delta Region. The natural and agricultural communities found within the Delta are described below.

Riparian and Wetland Communities.

Open water in the Delta Region includes sloughs and channels in the Delta, flooded islands, ponds, and bays. Deep open-water areas are largely unvegetated; beds of aquatic plants occasionally occur in shallower open-water areas. Typical aquatic plant species include water hyacinth (a nonnative noxious weed), water milfoil, and yellow water weed. (DWR 1994.). Open water provides resting and foraging habitat for water birds, including loons, grebes, pelicans, gulls, cormorants, and diving ducks. These species forage primarily on invertebrates and fish (Madrone Associates 1980).

Nontidal freshwater marsh occurs on the landward side of Delta levees and in Delta island interiors mostly in human-made waterways and ponds in agricultural areas. Dominant nontidal freshwater marsh species include tule, bulrush, cattail, watergrass, and nutgrass. Common floating aquatic species include pretty water smartweed and yellow water weed. Nontidal freshwater marsh is typically associated with agricultural drainage and irrigation ditches, levee blowout ponds, state and federal wildlife refuges, duck clubs managed specifically to create and maintain marsh habitat, and extensive areas of open water. (Madrone Associates 1980).

Seasonal freshwater wetlands include inland freshwater marshes that maintain surface water during only a portion of the year and vernal pools associated with grasslands (see following description for vernal pool discussion). In addition to natural wetlands, seasonal wetland conditions are also created when harvested cornfields are flooded in the Delta during fall and winter to reduce soil salinity and control weeds (DWR 1994). Large seasonal wetlands managed for waterfowl occur in the northwestern part of the Delta, west of the Sacramento Deep Water Ship Channel. Seasonal freshwater wetlands are of great importance to migratory waterfowl and shorebird populations for the forage they provide during fall, winter, and spring when bird populations in the Delta increase dramatically (DWR 1994).

Vernal pools, a type of seasonal wetland in which water is present only during the rainy season (usually spring), occur in grasslands along the fringes of the Delta Region and support a wide diversity of native plants and invertebrates, including several special-status species. In particular, the Jepson Prairie Preserve contains vernal pools that support several special-status species.

Riparian woodland typically occurs along unmaintained, narrow channelbanks in the Delta, creeks, other waterways, and major tributaries (DWR 1994). The major rivers of the Delta consist of the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras. NWI maps document

approximately 7,000 acres of riparian vegetation occurring primarily on the levees of the Delta islands and along the Cosumnes and Mokelumne rivers. The riparian zone along leveed islands is usually very narrow, but more extensive riparian areas occur along the San Joaquin River just below its confluence with the Stanislaus River, and along the Cosumnes River. Extensive and relatively wide corridors of riparian woodland that support a multilayered canopy generally provide greater wildlife habitat values than do smaller, less diverse stands.

Riparian scrub is associated with banks protected from erosion by riprap and levees, channel islands, and natural berms that are not protected by riprap, at the margins of some Delta islands, and with unmaintained agricultural ditches in the interior of Delta islands. Riparian scrub habitats typically are disturbed periodically for levee maintenance. In the absence of disturbance or frequent inundation from highest tides, most sites supporting riparian scrub in the Delta would eventually develop into riparian woodland (Madrone Associates 1980). The riparian zone along leveed islands is usually very narrow, but more extensive riparian areas occur along the San Joaquin River just below its confluence with the Stanislaus River, and along the Cosumnes River.

Upland Communities.

Grassland and ruderal habitat are present throughout the Delta Region and are typically small in size, but can provide relatively high wildlife values because intensive and extensive agriculture has greatly reduced the available natural or naturalized upland habitats. The extent of use by wildlife is dependent on the type of vegetation present and adjacent land use.

Agricultural habitat within the Delta Region encompasses approximately 546,000 acres (see Table IV-2). Major crops and cover types in agricultural production include small grains (e.g., wheat and barley), field crops (e.g., corn, sorghum, and safflower), truck crops (e.g., tomatoes and sugar beets), forage crops (e.g., hay and alfalfa), pastures, orchards, and vineyards. Vegetable crops are the most abundant crops in the region. The distribution of seasonal crops in the Delta Region varies annually depending on crop-rotation patterns and market forces. Recent agricultural trends in the Delta include an increase in the extent of vineyards and orchards.

Agricultural lands in the Delta Region provide important forage and resting habitat for wintering and migrant waterfowl and sandhill cranes. Pastureland and open fields in the easterr. portion of the Delta are of great importance to wintering sandhill cranes.

2. Selected Factors Affecting Habitat Conditions and Productivity

Several factors affect the wetland and terrestrial habitat conditions and productivity within the Delta. These factors include land subsidence of the Delta islands, habitat fragmentation, and the introduction and expansion of nonnative plant and animal species. These factors are further defined as follows:

Subsidence of Delta Islands. Historically, Delta islands were at or near sea level. Islands have subsided by as much as 20 feet as a result of decomposition of peat soils, wind erosion, the earlier practice of burning peat soils, water erosion, compaction by heavy equipment, natural gas extraction, and

groundwater withdrawal. Unless the water table is elevated above ground level, subsidence will continue until the peat soils have oxidized or blown away. Island levees are also subsiding and eroding, and periodic refurbishment is required to maintain their height and prevent flooding (Madrone Associates 1980).

Loss of productive peat soils could cause changes in Delta cropping patterns. A shift from high-value wildlife crops to lower value crops would reduce the Delta's value to wildlife. If subsidence is severe enough, farming could become economically inviable on some islands (Madrone Associates 1980). Levee repairs necessitated by subsidence result in periodic disturbance of riparian vegetation, degrading the value of levees to wildlife.

Habitat Fragmentation. Habitat losses that have occurred since early settlement of the Delta Region have resulted in the fragmentation of once-contiguous areas of habitat into smaller, isolated patches. The extensive riparian woodlands once associated with the margins of the Delta along the Sacramento, San Joaquin, Cosumnes, and Mokelumne rivers have largely disappeared (Madrone Associates 1980). Today, most riparian vegetation occurs in relatively degraded and noncontiguous stands along channelbanks. Even with the ongoing destruction or degradation of riparian habitat, these habitats remain among the most productive and diverse in the state.

Nonnative Species Populations. A total of 212 species of nonnative invertebrates (69 percent), fish and other vertebrates (15 percent), vascular plants (12percent), and protists (single-celled mobile organisms (percent) have been introduced into the Bay-Delta estuary. The establishment of invasive nonnative plants in native habitats is of concern because these species displace native plants and their function in ecosystems and typically provide lower wildlife habitat value than native plants. In the Delta Region, water hyacinth, a highly invasive aquatic plant that can form thick mats of vegetation in waterways dense enough to impede boat navigation and salmon migration (Cohen and Carlton 1995), and control of the establishment and spread of Himalaya berry, giant reed, and other nonnative plants in riparian habitats are the major concern.

Nonnative birds include the ring-necked pheasant, rock dove, European starling, and house sparrow (Cohen and Carlton 1995). Of these species, the European starling probably has the greatest effect on native birds. The European starling is a cavity-nesting species and competes aggressively with native cavity-nesting birds for nest sites (Zeiner et al. 1990).

Nonnative mammals include the house mouse, Norway rat, domestic cat, and red fox. In some locations, feral cats may be major predators on small mammals and birds, including listed species associated with salt marshes. The Norway rat is an efficient predator on the eggs of ground-nesting birds, including the federally listed endangered California clapper rail. The red fox is also an efficient predator on nests, young birds, and small mammals, including the federally listed endangered salt marsh harvest mouse and California clapper rail.

3. Special-Status Plants

Generally, the distribution of plant and animal species in the Delta Region is closely linked with the distribution of one or more habitat types on which a species is dependent. The distribution of special-status species described below is reported as the number of occurrences within the Delta Region. In this report, an occurrence indicates only that one or more individuals of a species was recorded as being observed; no inference is made about the status of the species population at the location of the reported occurrence.

Table IV-4 lists the number of special-status plant species that occur in the Delta Region. The largest number of special-status species occurs in grassland, which includes vernal pools. The second largest number of special-status species occurs in freshwater emergent wetland. At least two plant species that were once present in the Delta Region are presumed to be extinct: Mount Diablo buckwheat and caper-fruited tropidocarpum. Mount Diablo buckwheat occurred on sandy soils in shrublands and grasslands of Alameda, Contra Costa, and Solano counties and was last seen in 1940. Caper-fruited tropidocarpum occurred in Alameda, Contra Costa, Glenn, Monterey, Santa Clara, and San Joaquin counties in grasslands of alkaline hills and was last seen in 1957. The extinction of these two plants was most likely caused by agricultural and urban development of grassland and shrubland habitat.

At least two special-status plant species, delta button-celery and Mount Diablo manzanita, once occurred in the Delta Region but currently occur only outside the Delta Region. Delta button-celery is a species of riparian scrub and Mount Diablo manzanita occurs in chaparral. The extent of both species has been reduced by urban and agricultural development.

4. Special-Status Wildlife

Table IV-5 identifies a total of 30 special-status wildlife species that could potentially occur in the Delta Region and their preferred habitats. Most of these species are associated with freshwater emergent wetlands, open water of marshes, and cereal and grain crops. Species such as the American peregrine falcon, bald eagle, Swainson's hawk, California least tern, California black rail, California red-legged frog, California tiger salamander, northwestern pond turtle, giant garter snake, and various fairy shrimp were probably common species in the Delta.

Several wildlife species that historically were present in the Delta Region are now extinct, including the grizzly bear, gray wolf, Antioch dunes katydid, Antioch weevil, Antioch Cophuran robber fly, yellow-banded andrenid bee, and Antioch sphecid wasp (Jones & Stokes, 1987). The extinct invertebrates were probably restricted to the sand dune habitat found near Antioch. Grizzly bears and gray wolves occurred in a wide range of habitats throughout California, and their extinction was caused by unregulated hunting and trapping (Storer and Tevis 1955).

Special-status wildlife species that once occurred in the Delta Region, but are now found only outside the Delta Region, include the San Joaquin dune beetle, western least bittern, western yellow-billed cuckoo, and greater western mastiff bat. The reduction of riparian forests and marshland areas are the primary cause for the presumed extirpation

of cuckoos and least bitterns from the Delta Region. Greater western mastiff bats may forage in or near the Delta Region, but occurrence data are difficult to gather. The San Joaquin dune beetle occurred on vegetated sand dunes that have been reduced by urban and agricultural development.

Vernal pools and other freshwater seasonal wetlands support several special-status invertebrates. The Delta green ground beetle is known from two occurrences in Solano County; in the Delta Region, it occurs only at the Jepson Prairie Preserve.

Few occurrences of special-status crustaceans have been documented in vernal pools, in part because routine surveys for these species have been conducted only since 1992. The vernal pool tadpole shrimp (federally listed as endangered) is known from the Jepson Prairie Preserve and near Elk Grove in the northeastern portion of the Delta (NDDB 1996) and has potential habitat in other areas with vernal pools. The Conservancy fairy shrimp (federally listed as endangered) occurs at the Jepson Prairie Preserve and elsewhere in Solano County in deep vernal pools (NDDB 1996). The vernal pool fairy shrimp (federally listed as threatened) occurs in vernal pools and other seasonal wetlands. It has been found in the Brentwood area (CVPIA 1997).

Although severely declining due to a dramatic shrinkage of suitable habitat, the valley elderberry longhorn beetle (federally listed as threatened) has been found in the Delta Region on McCormac-Williamson and New Hope tracts (CDFG 1995).

Grasslands and dryland-farmed fields in the southwestern portion of the Delta support the San Joaquin kit fox (federally listed as endangered, state-listed as threatened). Areas south of Brentwood, east and south of Clifton Court Forebay, and west of Tracy are considered the northernmost portion of the species range within the Delta Region (NDDB 1996).

Several special-status invertebrates occur in the Antioch Dunes area. The Lange's metalmark butterfly (federally listed as endangered) is known to occupy 15 acres of open dune habitat in the Antioch Dunes National Wildlife Refuge and adjacent properties owned by Pacific Gas and Electric Company. Six other insect species endemic to the Antioch Dunes are considered species of concern by USFWS.

The greater sandhill crane (state-listed as threatened) winters in the Central Valley and forages in the Delta in harvested cornfields and pastures, as well as in wetlands and flooded fields. In the Delta, greater sandhill cranes traditionally roost near Thornton, on Black Tract, Canal Tract, and Staten Island and at scattered locations on other islands (CDFG 1995; Miriam Green Associates 1996).

The Aleutian Canada goose (federally listed as threatened) winters in the Central Valley near Colusa and along the San Joaquin River from Modesto to Los Banos. These geese have also been observed in the Delta, but probably only during migration where they forage agricultural fields (CDFG 1995).

5. Significant Natural Areas

A total of 29 SNAs in the Delta Region protect fresh, brackish, and salt marsh; inland dune; and valley sink scrub habitats (Figure V-2). A small but biologically important remnant native grassland is

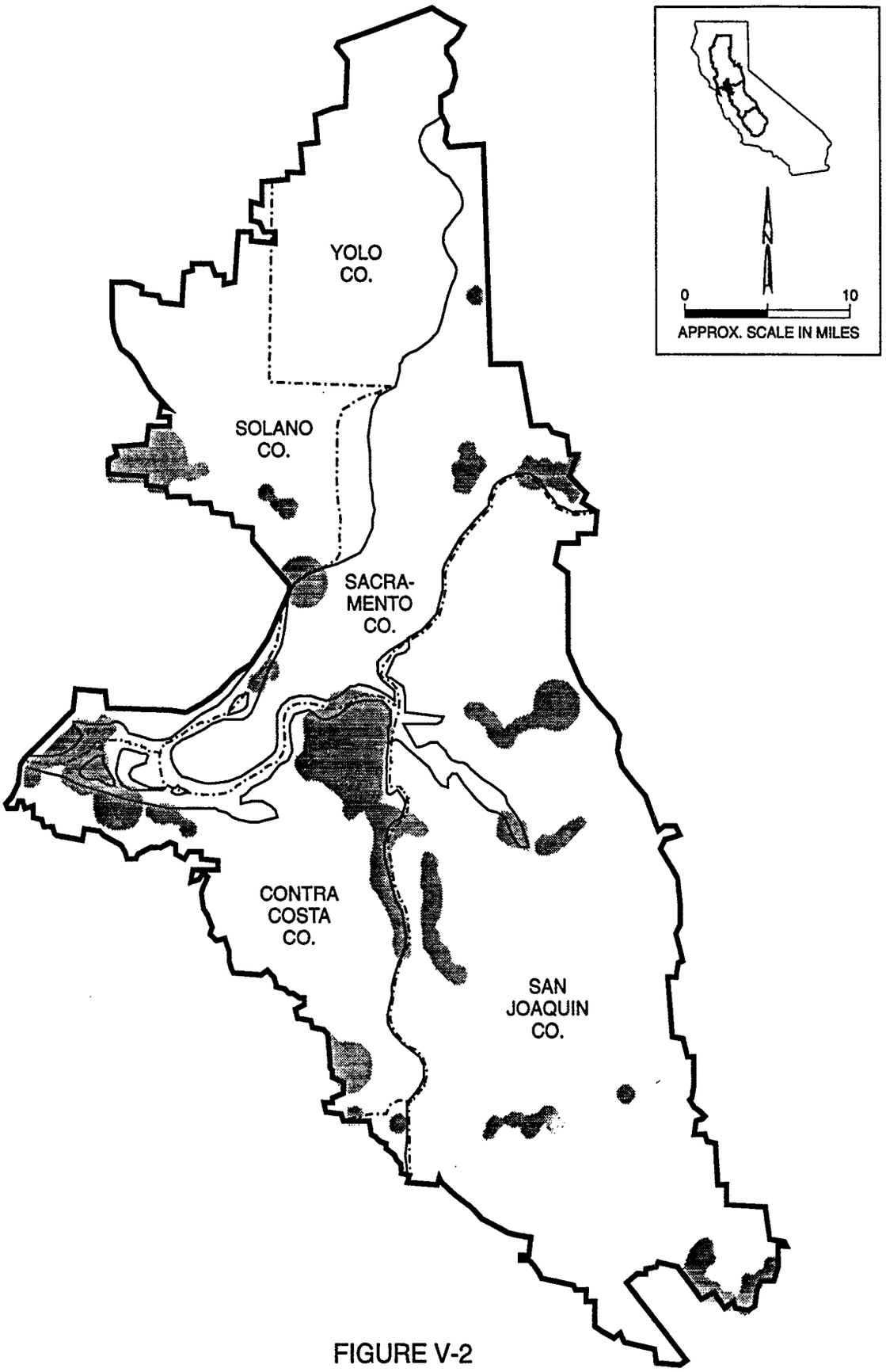


FIGURE V-2

LOCATION OF SIGNIFICANT NATURAL AREAS
IN THE COUNTIES OF THE DELTA REGION

present at the Jepson Prairie Preserve in the northwestern part of the Delta. Antioch Dunes, a small area of inland dune habitat near Antioch, in Contra Costa County, provides important habitat for legally protected plant and invertebrate species, including Antioch Dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly.

6. Waterfowl and Shorebirds

Waterfowl and shorebirds forage primarily in natural and artificial wetlands and agricultural lands.

The Central Valley portion of California is the most important waterfowl wintering area on the Pacific Flyway, annually supporting approximately 60 percent of the Flyway's waterfowl population (CVHJV 1990). Approximately 10 percent of California's wintering waterfowl population (or 6 percent of the flyway's waterfowl population) occurs in the Delta (CVHJV 1990). Between 1969 and 1990, estimates of the wintering waterfowl population in the Bay-Delta area ranged from a high of 1.3 million in 1977 to a low of 109,000 in 1982. The average wintering population between 1981 and 1990 was estimated to be 390,500 (DWR 1994).

More than 30 species of shorebirds regularly use the Delta Region (DWR 1994). Six species nest in the Delta Region, and the rest overwinter there or pass through during spring and fall migration. During the 1992-1993 winter, 28,500 shorebirds were counted in the Delta, primarily dunlins and long-billed dowitchers (Shuford et al. 1993). Shorebirds prey extensively on invertebrates. Important foraging habitats include permanent saline, brackish and freshwater marshes, seasonal wetlands and agricultural croplands (CVHJV 1990).

B. Bay Region

The Bay Region includes the entire watershed for the San Francisco Bay (Figure I-1). However, the options associated with the CALFED program would occur primarily in the area of Suisun Marsh and Bay and northern San Pablo Bay. Therefore, the description of affected environment focuses on this area. Suisun Bay supports large areas of tidal flats that provide important foraging habitat for shorebirds. Suisun Marsh supports mostly saline emergent wetland, which provides habitat for salt marsh species that prefer infrequently flooded, salt marsh habitat. The nonleveed lowlands in the region support wetlands that change in character from salt marsh around Suisun Marsh to brackish marsh on the major nonleveed channel islands, such as Browns Island. The animal and plant species composition of the tidal wetlands changes as the salinity gradient decreases from west to east. The 112,900-acre Suisun Marsh contains more than 10 percent of the remaining wetlands in California and is one of the largest contiguous brackish marshes in the U.S. (DWR 1984). Approximately 89 percent (53,000 acres) of the wetlands consist of leveed marshlands that support mostly saltgrass, pickleweed, alkali bulrush, and tule (CVPIA 1997). Adjacent to the wetlands is upland habitat including grassland, shrub, riparian, and agricultural communities (DWR 1984).

1. Natural and Agricultural Communities and Associated Wildlife

Natural communities in the Bay Region include tidal flats, and freshwaterand emergent wetlands.

Wetland and Riparian Communities.

Tidal flats include shoals, sandy mud bars, and portions of streambeds that are exposed at low tide. Tidal flats are largely unvegetated, although some emergent vegetation may be present.

Exposed tidal flats provide resting and foraging habitat for several bird groups. California and ring-billed gulls use tidal flats as resting areas; during spring and fall migration, large numbers of shorebirds congregate to forage on invertebrates in and or forage on the tidal flat substrate. Mammals such as raccoons and skunks also forage on the tidal flat.

Saline emergent wetland is confined to the Suisun Bay/Marsh boundaries. The historic Suisun Marsh system has been modified substantially as a result of agricultural and industrial development (ACOE 1994). Historically, saline emergent wetland was subject to tidal influence; however, dikes constructed around most of the marsh eliminated tidal influence. Common plant species associated with saline emergent wetland include cordgrass, pickleweed, and saltgrass (DWR 1994; USFWS 1992). Each plant species typically occupies a specific elevational band in relation to the mean tidal water level (DWR 1994).

The Suisun Marsh system supports approximately 200 species of birds, 45 species of mammals, and 36 species of reptiles and amphibians (ACOE 1994). Saline emergent wetlands in the Bay Region provide foraging and nesting habitat for wading birds, such as great blue herons and egrets, and foraging habitat for resident and migratory waterfowl, shorebirds, and raptors. Dense emergent vegetation provides nesting and foraging habitat for species such as rails and long-billed marsh wrens (DWR 1994). Mammals associated with saline emergent marsh include the Suisun ornate shrew, mink, beaver, and muskrat (USFWS 1992).

Approximately 52,000 acres of saline and other wetlands are managed by the state or private duck clubs specifically to provide habitat for wintering waterfowl and other wildlife (ACOE 1994). In 1995, approximately 65,000 ducks and geese were observed using Suisun Marsh during midwinter waterfowl surveys conducted annually by CDFG and USFWS (CDFG 1995). Saline wetlands also support small numbers of nesting ducks during the breeding season (ACOE 1994).

2. Special-Status Plants

Table IV-4 lists the legal status and habitat of special-status plants in the Bay Region. Thirty-five special-status plants have known occurrence, six special-status plants have potential to occur, and six species have been extirpated from the Bay Region (Skinner and Pavlik 1994; NDDB 1996). The status of state-listed and federally listed species and species proposed for listing is described below.

The saline emergent marsh habitat of Suisun Marsh supports populations of two plant

species that are proposed for federal listing as endangered: Suisun thistle and soft bird's-beak. The latter species also occurs in saline emergent marshes in northern Contra Costa County.

Palmate-bracted bird's-beak (federally listed and state-listed as endangered) occurs in alkaline scrub and grasslands. It is presumed extirpated from the Bay Region but has potential to occur in its alkaline habitats. Mason's lilaeopsis (state-listed as rare, no federally listed status) occurs in brackish or freshwater tidal marshes of Suisun Bay/Marsh.

3. Special-Status Wildlife

Table IV-5 presents a summary of 41 special-status wildlife species and their associated habitats that could potentially occur in the Bay Region. The majority of these species are associated with upland grasslands and freshwater emergent wetlands and are restricted in their range because of the fragmentation and low diversity of habitats. Species such as bald eagle and peregrine falcon are seasonal visitors to the Bay. Two federally listed and state-listed endangered species occur in saline emergent wetlands of the Bay Region: the salt marsh harvest mouse and the California clapper rail. Salt marsh harvest mouse is known from occurrences in Suisun Marsh, islands in Suisun Bay, and saline emergent marshes south of Suisun Bay. It occurs in higher-elevation marshes throughout the San Francisco Bay estuary. The California clapper rail is known from occurrences in Suisun Marsh and islands in Suisun Bay. It occurs in the lower tidal marshes of the San Francisco Bay estuary The salt marsh yellowthroat and salt marsh song sparrow subspecies use the tall emergent vegetation that grows in the more brackish areas. California brown pelican, snowy plover, and California least tern also occur in this region.

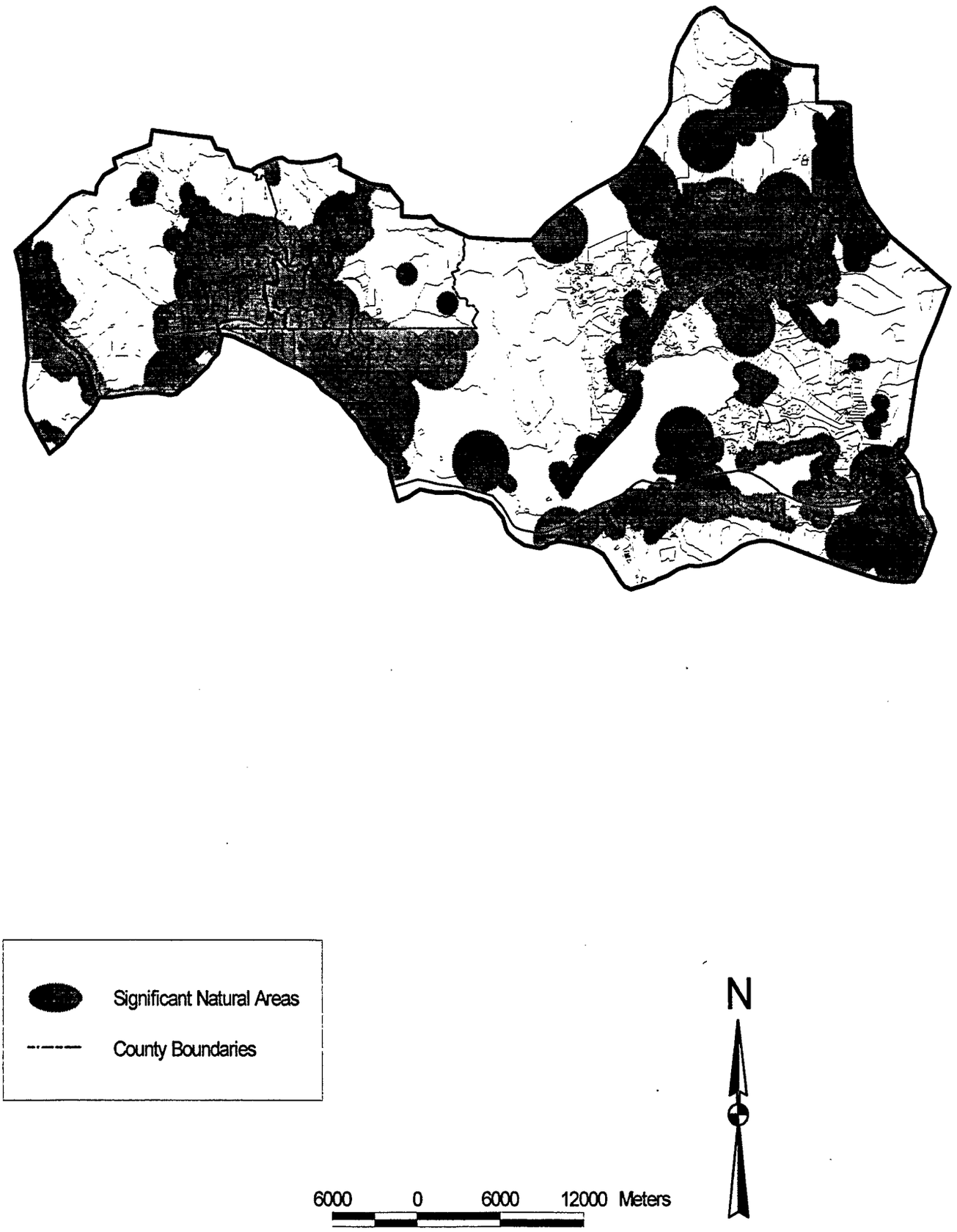
4. Waterfowl and Shorebirds

The Bay Region is an important waterfowl area that may contain more than 1 million birds during migration with more than 70 percent of the waterfowl (or 86 percent of the Pacific Flyway's total waterfowl population) on the Pacific Flyway moving through this area (USFWS 1989). Mid-winter waterfowl surveys in 1991 estimated nearly 268,700 waterfowl in the Bay Region, including approximately 265,000 ducks, primarily scaups, scooters, canvasbacks, ruddy ducks, and pintails.

The Bay Region is a particularly important area for shorebirds, supporting more shorebirds than all other California coastal wetlands combined (Page et al. 1992). An estimated 300,000 to 400,000 shorebirds in fall and 600,000 to 1 million shorebirds in spring can be found in this region (Page et al. 1992).

5. Significant Natural Areas

A total of 32 SNAs in the Bay Region protect brackish marsh, salt marsh, open water, vernal pools, and native grassland habitat (see Figure V-3). Some of the larger SNAs include Dozier Vernal Pools, Peytonia Slough, Pelican Point Marsh, Napa Slough, and Chain Island.



LOCATION OF SIGNIFICANT NATURAL AREAS IN THE COUNTIES OF THE BAY REGION

Figure V-3

C. Sacramento River Region

1. Natural and Agricultural Communities and Associated Wildlife

The ten natural terrestrial community types in the Sacramento River Region occupy nearly 8.7 million acres, or 72 percent, out of a total land area of 12 million acres. They include mixed conifer forest, montane hardwood, valley foothill hardwood, montane riparian, valley foothill riparian, chaparral, sagebrush scrub, grassland, and freshwaterand saline emergent wetlands (marsh). Table IV-1 summarizes the area of each of these habitat types to the nearest 1,000 acres. Figure V-4 presents the distribution of habitats in the Sacramento River Region.

Upland Communities. Mixed conifer forest is the most abundant natural community in this region (3,690,000 acres). Grassland, mostly the nonnative type, is the most common natural community on the valley floor and adjacent foothills, occupying 1,066,000 acres. Approximately 242,000 acres are naturally unvegetated (barren) land in the northeastern portion of Shasta County and consist of lava beds and similar substrates unsuitable for vegetation.

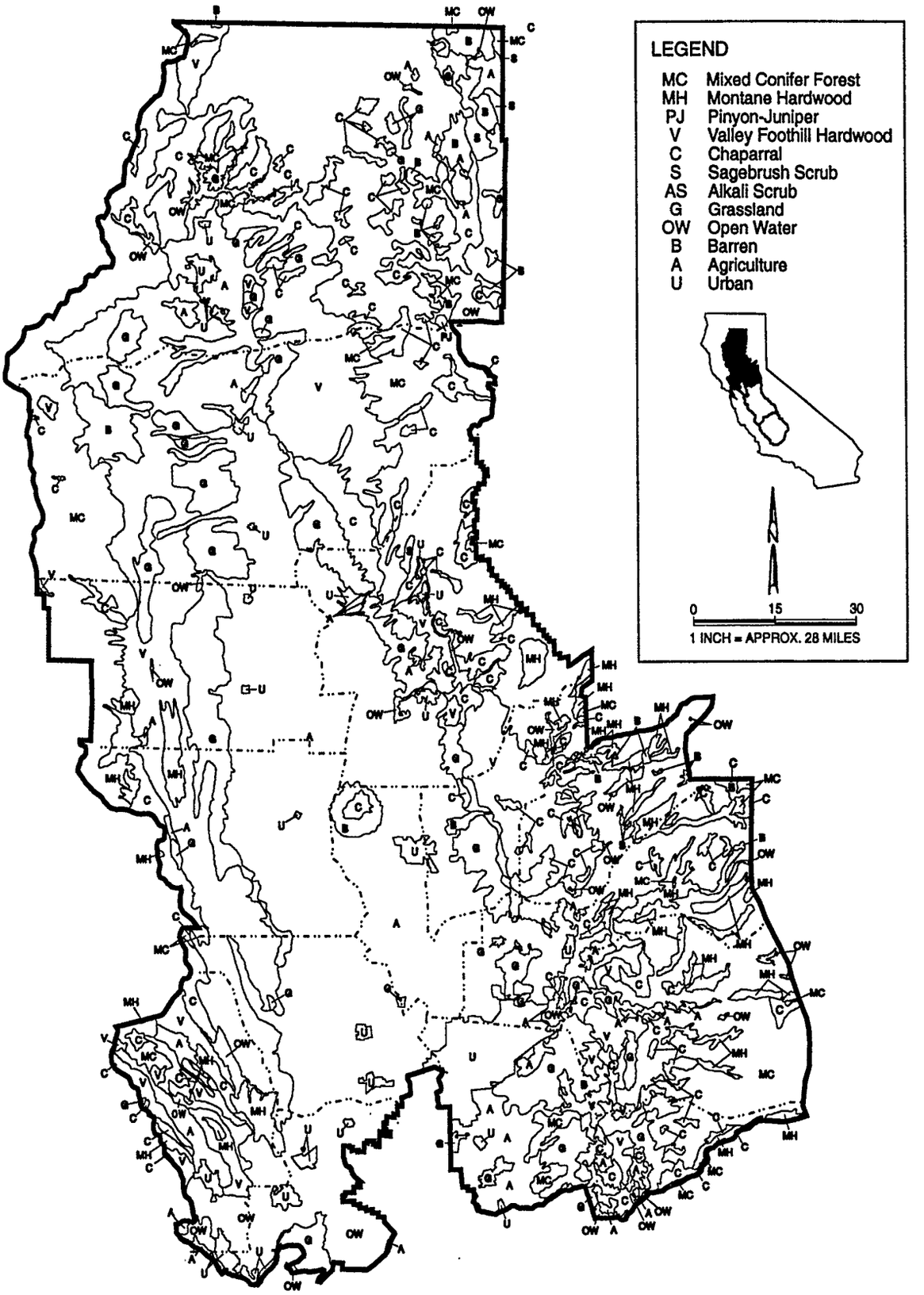
The lowland areas of the Sacramento River Region are dominated by agricultural land, occupying approximately 1,984,000 acres. Agricultural crops in the Sacramento River Region include grains, pasture, rice, orchards and vineyards, and vegetables. Grains and pasture are the most abundant crops in the region, at 601,000 and 442,000 acres, respectively.

Riparian and Wetland Communities. The major rivers of the Sacramento River Region are the Sacramento, Pit, Fall, McCloud, Yuba, Feather, Bear, and American, and Cache Creek. Estimates of riparian vegetation acreage in the Sacramento River Region vary widely because each mapping effort has covered different geographic areas and used different vegetation classifications or mapping criteria (CVPIA 1997). Warner and Hendrix (1985) estimated that approximately 175,000 acres of riparian vegetation exist in the northern portion of the Central Valley (possibly including portions of the Delta). Frayer et al. (1989) estimated that 34,600 acres of "palustrine forested and scrub/shrub" (riparian wetlands) occur in the Central Valley; presumably, most of this habitat type is in the Sacramento River Region. The *Sacramento River Environmental Atlas* (DWR 1978) documented 13,107 acres of "young trees, sub-climax, and climax native vegetation" on high and low terraces along the Sacramento River from Colusa to Keswick Dam (excluding vegetation along tributary rivers and streams). The lower 60 miles of the Sacramento River are leveed and support relatively little riparian vegetation.

Approximately 157,000 acres of wetlands occur in the Sacramento River Region (Table IV-1), comprising 1.3 percent of the region. Open water accounts for 122,000 acres, or 1 percent of the region.

2. Rivers and Reservoirs

The rivers and 12 reservoirs in the Sacramento River Region are identified on Figure V-5. Wildlife species that frequent these reservoirs are described below.



SOURCES:
Vegetation categories are derived from CALVEG data (Matyas and Parker 1980) modified by the DFF and are greatly generalized. Numerous vegetation types occupying small areas are not shown because of map scale.

FIGURE V-4

GENERAL VEGETATION TYPES OF THE SACRAMENTO RIVER REGION

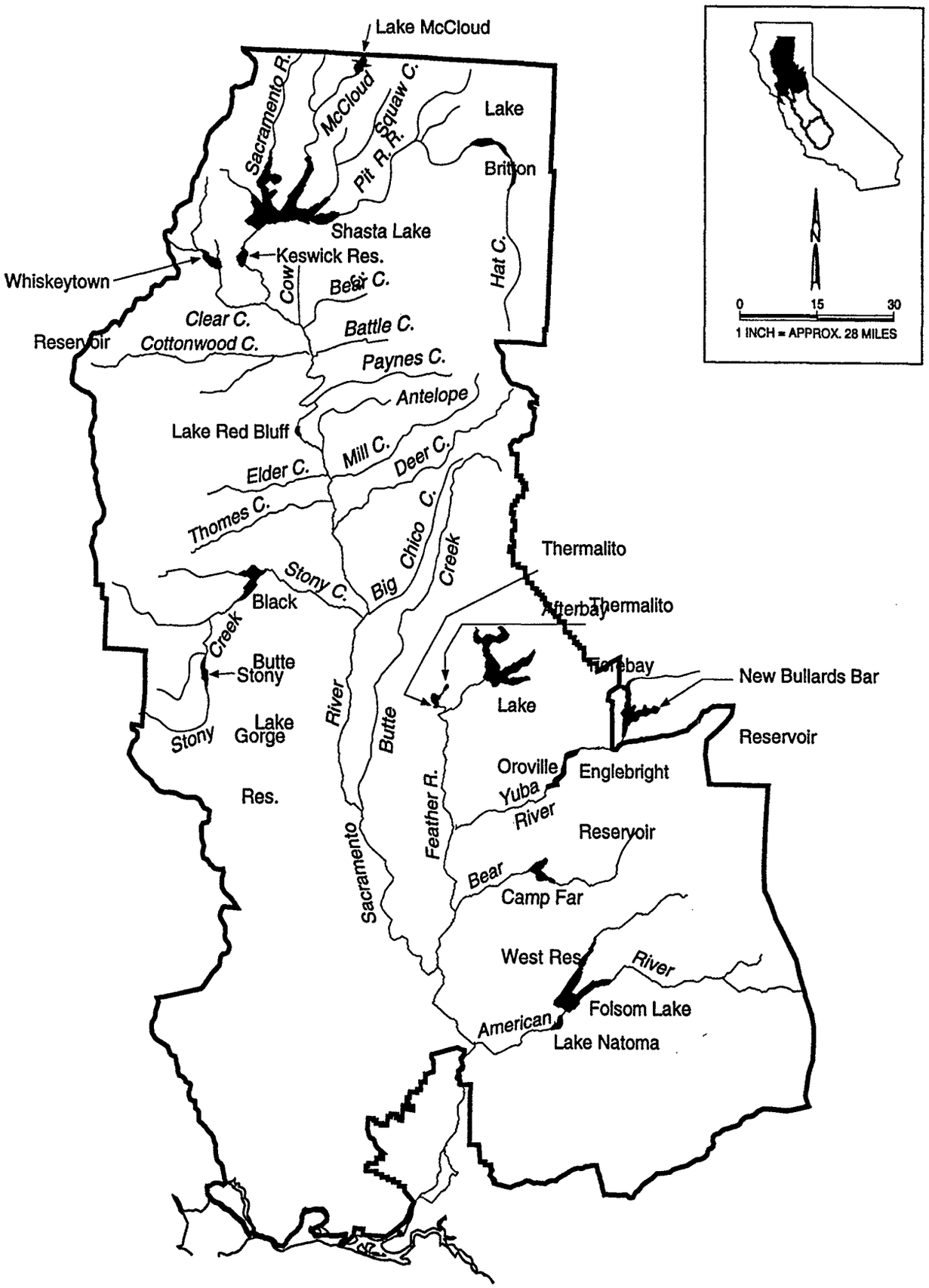


FIGURE V-5

RIVERS AND RESERVOIRS OF THE SACRAMENTO RIVER REGION

Whiskeytown Lake supports primarily diving ducks and western and Clark's grebes (Laymon, pers. comm.). Between 1970 and 1990, this reservoir supported one nesting pair of bald eagles (Jurek 1990).

Shasta Lake has generally low waterbird use because of its steep-sided slopes and the minimal amount of shallow water, which limits the available foraging habitat for most waterbirds (Laymon, pers. comm.); however, Shasta Lake does have one of the highest concentrations of nesting bald eagles and ospreys in California (Laymon, pers. comm.). Between 1970 and 1990, 13 nesting bald eagles were observed (Jurek 1990), and the reservoir also supports up to 20 nesting ospreys (Laymon, pers. comm.).

Lake Red Bluff supports small numbers of water birds. The American coot is the dominant water bird at this reservoir. Mallards, buffleheads, and common goldeneyes are also found on the lake. Keswick Reservoir supports small numbers of water birds. Mallards, buffleheads, and common goldeneyes (around 100 each of each species) are also found on the reservoir (Laymon, pers. comm.).

Lake Oroville supports a large number of water birds during the year. Several hundred waterfowl, mostly dabbling ducks, winter there regularly. More than 15,000 gulls use the open water as a night roost, and several hundred eared grebes winter on the lake. About six Canada geese nest in the area. The lake receives minimal use by shorebirds (Snowden, pers. comm.).

Between 1970 and 1990, two bald eagles nested on or near the lake (Jurek 1990), and several ospreys also bred at the reservoir (Snowden, pers. comm.) An estimated 33 bald eagles presently winter in the area (Snowden, pers. comm.).

Thermalito Afterbay is used by a large number of water birds during winter (Snowden, pers. comm.). Forty to fifty thousand wintering waterfowl (primarily northern pintail, American wigeon, and ruddy duck) use the lake regularly, and more than 10,000 American coots occur there. Approximately 2,000 tundra swans also roost at the lake. Several hundred Clark's, western, and eared grebes and gulls feed and roost at the lake. Three to four bald eagles are known to use the lake daily (Snowden, pers. comm.).

Thermalito Forebay also supports large numbers of water birds, but the species composition differs from that of Thermalito Afterbay. The forebay supports up to 10,000 dabbling ducks during winter, in addition to several thousand ruddy ducks. Approximately 15,000 snow and Ross' geese occur there during winter. The forebay is also used by several thousand Canada geese as a night roost. Ospreys also forage occasionally at the forebay (Snowden, pers. comm.).

Englebright Lake receives low use by waterbirds (Laymon, pers. comm.). Several hundred diving ducks (e.g., ring-necked duck, ruddy duck, and redhead) use the lake irregularly (Whitmore, pers. comm.). Shorebirds are uncommon to rare at Englebright Lake (Laymon, pers. comm.), and wintering bald eagles occasionally forage there (Whitmore, pers. comm.).

New Bullards Bar Reservoir receives little waterfowl use (Whitmore, pers. comm.; Laymon, pers. comm.). Diving ducks, such as the common merganser and ruddy duck,

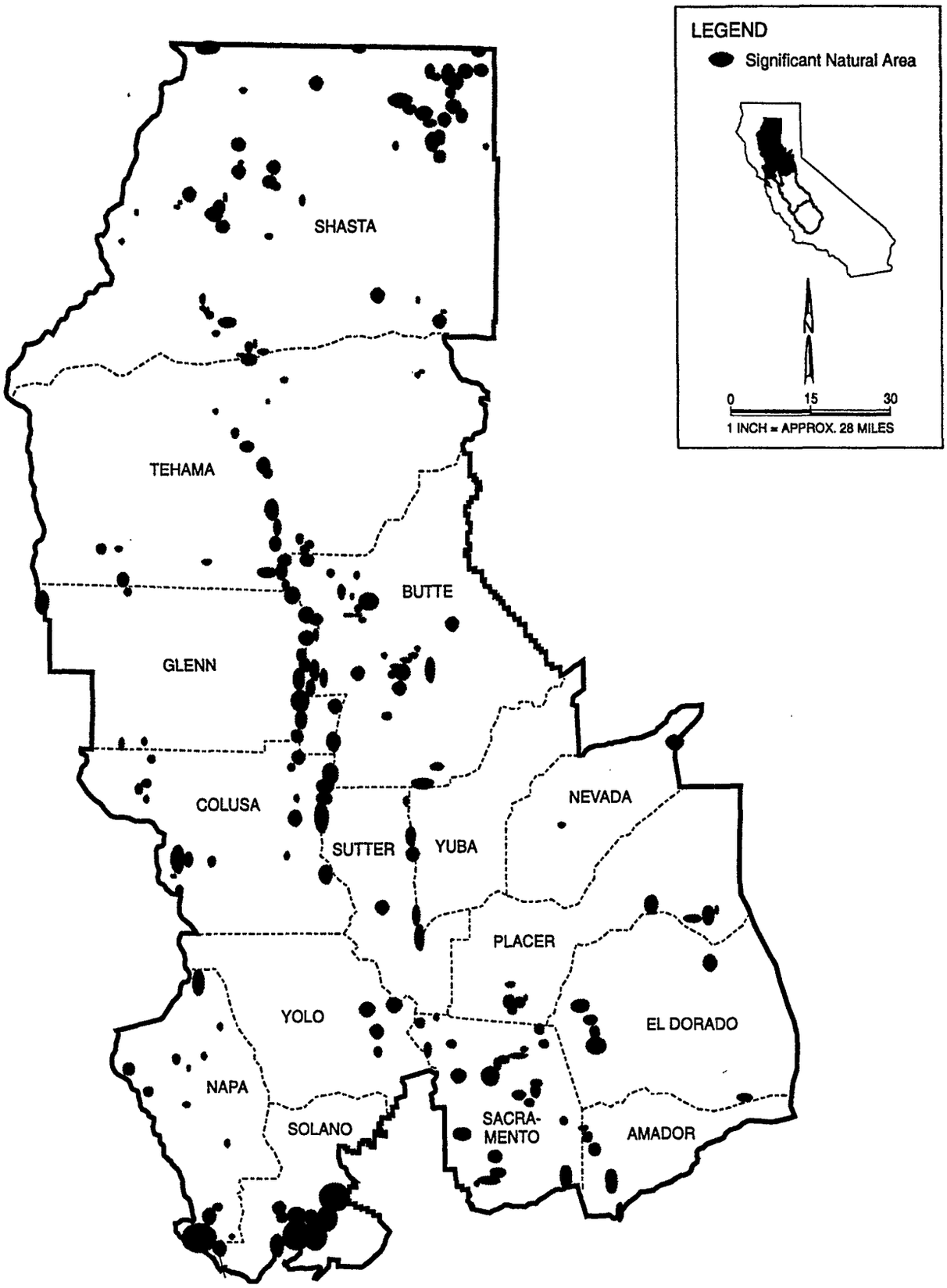


FIGURE V-6

LOCATION OF SIGNIFICANT NATURAL AREAS IN THE COUNTIES OF THE SACRAMENTO RIVER REGION

occur in low numbers during winter. Between 1970 and 1990, one bald eagle's nest was observed at the lake (Jurek 1990). One pair of ospreys is known to nest at this reservoir (Whitmore, pers. comm.; Laymon, pers. comm.).

Hundreds of diving ducks (mostly ring-necked, ruddy, and redhead ducks) and fewer numbers of dabbling ducks winter at Camp Far West Reservoir. Two to five bald eagles winter at Camp Far West Reservoir(Whitmore, pers. comm.).

Approximately 40 great blue herons occur at Folsom Lake during winter, but other wading birds and shorebirds are less common. Dabbling ducks (e.g., mallards [400 to 500]) and American wigeons [100 to 500]) and geese (1,400 to 2,400 Canada geese) are regular winter residents at Folsom Lake. Diving waterbirds are less common than dabbling ducks. The lake supports about 700 western grebes and 50 pied-billed grebes during winter. More than 2,000 gulls use Folsom Lake as a night roost during winter.

Dabbling ducks (e.g., mallards and American wigeons) and Canada geese are regular winter residents at Lake Natoma. Diving water birds are less common than dabbling ducks. The lake supports small numbers of western grebes and pied-billed grebes during winter.

3. Special-Status Plants

Table IV-4 lists 65 special-status plants that occur in the Sacramento River Region. The largest number of special-status species in this region occurs in grassland, which includes vernal pools. The next largest number of special-status species occurs in chaparral and montane hardwood.

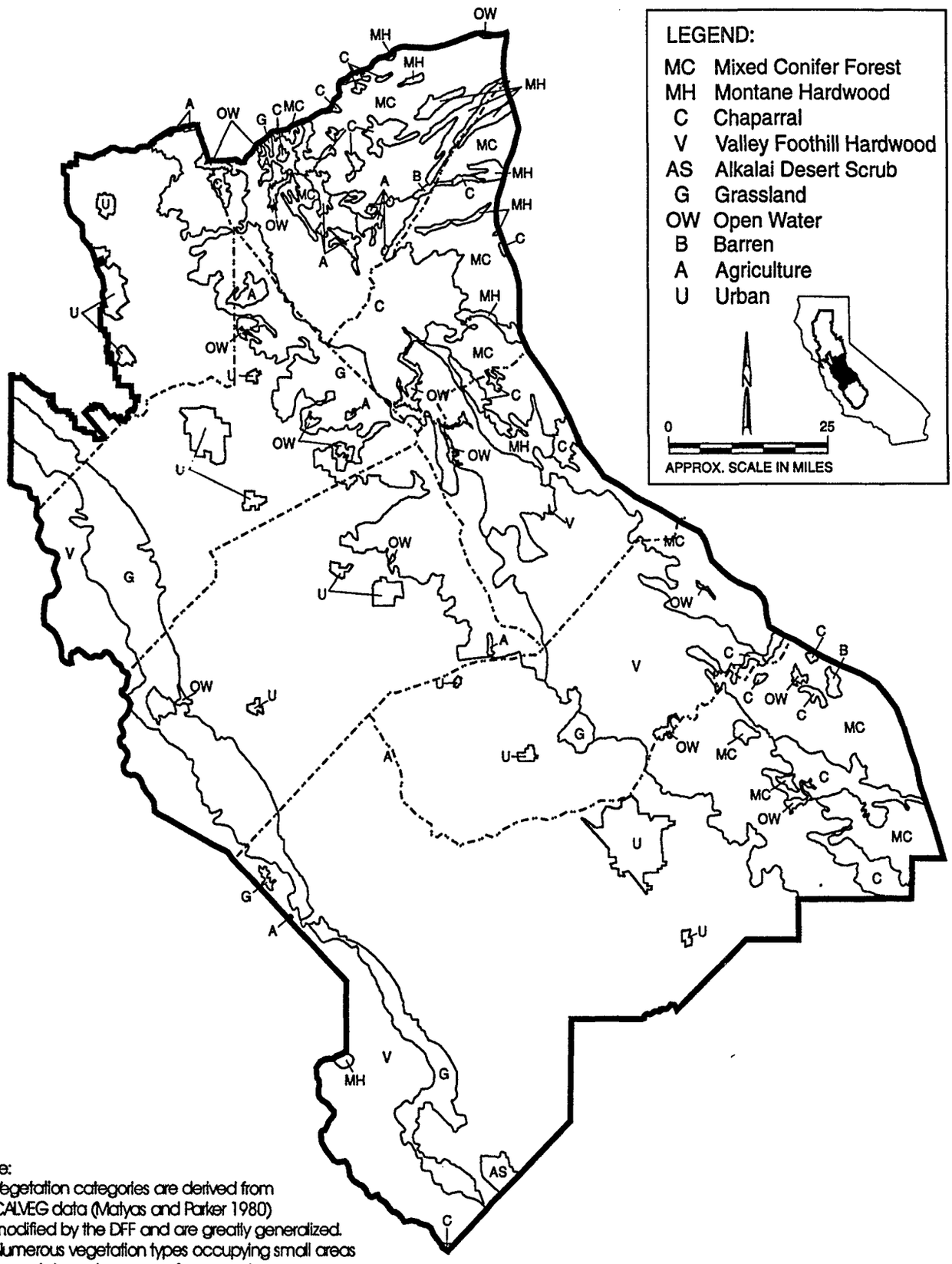
4. Special-Status Wildlife

Table IV-5 identifies a total of 39 special-status wildlife species that could occur in the Sacramento River Region and their preferred habitats. The majority of these species are associated with grasslands, freshwater emergent wetlands, lakes, and rivers on the valley floor. Many of these species have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects. Grain crops also provide important habitat for species such as the Aleutian Canada goose, Swainson's hawk, ferruginous hawk, greater sandhill crane, and loggerhead shrike.

5. Significant Natural Areas

The Sacramento River Region has 188 designated SNAs (Figure V-6). Many of these are along the Sacramento River and contain habitats such as Fremont cottonwood riparian, valley oak riparian, mixed riparian, and Great Valley willow scrub. These habitats support riparian-dependent, special-status wildlife species, such as western yellow-billed cuckoo, bank swallow, and valley elderberry longhorn beetle.

SNAs are also designated along other significant waterways, such as creeks, lakes, or reservoirs, that support special-status wildlife or plant species (e.g., the Shasta salamander, Shasta sideband snail, bald eagle, bank swallow, Shasta crayfish, and rough sculpin in the northern region).



Note:
Vegetation categories are derived from CALVEG data (Matyas and Parker 1980) modified by the DFF and are greatly generalized. Numerous vegetation types occupying small areas are not shown because of map scale.

FIGURE V-7

GENERAL VEGETATION TYPES OF THE SAN JOAQUIN RIVER REGION

Designated vernal pool and grassland habitats throughout the Sacramento Valley may support valley needlegrass grassland, California tiger salamanders, and burrowing owls or northern claypan vernal pools, which support many endemic vernal pool plant species.

Finally, marsh habitats in the southern portion of the region contain northern coastal salt marsh, which supports several special-status species, including California clapper rail, California black rail, Suisun Marsh aster, Suisun thistle, and Suisun song sparrow.

6. Waterfowl and Shorebirds

CDFG conducts annual statewide surveys of waterfowl numbers throughout winter. This document presents January 1991 midwinter survey results to indicate waterfowl use and species composition within an area.

Private duck clubs and state and federal refuges in the Sacramento Valley provide essential habitat for wintering waterfowl and shorebirds. Approximately 55 percent of the Pacific Flyway waterfowl population winters in the Sacramento Valley (or 92 percent that winter in the Central Valley) (CVHJV 1990). Midwinter waterfowl surveys in 1991 estimated 2,127,800 waterfowl in the valley, including approximately 1,432,000 ducks and 572,800 geese. Approximately 76 percent of the ducks were northern pintails, mallards, and American wigeons. Snow and Ross' geese comprised 82 percent of the geese present. Additionally, more than 25,000 swans and 25,000 American coots were in the valley.

Sacramento Valley wetlands also provide important habitat for shorebirds, with more than 140,000 shorebirds counted in the valley during winter 1992-1993 (Shuford et al. 1993). The valley is particularly important to shorebirds in the spring, when 30,000 to 300,000 shorebirds use wetlands in the valley as staging areas during migration to northern breeding grounds (Page et al. 1992).

D. San Joaquin River Region

1. Natural and Agricultural Communities and Associated Wildlife

The natural terrestrial community types in the San Joaquin River Region occupy approximately 4.6 million acres out of a total land area of 8.3 million acres. The natural communities include mixed conifer forest, montane hardwood, valley foothill hardwood, montane riparian, valley foothill riparian, chaparral, grassland, and fresh water and saline emergent wetlands. Table IV-1 summarizes the area of each of these habitat types to the nearest 1,000 acres. Figure V-7 presents the distribution of habitats in the San Joaquin River Region.

Upland Communities. Grassland, dominated by nonnatives, is the most abundant natural community in this region, with 1.1 million acres mostly on the edges of the valley floor. Valley foothill woodland is the next most common natural community, occupying 1.4 million acres of the foothill areas of the region.

The lowland areas of the San Joaquin River Region are dominated by approximately 3.1 million acres of agricultural land. Crops include pastures, orchards and vineyards,

vegetables, cotton, grains, and rice. Pastures and orchards and vineyards are the most abundant croplands in the region, at 868,000 and 843,000 acres, respectively.

Riparian and Wetland Communities. Estimates of riparian and wetland vegetation acreage in the San Joaquin River Basin vary widely because each mapping effort covered different geographic areas and used different vegetation classifications or mapping criteria. An estimated 30,800 acres of riparian vegetation existed in the San Joaquin River Region in 1977 (USBR 1990). CDF data indicate the presence of approximately 15,000 acres of riparian vegetation in the San Joaquin River Region (estimate based on unpublished file data). Warner and Hendrix (1985) estimated that 64,000 acres of riparian vegetation occurred in the southern part of the Central Valley, presumably at least half in the San Joaquin River Region. Frayer et al. (1989) estimated that 34,600 acres of "palustrine forested and scrub/shrub" (riparian wetlands) occur in the Central Valley; presumably, a third of this or less would have been in the San Joaquin River Region.

Approximately 138,000 acres of freshwater emergent wetlands occur in the San Joaquin River Region (Table IV-2), mostly in western Merced County. CVHJV (1990) identified approximately 120,320 acres of wetlands in this region.

Rivers and Reservoirs. The major rivers of the region include the Mokelumne, San Joaquin, Stanislaus, Merced, Fresno, Tuolumne, and Chowchilla rivers.

2. Special-Status Plants

Sixty-nine special-status plant species occur in the San Joaquin River Region. The largest number of special-status species (18) occurs in grassland. The second largest number of special-status species (16) occurs in valley foothill woodland.

3. Special-Status Wildlife

Forty-six special-status wildlife species could occur in the San Joaquin River Region. Most of these species are associated with grasslands, freshwater emergent wetlands, lakes, and rivers that occur on the valley floor. Many of the species have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects. Grain crops do, however, provide important habitat for species such as Aleutian Canada goose, Swainson's hawk, ferruginous hawk, greater sandhill crane, and loggerhead shrike.

4. Significant Natural Areas

The 77 SNAs in the San Joaquin Valley are scattered throughout the region but are concentrated in the grasslands of the Valley in freshwater marsh, valley sink scrub, and grassland vernal pool habitats (Figure V-8). These areas are important to waterfowl and shorebirds that winter and nest in the San Joaquin Valley, as well as for several special-status species, including the giant garter snake, Swainson's hawk, tricolored blackbird, and Delta button celery. In the southwestern portion of the valley, several SNAs support special-status species (e.g., the giant kangaroo rat, blunt-nosed leopard lizard, Swainson's hawk, and San Joaquin antelope squirrel) and habitats (e.g., valley needlegrass grassland and northern vernal pool). Along the eastern side of the valley,

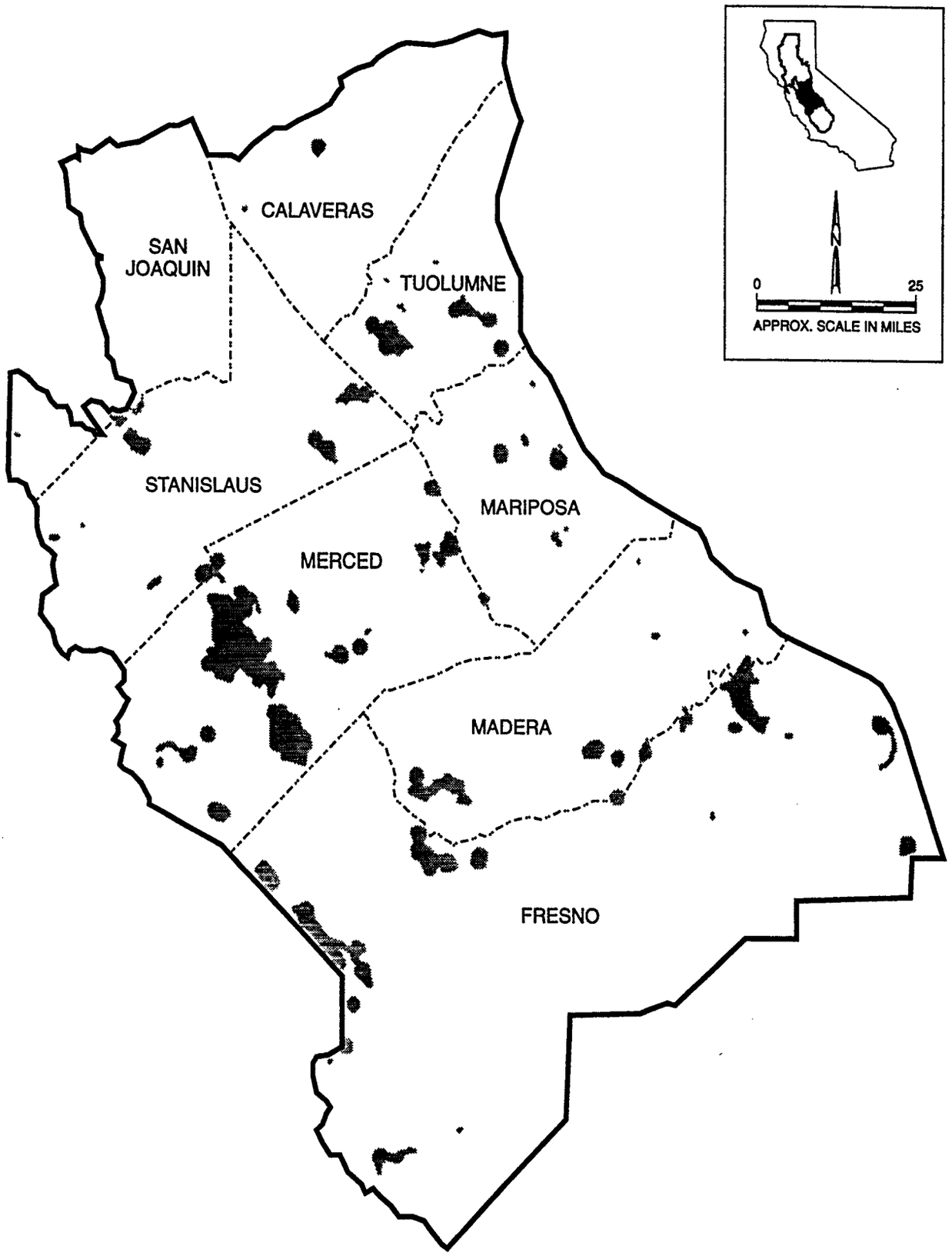


FIGURE V-8

LOCATION OF SIGNIFICANT NATURAL AREAS IN THE COUNTIES OF THE SAN JOAQUIN RIVER REGION

SNAs encompass native grasslands and vernal pool habitats, as well as alkali sink scrub, cismontane woodland, chaparral habitats, and grassland habitats. These habitats support special-status species such as Chinese camp brodiaea, tree anemone, and tricolored blackbird.

5. Waterfowl and Shorebirds

The San Joaquin Basin is bounded on the north by the Delta and on the south by the San Joaquin River. Historically, the basin was a large floodplain of the San Joaquin River that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas. Almost 70 percent of the basin has been converted to irrigated agriculture, with wetland acreage reduced to 120,300 acres. Nevertheless, the basin contains the largest contiguous block of wetland habitat in the Central Valley (CVHJV 1990). In combination with the adjacent uplands, this wetland complex is referred to as "the Grasslands" and consists of 160,000 acres of private and public lands (Marciochi, pers. comm.). Approximately 75,000 acres west of the San Joaquin River (West Grasslands) fall within the Grasslands Resource Conservation District with water delivery to private wetland management primarily through the Grasslands Water District (CVHJV 1990). Approximately 53,300 acres of the Grasslands are permanently protected in state or federal wildlife refuges or in federal conservation easements (CVHJV 1990).

The San Joaquin River Region supports approximately 25 percent of the Central Valley waterfowl and shorebird populations and up to 30 percent of the wintering duck population (CVHJV 1990; Shuford et al. 1993). Winter shorebird numbers in 1992-1993 were estimated at 66,700 birds (Shuford et al. 1993). Between 100,000 and 1 million birds were estimated during annual spring staging during 1988-1992 (Page et al. 1992).

In the San Joaquin Valley, more than 37,700 acres are managed by the state and federal governments, including Kesterson, San Luis, and Merced National Wildlife Refuges North Grasslands, Los Banos, and Volta Wilderness Management Areas; and San Joaquin Basin Action Planlands. The number of habitat types on the public refuges is shown in Table III-2.

E. SWP and CVP Service Areas Outside the Central Valley

The SWP and CVP Service Areas include the Central Coast, South Coast, and San Francisco regions. It is not known specifically how the CALFED Project would affect these service areas; therefore, resources within these service areas are described in very general terms.

1. Natural Communities

The natural communities occurring in the Service Areas vary by region. The Central Coast Region is dominated by mixed conifer and mature hardwood forest; valley hardwood and valley foothill riparian forests and woodlands; chaparral, coastal sage scrub, and desert alkali; scrub habitats; coastal beaches and cliffs; grassland; freshwater emergent wetland; and open water on reservoirs, lakes, and rivers. Dominant natural communities within the South Coast Region include grassland, chaparral, sage scrub, and riparian habitats.

Natural communities in the San Francisco Region are dominated by chaparral with pockets of mixed conifer forest, montane hardwood, valley foothill riparian, coastal scrub, inland dunes, coastal beaches and cliffs, grassland, and freshwater and emergent wetlands.

2. Rare Natural Communities

Most of the natural communities listed in Table IV-1 occur within the Services Areas (Central Coast and San Francisco regions) with the addition of the following 13 communities: central foredunes, central maritime scrub, Monterey cypress forest, Monterey pygmy cypress forest, central dune scrub, maritime coast range ponderosa forest, Monterey pine forest, northern Bishop pine forest, northern claypan vernal pool, northern foredune grassland, northern interior cypress forest, northern maritime chaparral, and northern vernal pool.

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ATTACHMENT A

LIST OF WILDLIFE TAXA

ATTACHMENT B

LIST OF PLANT TAXA

ATTACHMENT A

COMPARISON OF VEGETATION TYPES USED IN THIS DOCUMENT WITH OTHER CALIFORNIA VEGETATION CLASSIFICATION SYSTEMS

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COMPARISON OF VEGETATION TYPES USED IN THIS DOCUMENT COMPARED WITH OTHER CALIFORNIA VEGETATION CLASSIFICATION SYSTEMS

Common Natural Communities and Rare Natural Communities	Wieslander (1945)	California Native Plant Society (1993)	CDFG Classification System (Holland 1986)
Mixed conifer forest	Pine-Douglas fir-fir (M), pine (P), Douglas fir (D), lodgepole pine-whitebark pine (L), fir (F)	Lower montane coniferous forest	Lower montane coniferous forest
--	--	North Coast coniferous forest	Coast and Klamath Range conifer forest
--	--	Upper montane coniferous forest	Upper montane coniferous forest
--	--	Subalpine coniferous forest	Subalpine coniferous forest
Montane hardwood	Woodland (hardwoods) (W)	Broad-leaved upland forest	Broad-leaved upland forest
--	--	Cismontane woodland, in part	Cismontane woodland, in part
Pinyon-juniper	Juniper (J), pinyon pine (N)	Pinyon and juniper woodlands	Pinyon and juniper woodlands
--	--	--	Great Basin woodlands
--	--	--	Great Basin pinyon and juniper woodlands
Valley foothill hardwood	Woodland-grass (V)	Cismontane woodland, in part	Cismontane woodland
Valley oak woodland*	--	--	Valley oak woodland*
Valley foothill riparian	--	Riparian forest	Riparian forest
Valley oak riparian forest*	--	--	Great Valley valley oak riparian forest*
Fremont cottonwood riparian forest*	--	--	Great Valley cottonwood riparian forest*
Mixed riparian forest*	--	--	Great Valley mixed riparian forest*
--	--	Riparian woodland	Riparian woodland
Sycamore alluvial woodland*	--	--	Sycamore alluvial woodland*
--	--	Riparian scrub	Riparian scrub
Great Valley willow scrub*	--	--	Great Valley willow scrub*
Great Valley mesquite scrub*	--	--	Great Valley mesquite scrub*
Elderberry savanna*	--	--	Elderberry savanna*
Montane riparian	--	--	Montane riparian forest
Desert riparian	--	--	Mojave riparian forest
Chaparral	Chaparral ©	Chaparral	Chaparral
Ione chaparral*	--	--	Ione chaparral*

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Common Natural Communities and Rare Natural Communities	Wieslander (1945)	California Native Plant Society (1993)	CDFG Classification System (Holland 1986)
Coastal scrub	Coastal sagebrush (T)	Coastal scrub	Coastal scrub
--	--	--	Coastal bluff scrub, in part
Alkali desert scrub	Great Basin sagebrush (S), in part	Chenopod scrub	Chenopod scrub
--	--	--	Desert chenopod scrub
--	--	--	Great Valley chenopod scrub
Valley sink scrub*	--	--	Valley sink scrub*
Valley saltbush scrub*	--	--	Valley saltbush scrub*
Desert scrub	Desert (Z)	Desert scrub	Mojavean desert scrub
--	--	--	Sonoran desert scrub
Sagebrush and bitterbrush scrub	Great Basin sagebrush (S), in part	Great Basin scrub	Great Basin scrub
Inland dunes	--	Inland dunes	Stabilized interior dunes*
--	--	--	Monvero residual dunes*
Coastal beaches and cliffs	--	--	Coastal bluff scrub, in part
--	--	Coastal bluff scrub	--
--	--	--	Coastal dunes
Grassland	Grass (G)	--	Grasslands, vernal pools, and other herb communities
--	--	Valley and foothill grasslands	Valley and foothill grasslands
Valley needlegrass grassland*	--	--	Valley needlegrass grassland*
Serpentine bunchgrass grassland*	--	--	Serpentine bunchgrass*
Valley sacaton grassland*			
Wildflower field*	--	--	Wildflower field*
--	--	Great Basin grassland	Great Basin grassland
--	--	Coastal prairie	Coastal prairie
Alkali meadow and seep	--	Meadows	Meadows and seeps
--	--	--	Alkali meadow, alkali seep
Vernal pools*	--	Vernal pools*	Vernal pools*
Freshwater emergent wetland	Marsh, in part	--	Bog and marsh
--	--	Marshes and swamps, in part	Marsh and swamp
Coastal and valley freshwater marsh*	--	--	Coastal and valley freshwater marsh*
Cismontane alkali marsh*	--	--	Cismontane alkali marsh*
Bogs and fens	--	Bog and fen	Bog and fen

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Common Natural Communities and Rare Natural Communities	Wieslander (1945)	California Native Plant Society (1993)	CDFG Classification System (Holland 1986)
Saline emergent wetland	Marsh, in part	Marshes and swamps, in part	Marsh and swamp
--	--	--	Coastal salt marsh*
Coastal brackish marsh*	--	--	Coastal brackish marsh*
Northern coastal salt marsh*	--	--	Northern coastal salt marsh*
Agricultural	Agricultural (A)	None	None
Pasture	--	--	--
Orchard/vineyard	--	--	--
Row crops	--	--	--
Grain	--	--	--
Rice	--	--	--
Cotton	--	--	--

LEGEND: * = rare natural community.
-- = indicates no equivalent community type.

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TABLE 1 GENERALIZED GEOLOGIC SITE CATEGORIES FOR THE PORTLAND METROPOLITAN AREA

Zone	Stratigraphic Units	Median Velocity (ft/sec)	Density (g/cm^3)	Shear Modulus Reduction and Damping	Depth Ranges (ft)
Portland Hills	Q_{ph} (loess)	900 (274)	1.8	Loess Curves	0 - 30 (0 - 9.1) 30 - 70 (9.1 - 21.3) 70 - 130 (21.3 - 39.6)
	T_{cr} (basalt)	3,600 (109)	2.8		
Tualatin Basin	Q_{ff} (silt)	1,000 (305)	1.9	Vucetic/ Dobry Curves	0 - 50 (0 -15.2) 50 - 100 (15.2 - 30.5) 100 - 200 (30.5 - 61.0)
	Q_{ts} (mudstone)	1,800 (549)	2.2	EPRI or Rock Curves	0 - 50 (0 - 15.2) 50 - 100 (15.2 - 30.5) 100 - 200 (30.5 - 61.0) 200 - 400 (61.0 - 121.9) 400 - 1,000+ (121.9 - 304.8)
	T_{cr} (basalt)	3,600 (1097)	2.8		
Portland Basin	Q_{ff} (silt)	1,000 (305)	1.9	Vucetic/ Dobry	0 - 50 (0 - 15.2) 50 - 100 (15.2 - 30.5) 100 - 200 (30.5 - 61.0) 200 - 400 (61.0 - 121.9)
	Q_{fc} (coarse grain flood deposit)	1,600 (488)	1.9	EPRI Curves	0 - 50 (0 - 15.2) 50 - 150 (15.2 - 45.7)
	Q_{tg} (gravels)	2,600 (792)	2.3	Rock Curves	0 - 50 (0 - 15.2) 50 - 150 (15.2 - 45.7) 150 - 300 (45.7 - 91.4) 300 - 600 (91.4 - 182.9)
	Q_{ts} (mudstone)	1,800 (549)	2.2	EPRI or Rock Curves	0 - 50 (0 - 15.2) 50 - 100 (15.2 - 30.5) 100 - 200 (30.5 - 61.0) 200 - 400 (61.0 - 121.9) 400 - 1,000+ (121.9 - 304.8)
	T_{cr} (basalt)	3,600 (1097)	2.8		

Notes: Any combination greater than 1525 ft (464.8 m) is not possible
Some combinations of Q_{SR} and T_{SR} can be excluded
Metric units in parentheses

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Attachment A Habitat Guild and Species Summary

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List of Acronyms

CALFED	CALFED Bay-Delta Program
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CNPS	California Native Plant Society
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DWR	(California) Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ERP	Ecosystem Restoration Plan
GIS	Geographic Information System
NDDB	(California) Natural Diversity Data Base
NEPA	National Environmental Policy Act
NWI	National Wetlands Inventory
PEIS	Programmatic EIS
SRA	Shaded Riverine Aquatic
SWP	State Water Project
WHR	Wildlife Habitat Relationship

1.0 INTRODUCTION

The intent of the CALFED Bay-Delta Program (CALFED) is to develop long-term solutions to problems affecting the San Francisco Bay/Sacramento-San Joaquin Delta estuary. The purpose of this technical report is to document, in a programmatic manner, the potential CALFED impacts on vegetation and wildlife. The objective is to describe potential effects on vegetation and wildlife that could result from the No Action Alternative or implementing any of the three CALFED alternatives. This report discusses potential impacts that may occur in the five regions within the study area: the Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and State Water Project (SWP) and Central Valley Project (CVP) Service Areas. The report also contains a brief description of potential mitigation strategies designed to reduce CALFED impacts. The executive summary contained in this technical report in conjunction with other information, data, and modeling developed during prefeasibility will be used to prepare the environmental impacts section of the Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS). Following the summary of impacts presented in this technical report, the assessment methods, assessment tools, methods for impact assessment, and significance criteria used to evaluate impacts are discussed.

CALFED has developed three comprehensive solution alternatives. Each alternative is composed of a set of four common programs (ecosystem restoration, water quality, levee system integrity, and water use efficiency), which is a relative constant in each alternative, and a set of features unique to each alternative. Physical differences between the alternatives lie mainly in the method of transporting water through or around the Delta (conveyance), and the amount of additional water storage included in each alternative. Each of the three action alternatives includes a variety of potential combinations, or variations, of conveyance and storage (i.e., Variations 1A-1C, 2A-2E, and 3A-3I). While the basic composition of the common programs remains relatively constant in each alternative, they may perform somewhat differently depending on the storage and conveyance components included within a specific alternative formulation. This programmatic approach resulted in descriptions of alternatives that are very general in nature. In most cases the physical components and locations are described in more general terms. Since the specific locations for most of the alternative features are not identified, a site-specific impact analysis cannot be made. Once a preferred alternative is chosen, a more specific and detailed analysis will be made.

This analysis was conducted on project description information presented in several source documents including:

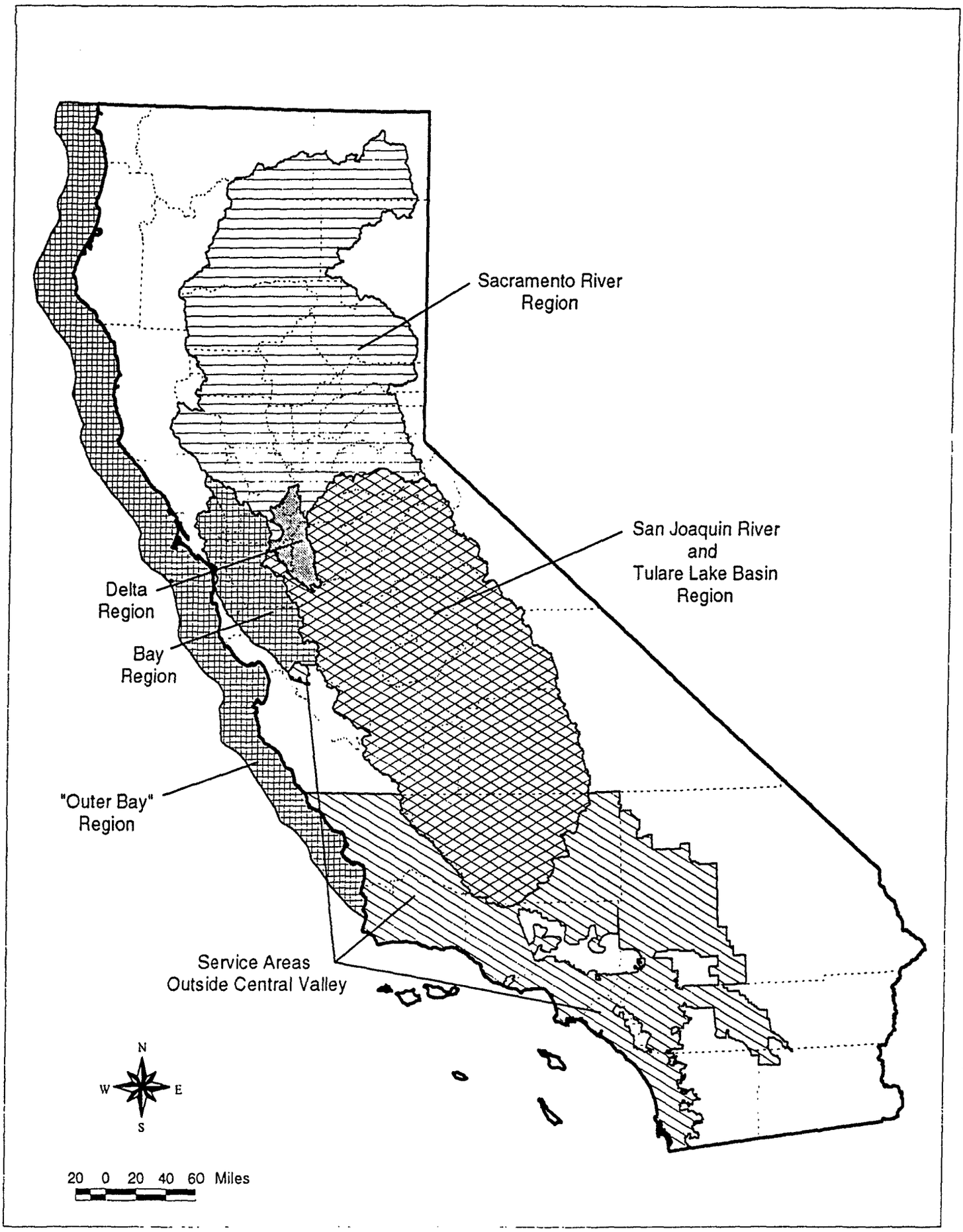
- *Phase II Alternative Descriptions* (CALFED 1997a)
- Appendices A through E to the *Phase II Alternative Descriptions* (CALFED 1997a)
- *Status Report on Technical Studies for the Storage and Conveyance Refinement Process* (CALFED 1997b)

- CALFED regional handout summaries of the ERP and Levee System Integrity Program proposed programmatic actions, and the storage and conveyance alternatives

The first two sources described above took precedence over the other sources where conflicting information is presented in these documents.

The impact assessment in Section 5.0 begins with a comparison of the No Action Alternative to existing conditions. Then, each of the three alternatives is compared to the No Action Alternative. Each of these comparisons is done separately for each of the five regions that comprise the CALFED solution area. Under the analysis for each alternative, all four common programs are addressed as well as the storage and conveyance components that vary by alternative.

The level of detail in this Technical Appendix is limited by the specificity of the actions and the fact that no specific locations are identified for actions. This is consistent, however, with guidance for programmatic National Environmental Policy Act (NEPA) documents (50 CFR 1528.18), which allow general or qualitative analysis at a program level. It is also consistent with California Environmental Quality Act (CEQA) Guidelines (Section 15168), which allow a lead agency to consider broad policy alternatives in a program EIR. In the future as specific projects and sites are identified quantitative assessments will be conducted as part of subsequent environmental review (EIR, EIS, or EIR/EIS) and tiered back to the original programmatic document. The level of analysis provided is greatest for the Delta region since the description of project features in the Delta was more detailed. The least amount of detail is provided for upper watersheds above storage facilities in each of the identified regions. Figure 1-1 shows the boundaries for each of the regions comprising the study area.



CALFED
BAY-DELTA
PROGRAM

Figure 1-1
Study Area

2.0 EXECUTIVE SUMMARY

2.1 Introduction

The purpose of this summary is to document, in a programmatic manner, the potential CALFED impacts on vegetation and wildlife. The objective is to describe potential effects on vegetation and wildlife that could result from the No Action Alternative or implementing any of the three CALFED Alternatives. This summary discusses potential impacts that may occur in the five regions within the study area: the Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and SWP and CVP Service Areas (Figure 1-1). The summary also contains a description of conceptual mitigation strategies designed to reduce CALFED impacts. More detailed information for impacts and mitigation strategies is presented in the complete Impact Assessment Technical Appendix: Vegetation and Wildlife.

2.2 Assessment Methods

The analysis included in this summary is focused on impacts to plant communities and associated plants and wildlife rather than individual species. Special-status species, rare natural communities, and significant natural areas are considered separately. The plant community classification system that is used is a modified Holland system. This community approach assumes that those species dependent on a plant community would generally be affected in the same direction by a particular CALFED action; that is, if the plant community is adversely affected, the associated plants and animals will be similarly affected.

Some CALFED actions would have a direct effect on specific environmental variables such as flow, water quality, substrate, etc. Changes in these environmental variables could affect the plant communities by changing rates of erosion, sedimentation, or water availability, by directly creating new plant communities, or by removing or converting existing communities. These impact mechanisms may cause changes in the quality and/or quantity of plant communities and associated wildlife. Changes may also affect the number of special-status species and/or the area or quality of rare natural communities by altering existing foraging, living, and breeding areas.

These changes in quality and quantity are the measures used to determine impacts of the alternatives being considered. Since details regarding the size and location of specific alternative features are unavailable, the impacts are measured as estimates of gains or losses or types of gains or losses that might be expected to occur. When specific details regarding size and location of features are known, more exact values of loss or conversion of plant communities will be determined.

The following general categories of impact measures were used to assess the level of impact of the CALFED alternatives on vegetation and wildlife, including special-status species:

1. Area of natural plant communities including associated wildlife and plant species

2. Quality of natural plant communities including associated wildlife and plant species, and changes in nonindigenous/introduced species
3. Area of agricultural land providing habitat value
4. Habitat patterns for plant communities (e.g., spatial orientation of habitats, connectivity, landscape-level diversity, etc.)
5. Number of known special-status species and/or areas with Acritical habitat@ designation
6. Area and quality of plant communities occupied by special-status species
7. Area and quality of rare natural communities or significant natural areas.

Two types of analysis have been included: changes in aerial extent due to direct loss, conversion, or creation of plant communities; and changes in quality. Changes to the aerial extent of vegetation have been defined and analyzed by using various tools in Geographic Information System (GIS) and hardcopy mapping that focus primarily on spatial analysis of plant community area. The change in acreage of each plant community is used as the quantitative measure of impacts on wetland and terrestrial habitats, associated vegetation and wildlife, or species groups.

The assessment of qualitative impacts on plant communities considers geographic extent, distribution, quality, and spatial configuration. A project that affects the continuity of a linear riparian plant community or drainage patterns in wetlands, for example, may have greater impact than those resulting from changes in areal extent. The severity of impacts is determined by the magnitude of changes in quality or condition of the plant communities.

Broad groups of plant communities have been addressed in the assessment, e.g., riparian, grasslands, etc. An increase or decrease in the area of a particular plant community has been used to indicate whether the populations of wildlife or plant species closely associated with the affected plant community will be beneficially or adversely affected.

Geographic comparisons have been made using electronic databases and hard-copy maps of plant community distributions. Results of this analysis provided information on the likelihood of affecting a given plant community or special-status species with implementation of a particular alternative. The approach that was used to conduct impact assessments on areas for which database or hardcopy maps of plant community distributions are not available is described in the Technical Appendix.

The best available information has been used for special-status species. California Department of Fish and Game's (CDFG's) National Diversity Data Base (NDDB) location information on special-status plants and animal species and rare natural communities has been used in the analysis. Rare natural communities and significant natural areas were treated qualitatively in part because specific data on the location of the project features in relation to specific areas or communities were not generally available. CDFG's mapping of vernal pools and RAREFIND database and

files were utilized to obtain some quantitative information regarding affects to rare natural communities.

2.3 Significance Criteria

The significance of any of the CALFED actions would vary on the environmental setting in which the activity occurs. Thresholds of significance for a given impact may include flexible standards that recognize differences in the environmental setting. Thresholds may also be qualitative or quantitative. The general nature of the planning and the broad range of settings and impacts involved with the Phase II Bay-Delta Program dictate the use of qualitative thresholds of significance at this programmatic stage. The thresholds can and will be made more definitive and more quantitative at the project-specific level.

The significance criteria identified for evaluation of impacts to vegetation and wildlife resources follow:

1. Temporary or permanent removal, filling, grading, or disturbance of wetlands and riparian communities

2. Substantial decrease in the area of important wildlife habitats or use areas in watersheds of major tributaries to the Sacramento and San Joaquin Rivers

3. Substantial fragmentation or isolation of wildlife habitats or movement corridors, especially riparian and wetland habitats

4. Decrease in the amount of available forage for wintering waterfowl

5. Increase in the potential for outbreaks of wildlife diseases

6. Result in the permanent loss of occupied special-status species habitat or direct mortality of special-status species

7. Reduction in the area or extent of special-status communities

8. Reduction in area or habitat value of critical habitat areas designated under the Federal Endangered Species Act

The impact analysis in Section 5 includes reference to both temporary and permanent impacts (e.g., significance criteria number 1). The definitions of these terms as used in this document follow:

Temporary Impacts: Impacts expected to result in short-term loss of habitat area or quality as a result of construction or restoration activities.

Permanent Impacts: Impacts expected to result in long-term loss of habitat area or quality as a result of construction or restoration activities.

2.4 Summary of Impacts

The impact summary begins with a description of the No Action Alternative and a comparison to existing conditions, following by an impact assessment in which the CALFED Alternatives are compared to the No Action Alternative.

2.4.1 No Action Impacts

Effects of the No Action Alternative are evaluated relative to the existing conditions. The time frame identified for the No Action Alternative is the year 2020. The differences between the No Action Alternative and existing conditions result from changes in water project operations in response to new or modified facilities, increased or reduced demands, and new water resource projects that could affect the area and quality of existing habitat. New or modified facilities include new surface water and groundwater storage, new conveyance, and modified reservoir discharge structures. Changes in demand for water could result from increased CVP and SWP needs, land retirement, full use of existing water rights, revised environmental flow needs, and increased wildlife refuge needs.

Although operations and surface-water and groundwater storage would change under the No Action Alternative, **Delta Region** inflow and outflow would most likely be similar to flows under existing conditions. Operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns and the associated salinity distribution in the Delta. As a result, the quantity and quality of wetland and riparian vegetation in the Delta would not change appreciably. Changes that could occur are not quantifiable at a programmatic level of analysis.

Sediment supply and movement could be affected by the Delta Levees Subvention Project and actions upstream of the Delta, including land retirement and the Sacramento River Flood Control Project. None of the projects would substantially change the structure of the existing ecosystem, and change in sediment supply and movement would most likely be minimal. Any changes to quantity or quality of habitat could not be quantified at this programmatic level of analysis.

Contaminant input and movement could be reduced by land retirement and, possibly, by restoration associated with the Stone Lakes National Wildlife Refuge. Contaminant input under the 2020 level of development, however, could increase or decrease and could negate any reduction attributable to other land retirement and restoration. Relative to existing sources of contaminants, the change in contaminant input would most likely be small. Change in flow could also affect the movement and dilution of contaminants; however, information on flow change is currently unavailable.

Productivity and nutrient input is affected by the processes discussed above and changes in structural characteristics described below. Relative to existing conditions, projects under the No Action Alternative that could increase biological productivity and nutrient input and movement in the terrestrial ecosystem include changes in wildlife refuge operations, and restoration associated with the Stone Lakes National Wildlife Refuge, Delta Levees Subvention Project, and Sacramento River Flood Control Project. Restoration of riparian, shaded riverine aquatic, and tidal marsh areas could slightly increase productivity through increased production and input of organic carbon and provide a small benefit to Delta species.

Structural characteristics of the Delta would be similar for both the No Action Alternative and existing conditions. Projects that could affect structural characteristics of the Delta ecosystem and species habitat include the Delta Levees Subvention Project and Stone Lakes National Wildlife Refuge. Change in structural characteristics is consideredc to have a beneficial effect when the change moves toward a natural condition. Restoration of tidal marsh and connecting sloughs in Stone Lakes National Wildlife Refuge and changes in levee maintenance practices to allow development of natural riparian and marsh communities would have small beneficial effect relative to the existing Delta system. For example, an additional 1,300 acres of habitat added to Stone Lakes National Wildlife Refuge under the No Action Alternative would benefit several plant communities (including wetlands) by assisting the recovery of special-status species and adding to linkage between refuge habitats.

Under the No Action Alternative, effects on vegetative and wildlife communities in the **Bay Region** would primarily be dependent on movement of contaminants, sediment, nutrients, and production from the Delta Region. The small increase in productivity and nutrient input identified for the Delta could be transported to the Bay and provide small benefits to the wetlands and adjacent upland habitats surrounding waters in the Bay Region.

Differences between the No Action Alternative and existing conditions for the **Sacramento River Region** would primarily be reflected by flow changes. Although operations and surface-water and groundwater storage would change under the No Action Alternative, Sacramento River and tributary flows would most likely be similar to flows under existing conditions. Operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns. Changes to the quality and quantity of riparian and wetland communities would be small and not measurable at a programmatic level of analysis.

The Sacramento River Flood Control Project could affect structural characteristics of the Sacramento and American rivers. Change in structural characteristics is considered to have a beneficial effect when the change moves toward a more natural condition. Changes in levee maintenance practices to allow development of natural riparian and shaded riverine aquatic communities would have small beneficial effects relative to the existing levee system. The structural changes could result in a slight increase in quantity and quality of habitats supporting species (including special-status species) associated with riparian and shaded riverine terrestrial habitats.

Changes in flow between the No Action Alternative and existing conditions for the **San Joaquin River Region** would occur. San Joaquin River and tributary flows would most likely be similar to flows under existing conditions. Mokelumne and Tuolumne river flows could be altered to improve spawning and rearing conditions, providing a beneficial impact primarily on chinook salmon but could also provide small benefits to riparian vegetation. The New Melones Conveyance Project could reduce water available for release down the Stanislaus

River, adversely affecting flow conditions and possibly riparian vegetation.

Water quality conditions in most rivers in the San Joaquin River Region under the No Action Alternative would be similar to water quality conditions under existing conditions. The retirement of 45,000 acres of agricultural land would, however, most likely occur in the San Joaquin River Region. Land retirement could reduce input of contaminants (primarily selenium and salts) to the San Joaquin River and have a beneficial impact on plant and animal species that obtain materials and food supply from areas affected by contaminants.

The water supplied to ten national wildlife refuges, four wildlife management areas, and private wetlands within the Grasslands Water District would be at Level 4 under the No Action Alternative. Level 4 is the amount of water required for full development of the land lying within the 1988 refuge boundaries, in contrast to Level 2 under existing conditions, which is the average amount of water the refuges had received for approximately 10 years. In general, Level 4 water supplies would allow for greater flexibility and consistency in providing water for full development of wetlands and water to support waterfowl and other species relying on refuge habitat. The increasing quantity and quality of habitat supported by Level 4 water supplies is not quantifiable at a programmatic level of detail.

2.4.2 CALFED Alternatives Impacts

The impact analysis presented in this summary for CALFED Alternatives is keyed to Table 2-1. In this table the impacts and benefits that would result from the common programs and storage/conveyance are summarized and listed for each of the three Alternatives with all variations. The impact and benefit categories are consolidated from a more comprehensive list presented in Section 5.0 of this Technical Appendix.

Each adverse impact or beneficial impact listed in Table 2-1 is categorized as a significant impact (S) or benefit (B). This evaluation is made before consideration of potential mitigation measures. The assignment of (S) or (B) is based upon application of significance criteria referenced above and qualitative assessment of impact magnitude included in Section 5.0 of the Technical Appendix. In most cases an impact with a - or -- rating in the technical appendix would be classified as a significant impact if the resource affected is considered sensitive. For example, if any number of special-status species or wetland acreages would be affected the impact would be considered significant regardless of magnitude. If the resource is not considered especially sensitive, e.g., upland grasslands or agricultural croplands, a - rating (indicating relatively

Table 2-1
Summary of Potential Significant Impacts and Benefits of CALFED Program Alternatives by Region

Potential Significant Impacts and Benefits	Regions	Alternative 1			Alternative 2					Alternative 3								
		A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Common Programs: Habitat Area, Quality, and Pattern																		
Impact: Loss or Degradation of Wetland and Riparian Communities	Delta	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Sacramento River	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	San Joaquin River	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Impact: Loss or Degradation of Important Wildlife Habitats and Use Areas	Delta	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay																	
	Sacramento River																	
	San Joaquin River																	
Benefit: Increase or Improvement of Wetland and Riparian Communities	Delta	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Bay	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Sacramento River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	San Joaquin River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Benefit: Increase or Improvement of Upland Habitats	Delta	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Bay	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Sacramento River																	
	San Joaquin River																	
Common Programs: Special-Status Species																		
Impact: Loss of Foraging Habitat for Special-Status Species	Delta	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Sacramento River	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	San Joaquin River	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Impact: Loss of Rare Natural Communities and Significant Natural Areas	Delta	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay																	
	Sacramento River																	
	San Joaquin River																	
Benefit: Increase in Habitat for Special-Status Species	Delta	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Bay	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Sacramento River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	San Joaquin River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Benefit: Expansion of Rare Natural Communities and Significant Natural Areas	Delta	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Bay	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	Sacramento River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	San Joaquin River	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

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Table 2-1 (continued)

Potential Significant Impacts and Benefits	Regions	Alternative 1			Alternative 2					Alternative 3								
		A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Storage Facilities: Habitat Area, Quality, Pattern																		
Impact: Loss or Degradation of Wetland and Riparian Communities	Delta						S				S		S	S		S		S
	Bay																	
	Sacramento River			S		S			S		S		S	S	S	S	S	S
	San Joaquin River			S		S		S	S		S		S	S	S	S	S	S
Impact: Loss or Degradation of Important Wildlife Habitats and Use Areas	Delta						S				S		S	S		S		S
	Bay																	
	Sacramento River			S		S			S		S		S	S	S	S	S	S
	San Joaquin River			S		S		S	S		S		S	S	S	S	S	S
Benefit: Increase or Improvement of Wetland and Riparian Communities	Delta										B		B	B		B		B
	Bay																	
	Sacramento River			B							B		B	B	B	B	B	B
	San Joaquin River			B							B		B	B	B	B	B	B
Benefit: Increase or Improvement of Upland Habitats	Delta						B											
	Bay																	
	Sacramento River					B			B									
	San Joaquin River					B		B	B									
Storage Facilities: Special-Status Species																		
Impact: Loss of Foraging Habitat for Special-Status Species	Delta						S				S		S	S	S	S		S
	Bay																	
	Sacramento River					S			S		S		S	S	S	S	S	S
	San Joaquin River			S		S			S		S		S	S	S	S	S	S
Impact: Loss of Rare Natural Communities and Significant Natural Areas	Delta						S				S		S	S	S	S		S
	Bay																	
	Sacramento River			S		S			S		S		S	S	S	S	S	S
	San Joaquin River			S		S			S		S		S	S	S	S	S	S
Benefit: Increase in Habitat for Special-Status Species	Delta						B				B		B	B	B	B		B
	Bay																	
	Sacramento River			B		B			B		B		B	B	B	B	B	B
	San Joaquin River			B		B			B		B		B	B	B	B	B	B

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Table 2-1 (concluded)

Potential Significant Impacts and Benefits	Regions	Alternative 1			Alternative 2					Alternative 3								
		A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Conveyance Facilities: Habitat Area, Quality, and Pattern																		
Impact: Loss or Degradation of Wetland and Riparian Communities	Delta		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay											U	U					
	Sacramento River											U	U					
	San Joaquin River											U	U					
Impact: Loss or Degradation of Important Wildlife and Use Areas	Delta		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay											U	U					
	Sacramento River											U	U					
	San Joaquin River											U	U					
Benefit: Increase or Improvement of Wetland and Riparian Communities	Delta			B	B	B	B	B	B	B	B	B	B	B		B	B	B
	Bay																	
	Sacramento River											U	U					
	San Joaquin River											U	U					
Benefit: Increase or Improvement of Upland Habitats	Delta			B														
	Bay																	
	Sacramento River											U	U					
	San Joaquin River											U	U					
Conveyance Facilities: Special-Status Species																		
Impact: Loss of Foraging Habitat for Special-Status Species	Delta									S	S	S	S	S	S	S	S	S
	Bay										U	U	U					
	Sacramento River																	
	San Joaquin River																	
Impact: Loss of Rare Natural Communities and Significant Natural Areas	Delta		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	Bay										U	U	U					
	Sacramento River																	
	San Joaquin River																	

Notes:
B = Benefit
S = Significant Impact
U = Unknown
Blank = No impact or minor impact

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small acreages affected), would not be considered a significant impact.

In accordance with the rating system used in Table 2-1, it is important to note that the identification of significant impacts (S) and beneficial impacts (B) does not indicate relative magnitude. Therefore, equal numbers of beneficial impacts and adverse impacts for one variation do not necessarily balance. Similarly, identification of a significant adverse impact for special-status species would not balance with a beneficial impact for restoration of habitat. The summary table should be used to judge the number of overall significant adverse or beneficial impacts for variations without regard to relative magnitude of impacts.

As discussed above, both adverse impacts and beneficial impacts are identified in the technical appendix and this summary. It is important to note that many of the benefits that would result from implementation of CALFED are directly attributable to the Ecosystem Restoration Program (ERP). The ERP has been designed to restore and enhance thousands of acres of habitat in the Delta Region, as well as other geographic regions, which would result in an overall positive habitat gain for each of the regions considering both adverse and beneficial impacts. However, this concept of overall benefit does not imply that the ERP restoration activities mitigate for those habitat losses that would result from storage or conveyance actions or actions associated with the other common programs. Each of the adverse impacts identified would require separate mitigation to compensate for or avoid adverse impacts. Mitigations are proposed as strategies in Section 5.0 of the technical appendix and are conceptual in nature. Final mitigations would need to be approved by responsible agencies as specific projects are approved by subsequent environmental review. The ERP therefore provides benefits above and beyond the mitigations proposed for any adverse impacts resulting from CALFED actions.

Potential impacts resulting from changes in flow cannot be quantitatively addressed without modeled flow data. At the time that modeled flow data are available, qualitative and quantitative assessments of such issues as vegetation changes due to salinity distribution, flow effects on erosion and sedimentation rates, and changes in water level that could impact vegetative and wildlife communities could be assessed.

Impacts and Benefits Associated with Common Programs

The proposed actions of the Common Programs, with minor exceptions for some alternative variations, are the same among the Alternatives. Consequently, impacts and benefits on terrestrial biological resources associated with implementation of the Common Programs are essentially the same among the Alternatives. Actions associated with construction and operation of conveyance and storage facilities vary substantially among Alternatives and, therefore, serve as the basis for identifying differences in types and magnitude of potential impacts and benefits among the Alternatives. In the discussion below, the common programs are addressed followed by a comparison of Alternatives 1, 2, and 3 for storage and conveyance facilities.

As a common program, the impacts and benefits of the **ERP** on terrestrial biological resources are the same under all Alternatives. The location of some habitat restorations within the Delta Region, however, differs among some variations to accommodate construction or operation of proposed conveyance and storage facilities.

Potential adverse impacts of the ERP on terrestrial habitats are associated with temporary loss or degradation of existing wetland, riparian, and agricultural habitats as a result of constructing restored habitats. Full implementation of the ERP, however, would provide benefits to terrestrial biological resources of substantially greater magnitude than the impacts incurred as a result of restoration activities.

Variations of all three Alternatives for the common programs could benefit up to 34 special- status species, 11 rare natural communities, and 29 significant natural areas. For the Bay Region, 48 special-status species, 6 rare natural communities and 29 significant natural areas could benefit. Forty-six special-status species, 17 rare natural communities, and 188 significant natural areas could benefit in the Sacramento River Region, and 49 special-status species, 19 rare natural communities, and 77 significant natural areas could benefit in the San Joaquin River Region. The majority of these benefits would come from the ERP.

The **Levee System Integrity Program** would affect only the Delta Region and, as a common program, the impacts and benefits of the program on terrestrial biological resources is the same under all variations except Variations 2C and 3I. The magnitude of impacts on terrestrial biological resources would be slightly less under these variations compared to other variations because some levees breached as part of the conveyance facilities component of the project would not be improved under the program. Potential impacts of the Levee System Integrity Program include the temporary or permanent loss of wetland, riparian, and agricultural habitats, and fragmentation of riparian habitat corridors as a result of levee improvement activities. Potential benefits to terrestrial biological resources associated with implementing the Levee System Integrity Program include creating open-water and wetland habitats as a result of flooding Delta islands to reduce the rate of subsidence, and reducing the effects of erosion on existing channel island and wetland habitats.

Implementation of the **Water Quality Program** would be beneficial to terrestrial biological resources in all regions and would provide the same levels of benefit under all Alternatives. The magnitude of benefits on plant communities and associated wildlife, however, are not predictable. Generally, implementation of the program would reduce the likelihood of bioaccumulation of compounds potentially toxic to some species in the foodweb. Such reductions would potentially reduce the likelihood of direct or indirect mortalities (e.g., reduced reproductive success) of wildlife associated with these compounds.

Specific actions that potentially could affect plant communities and associated wildlife in the CALFED problem and solution areas are not identified for the

Water Use Efficiency Program; therefore, the potential impacts and benefits of the program on terrestrial biological resources is not predictable.

Comparison of Impacts and Benefits Associated with Conveyance and Storage

Alternative 1. Among the three Alternative 1 variations, Variation 1C would potentially have greater impacts on terrestrial biological resources because it includes construction and operation storage facilities in the Sacramento River and San Joaquin River regions that are not included under Variations 1B and 1C. Variation 1B would potentially have a slightly greater impact on wetland, riparian, and agricultural habitats than Variation 1A, because it includes construction of conveyance facilities that are not proposed for Variation 1A.

Construction of **Storage Facilities** would result in the direct loss of wetland and riparian habitats in the Delta, Sacramento River, and San Joaquin River regions under Alternative 1 as a result of inundation and construction of related infrastructure. Impacts to special-status species from Alternative 1 range from seven species potentially impacted in the San Joaquin River Region under Variation 1C to 31 species potentially impacted in the Sacramento River Region under Variation 1C. Each of the above variations would also impact 6 rare natural communities and 18-20 significant natural areas. In addition, the storage facilities associated with Variation 1C in the Sacramento River Region have the potential to impact 9,873 acres of vernal pool landscape. No other variations have associated storage facilities.

Alternative 1 **Conveyance Facility** impacts would be limited to less than 200 acres of natural and agricultural habitats and these potential impacts are also part of most Alternative 2 and 3 variations. Alternative 1 could also impact 12 to 14 special-status species, 5 rare natural communities, and 7 significant natural areas.

Alternative 2. Variation 2A proposes no storage facilities and the fewest new **Conveyance Facilities** among the five Alternative 2 variations, and Variation 2E proposes the greatest increase in construction of these facilities. Consequently, Variation 2A would have the least impact and Variation 2E the greatest impact on terrestrial biological resources among Alternative 2 variations. All Alternative 2 variations have a greater impact on terrestrial biological resources in the Delta Region than Alternative 1 variations because improvements in conveyance facilities would be more extensive and, under Variation 2C, storage facilities would be constructed. Benefits associated with construction of conveyance and storage facilities in the Delta Region include the creation of open-water, wetland, and riparian habitats. Generally, variations having greater impact on existing resources also provide greater benefits because most impacts would be to agricultural lands, which generally provide lower wildlife values for most wildlife species than the habitats that would be affected. The degree that creation of these habitats under each variation would offset impacts of construction and operation of conveyance

and storage facilities, however, would depend on where facilities are sited and how they are operated and maintained.

Variation 1C would have greater impacts on resources in the Sacramento River Region than Variations 2A, 2C, and 2D because no **Storage Facilities** would be constructed under these variations. Variation 1C would have greater impacts on resources in the San Joaquin River Region than Variations 2A and 2C because no storage facilities would be constructed under these variations. Variations 2B, 2D, and 2E would have greater impacts on resources in the San Joaquin River Region than Variation 1C because larger off-stream or off-aqueduct storage facilities would be constructed. Proposed storage facilities under Variations 2B and 2E are the same and, consequently, implementation of these variations would have the same impacts on resources. Variation 2D would have fewer impacts than Variations 2B and 2E because groundwater and off-stream storage facilities would not be constructed under this variation.

Storage facilities proposed for the Sacramento River and San Joaquin River regions would create large open-water habitat areas as a result of inundation that would benefit associated wildlife. Creation of open-water habitats, however, would be unlikely to offset project impacts on native terrestrial habitats.

Storage associated with Alternative 2 has the potential to impact 10 special status species under Variation 2C in the Delta Region, 31 species under Variations 2B and 2E in the Sacramento River Region, and 44 species under Variations 2B and 2E in the San Joaquin River Region. Alternative 2 would impact the same number of rare natural communities and significant natural areas as Alternative 1. Additional areas could be impacted by the CVP-SWP facilities but the facilities are not described in enough detail to determine the level of impact at this time. Variations 2B and 2E in the Sacramento River Region could impact up to 9,837 acres of vernal pool landscape while Variations 2B and 2E in the San Joaquin River Region could impact up to 53,509 acres. No other variations have storage facilities associated with them.

Potential impacts from Alternative 2 **Conveyance Facilities** would vary from approximately 1,100 acres of natural and agricultural habitats (Variation 2C) to approximately 29,000 acres (Variation 2E). Approximately 85-95 percent of the potentially impacted area under Alternative 2 would be converted from agricultural lands with generally low habitat value for wildlife to shallow-water habitat, including emergent wetlands and riparian habitats, with high habitat value. The variations with the greatest potential impact on existing wildlife habitat also have the greatest potential benefit. The variations with the greatest potential benefit rely on flooded islands and setback channels for increased conveyance (Variations 2D and 2E). Variations that rely more heavily on setback channels result in an intermediate level of potential benefit and impact (Variations 2A and 2B). Because Variation 2C relies to the greatest degree on newly constructed isolated channels its potential impacts have fewer associated potential benefits than the other variations of Alternative 2. Potential impacts to special status-species

are from 8-14 species. Variation 2C has the fewest potential impacts because of the use of isolated channels. Impacts from all other variations are nearly the same. All variations under Alternative 2 could impact 5 rare natural communities and 7 significant natural areas.

Alternative 3. Variation 3C would have the least impact and Variation 3F the greatest impact on terrestrial biological resources in the Delta Region among the nine Alternative 3 variations because no storage facilities and the least improvements to conveyance facilities would be constructed under Variation 3C, and Variation 3F (Chain of Lakes) would inundate large areas of the Delta. Impacts associated with in-Delta storage facilities are the same under Variation 3I as for Variation 2C. Variations 3B, 3D, 3E, and 3G also provide for in-Delta storage, but would have greater impacts than Variations 3I and 2C because a greater amount of water would be stored under these variations. Benefits associated with construction of conveyance and storage facilities in the Delta Region include the creation of open-water, wetland, and riparian habitats. Generally, variations having greater impacts on existing resources also provide greater benefits because most impacts would be to agricultural lands, which generally provide lower wildlife values for most wildlife species than the habitats that would be affected. The degree that creation of these habitats under each variation would offset impacts of construction and operation of conveyance and storage facilities, however, would depend on where facilities are sited and how they are operated and maintained.

Spur conveyance facilities within the Bay, Sacramento River, and San Joaquin River regions are proposed under Variations 3C and 3D. Proposed siting, design, and operation of these facilities have not been described; therefore, the impacts and benefits that would potentially be associated with these facilities is unknown.

No **Storage Facilities** would be constructed in the Sacramento River and San Joaquin River regions under Variations 3A and C. Storage facilities to be constructed in these regions under Variations 3B and 3D-3I are the same and, consequently, would have the same impacts on terrestrial biological resources including special-status species. These storage variations would have the same impacts as Variations 1C, 2B, and 2D in the Sacramento River Region. Impacts of Alternative 3 storage in the San Joaquin Region would also be the same as for Variations 2B and 2D and would be greater than impacts of Variation 1C because larger off-stream and off-aqueduct storage facilities would be constructed. Storage facilities proposed for the Sacramento River and San Joaquin River regions would create large open-water habitat areas as a result of inundation that would benefit associated wildlife. Creation of open-water habitats, however, would be unlikely to offset project impacts on native terrestrial habitats.

Potential impacts from **Conveyance Facilities** associated with Alternative 3 would be least for Variation 3I. Variation 3I is similar to Variation 2C, except for an additional channel constructed from Hood to the San Joaquin River. Similar to Variation 2C, this variation also has the

least potential benefit associated with newly created shallow-water habitat, emergent wetland, and riparian habitat. The greatest potential impact would result from the Chain of Lakes Variation (3F), which would involve the creation of a large area of open-water habitat of varying depth (up to 37,000 acres), but the created wetland and riparian habitat area would be approximately the same as in Variations 3A to 3G. These variations would have similar potential impacts on natural plant communities, because the level of potential impact between 5,000 cubic feet per second (cfs) pipeline (Variation 3C), 5,000 cfs open channel (Variations 3A, 3B, 3D, 3G, and 3H), and 15,000 cfs open channel isolated facilities (Variations 3E and 3I) was not assumed to differ substantially. Variation 3H would have the greatest potential benefit because approximately 26,000 acres of agricultural lands would be converted to shallow-water habitat, as in Variation 2E. Variation 3H would have the same potential benefits as Variation 2E, but would have the additional potential impacts of the isolated channel facilities (approximately 1,000 acres of natural and agricultural habitats).

Impacts to special-status species would vary significantly for Alternative 3 depending on the variation considered. Variation 3F would impact the fewest number of species (6) and would also have long-term benefits on several species because of creation of wetlands on both the inside and outside of of levees forming the lakes on Delta islands. Variation 3G would impact the most special-status species, due primary to isolated conveyance construction in the western Delta. Alternative 3 variations would have similar impacts to rare communities and significant natural areas as under Alternative 3.

2.5 Summary of Potential Mitigation Measures

As discussed in the introduction to this summary, mitigations are proposed as strategies in this programmatic document and are conceptual in nature. Final mitigations would need to be approved by responsible agencies as specific projects are approved by subsequent environmental review.

Where the ERP would cause adverse impacts, phasing of the ERP would help mitigate potential adverse impacts resulting from ERP actions. All adverse impacts caused by other common programs, or storage or conveyance facilities, would have to be mitigated separately.

Potential mitigation measures are summarized below corresponding to the general impact categories evaluated in Section 5.0.

Temporary or Permanent Loss or Disturbance of Wetland and Riparian Communities

- Avoid wetland and riparian communities
- Restore or enhance sufficient in-kind wetland and riparian habitat area at off-site locations before or at the time that project impacts are incurred to offset habitat losses
- Initially implement the ERP, to the extent feasible, to restore sufficient wetland and riparian habitats in nonwetland/riparian habitat areas

before or at the time that project impacts associated with the ERP are incurred to offset temporary habitat losses
- Restore wetland and riparian communities temporarily or permanently disturbed by on-site construction activities immediately following construction

Temporary or Permanent Loss or Disturbance of Wintering Waterfowl Habitat

- Initially implement the ERP, to the extent feasible, to restore native waterfowl foragin habitats on agricultural lands that provide little or no existing waterfowl forage values to defer potential adverse impacts on waterfowl until sufficient natural habitat with high waterfowl forage value develops
- Initially implement the ERP, to the extent feasible, to focus habitat restoration efforts on restoring sufficient high forage value wetland habitat area to offset anticipated loss of agricultural foraging habitats
- Restore or enhance sufficient waterfowl foraging habitat to offset impacts to the abundance, quality, and availability of waterfowl forage; specific types of actions potentially include planting crops that produce high forage value on agricultural lands currently planted with low forage value crops or planting winter forage crops on fallowed agricultural lands

Potential for Increased Waterfowl Disease

- Monitor waterfowl use of restored and enhanced wetlands to locate incidences of waterfowl disease moralities
- Remove carcasses from affected restored and enhanced wetlands to reduce the rate of disease transmission
- Haze waterfowl from restored and enhanced wetlands affected by disease outbreaks to reduce the likelihood of disease transmission
- Where feasible and consistent with habitat restoration objectives, design wetlands to allow for rapid dewatering during disease outbreaks to discourage use of the affected habitat area by waterfowl

Decrease in Important Deer and Elk Use Areas or Other Wildlife Habitat

- Avoid critical deer winter range and fawning habitat, and tule elk calving habitat
- Restore habitat areas temporarily disturbed by on-site construction activities immediately following construction
- Restore historic, but currently unsuitable, habitat areas within affected watersheds or other watersheds used by the affected deer or elk population if sufficient historic habitat for restoration is unavailable within the affected watershed
- Enhance unaffected habitat areas within affected watersheds or other watersheds used by the affected deer or elk population is sufficient habitat for enhancement is unavailable within the affected watershed.

Temporary of Permanent Fragmentation of Riparian Habitats

- Avoid riparian vegetation
- Restore or enhancing sufficient riparian habitat area at off-site locations in a manner that reduces the degree of existing habitat fragmentation before or at the time that project impacts are incurred to offset habitat losses
- Initially implement the ERP, to the extent feasible, to restore sufficient riparian habitat before or at the time that project impacts are incurred to offset habitat losses
- Restore riparian vegetation disturbed by on-site construction activities immediately following construction
- Phase the implementation of modification to levees that would be necessary to meet PL-99 standards over a sufficient period to minimize the effects of fragmentation of riparian habitats and associated wildlife

Loss of Foraging Habitat for Special-Status Species

- Avoid inundation of lands that are of high forage value for special-status species when creating aquatic habitats
- Restore additional grasslands to serve as alternative foraging habitat over and above that restored as part of the ERP
- Manage agricultural lands for multiple foraging special-status species (i.e., flooding fields in the fall to provide wintering waterfowl habitat, while leaving the fields drier in the spring and summer for other species to utilize)
- Maximize the habitat quality of remaining agricultural lands by utilizing various wildlife-friendly techniques such as planting crops of highest forage value

Loss of Portions of Rare Natural Communities and Significant Natural Areas

- Avoid rare natural communities and significant natural areas altogether
- Restore or enhancing disturbed rare natural communities or significant natural areas at other locations before or at the time that Levee System Integrity Program impacts are incurred
- Restore rare natural communities or significant natural areas back into impacted locations once Levee System Integrity Program activities are completed

2.6 Summary of Significant Unavoidable Impacts

After mitigation strategies are developed into site-specific mitigation measures and applied, some unavoidable significant impacts may remain. These are identified below by Alternative and the region they would occur in.

Delta Region

No significant unavoidable impacts were identified.

Bay Region

No significant unavoidable impacts were identified.

Sacramento and San Joaquin River Regions

Under Alternatives 1, 2, and 3 existing riparian habitat corridors could be permanently fragmented as a result of inundation of off-stream storage reservoirs, potentially blocking the movement and interchange of populations of some wildlife species from upper to lower watershed locations. This impact cannot be mitigated. Therefore, this impact is considered a significant unavoidable impact.

3.0 ASSESSMENT METHODS

3.1 Introduction

The analysis included in this report is focused on impacts to plant communities and associated plants and wildlife rather than individual species. Special-status species, rare natural communities, and significant natural areas are considered separately. The plant community classification system that is used is a modified Holland system. This community approach assumes that those species dependent on a plant community would generally be affected in the same direction by a particular CALFED action; that is, if the plant community is adversely affected, the associated plants and animals will be similarly affected.

Some CALFED actions would have a direct effect on specific environmental variables such as flow, water quality, substrate, etc. Changes in these environmental variables could affect the plant communities by changing rates of erosion, sedimentation, or water availability, by directly creating new plant communities, or by removing or converting existing communities. These impact mechanisms may cause changes in the quality and/or quantity of plant communities and associated wildlife. Changes may also affect the number of special-status species and/or the area or quality of rare natural communities by altering existing foraging, living, and breeding areas.

These changes in quality and quantity are the measures used to determine impacts of the alternatives being considered. Since details regarding the size and location of specific alternative features are unavailable, the impacts are measured as estimates of gains or losses or types of gains or losses that might be expected to occur. When specific details regarding size and location of features are known, more exact values of loss or conversion of plant communities will be determined.

In addition to direct impacts to plant community area, changes in quality may occur. For example, changing water availability may not result in a change in the aerial extent of a plant community but may result in changes in growth patterns or seed production that would affect the quality of the plant community. Quality is defined as a measure of the degree to which the physical, chemical, and biological conditions provide for the growth, survival, and reproduction of the species or group of species associated with the plant community considered. Changes in quality have been assessed as they affect the associated group of species (plants and wildlife) as a whole. However, if a species or group of species of particular interest has been affected differentially or in opposite directions this has also been reported. However, habitat quality for special-status species has been assessed relative to each individual species.

3.2 Impact Measures

The following general categories of impact measures are proposed to assess the level of impact of the CALFED alternatives on vegetation and wildlife, including special-status species:

1. Area of natural plant communities including associated wildlife and plant species

2. Quality of natural plant communities including associated wildlife and plant species, and changes in nonindigenous/introduced species
3. Area of agricultural land providing habitat value
4. Habitat patterns for plant communities (e.g., spatial orientation of habitats, connectivity, landscape-level diversity, etc.)
5. Number of known special-status species and/or areas with critical habitat designation
6. Area and quality of plant communities occupied by special-status species
7. Area and quality of rare natural communities or significant natural areas.

Two types of analysis have been included: changes in aerial extent due to direct loss, conversion, or creation of plant communities; and changes in quality. Changes to the aerial extent of vegetation have been defined and analyzed by using various tools that focus primarily on spatial analysis of plant community area. The change in acreage of each plant community is used as the quantitative measure of impacts on wetland and terrestrial habitats, associated vegetation and wildlife, or species groups.

The assessment of qualitative impacts on plant communities considers geographic extent, distribution, quality, and spatial configuration. A project that affects the continuity of a linear riparian plant community or drainage patterns in wetlands, for example, may have greater impact than those resulting from changes in areal extent. The severity of impacts is determined by the magnitude of changes in quality or condition of the plant communities.

Broad groups of plant communities have been addressed in the assessment, e.g., riparian, grasslands, etc. An increase or decrease in the area of a particular plant community has been used to indicate whether the populations of wildlife or plant species closely associated with the affected plant community will be beneficially or adversely affected.

Geographic comparisons have been made using electronic databases and hard-copy maps of plant community distributions. Results of this analysis provided information on the likelihood of affecting a given plant community or special-status species with implementation of a particular alternative. The approach that was used to conduct impact assessments on areas for which database or hardcopy maps of plant community distributions are not available is described below for each of our identified impact categories.

The effects of CALFED actions on plant community condition was assessed and described qualitatively, based on the current understanding of existing land use and how ecosystems function. A quantitative analysis of change in plant community condition for some species or species groups associated with agricultural lands will be conducted when project features are described in detail in future reports. The ability of CALFED actions to control populations of nonnative species has been assessed qualitatively based on each treated community.

The best available information has been used for special-status species. CDFG's NDDB location information on special-status plants and animal species and rare natural communities has been used in the analysis. Rare natural communities and significant natural areas were treated qualitatively in part because specific data on the location of the project features in relation to specific areas or communities were not generally available. CDFG's mapping of vernal pools and RAREFIND database and files were utilized to obtain some quantitative information regarding affects to rare natural communities.

Impacts have been assessed in five geographic regions within the CALFED solution area: (1) the Delta Region, (2) the Bay Region, (3) the Sacramento River Region, (4) the San Joaquin River Region, and (5) SWP and CVP Service Areas.

In the discussion below, the assessment tools and methods are presented for each of the seven identified categories of impact measures.

3.2.1 Area of Natural Plant Communities

Changes in the areal extent of natural plant communities have been assessed for each of the alternatives and described in acreage lost or gained. A modified Holland system was used to identify and describe the plant communities according to vegetation type, their component plant species, and associated wildlife species. The plant communities included are seasonal wetland, saline emergent wetland, freshwater emergent wetland, grassland, chaparral, valley foothill riparian, montane riparian, valley foothill hardwood, montane hardwood, and mixed conifer forest. Agricultural areas were analyzed separately and are described below.

GIS-based vegetation data were used in making the impact analysis. The GIS data used included:

- CDFG's Central Valley Wetland and Riparian GIS (modified from Ducks Unlimited Data), Version 1.0 (July 1997)
- National Wetland Inventory (NWI) GIS data, Version 1.0
- California Gap Analysis GIS data (U.C. Santa Barbara Department of Geography, 1996 draft)
- Wildlife Habitat Relationships (WHR) digital data
- California Department of Water Resources (DWR) Land Use GIS data (Crop Mapping Program, Delta 1991 data)

In addition published reports were used, including:

- Central Valley Project Improvement Act Programmatic EIS (CVPIA PEIS) Vegetation and Wildlife Technical Appendix
- Draft EIR/EIS for the Interim South Delta Program (Entrix and Resource Insights 1996)
- Draft EIR/EIS for the Delta Wetlands Project (Jones & Stokes Associates 1995)

Approximate impact areas of storage and conveyance facilities in the Delta were digitized where facility designs have been described. Affected plant community categories, either agricultural or nonagricultural, and their approximated

acreages were determined using CDFG's Central Valley Wetland and Riparian GIS, Version 1.0 (July 1997). For comparative purposes, canals or pipeline alignments were assumed to be 200 feet wide throughout and impacts were calculated as one-tenth of an approximate 2,000-foot corridor. Approximate acreage ranges were presented only because specific locations and attributes of projects were not available.

The GIS data sources differ in mapping methodology, nominal mapping scale, minimum mapping unit area, date of acquisition, and land-cover classification. The listed data sources were compared and evaluated for their appropriateness. For assessment of storage and conveyance impacts in the Delta Region CDFG's Central Valley Wetland and Riparian GIS was deemed most appropriate, because it was the most recent mapping effort with consistent coverage of the Delta Region and surrounding areas, and because the mapping methods emphasized wetland and riparian plant communities. An accuracy assessment for these data by CDFG was in progress at the time that assessments were made.

The narrow and linear nature of most wetland and riparian vegetation in the Delta Region causes these habitat types to be seriously underrepresented in most regional-scale GIS datasets, aggravates rectification errors, and limits reliability of impact assessments using overlay analysis. Impacts on natural plant community types were analyzed jointly, rather than for plant community types separately, and ranges of acreages rather than exact acreage impact estimates were obtained, because locations of potential conveyance facilities were known only in concept or approximately. The impact ranges for conveyance and storage impacts were presented for comparative purposes only in this programmatic document. Project-level impacts should be assessed using more precise methods and more detailed data sources.

Acreages of potential conveyance and storage facilities outside the Delta could not be calculated, because no specific locations were identified. Approximate locations of storage and conveyance facilities in the Sacramento River and San Joaquin River regions that were under study were examined using the California Gap Analysis GIS vegetation data to obtain a range of potentially affected plant communities (Table 3-1). Impacts to potentially affected plant communities were compared qualitatively.

Potentially affected common wildlife species associated with impacted plant communities shown in Table 3-1 were obtained using the WHR data base (Attachment A).

3.2.2 Quality of Natural Plant Communities

The quality of natural plant communities directly affects the associated plants and wildlife that can be found in or are dependent upon the affected community. The quality of the community is related to such variables as the diversity of species present, the vigor of the independent species populations, the size of the community, and the spatial relationship of the community to other communities.

Table 3-1
Habitats and Plant Communities Considered to be Potentially Affected by the Program

Habitat or Plan Community	Delta Region	Bay Region	Sacramento River Region	San Joaquin River Region
Open Water	X	X	X	X
Watlands[1]	X	X	X	X
Valley Foothill Riparian	X	X	X	X
Montane Riparian			X	
Grassland	X	X	X	X
Valley Foothill Woodland			X	X
Montane Hardwood			X	
Chaparral			X	
Mixed Hardwood Conifer			X	
Ponderosa Pine			X	
Agricultural Lands	X	X	X	X

[1] Includes saline emerget wetland, freshwater emergent wetland, and seasonal wetland communities.

The quality of an existing plant community was considered to be affected if an alternative could potentially result in changing the extent of the hydrology necessary to support a community, or the abundance of competitive nonnative plant species. Other proposed CALFED actions could potentially also affect the quality of natural plant communities, but are not assessed because these actions are not described in sufficient detail in Alternative descriptions.

Determining exact measurable changes in the variables that affect the quality of communities requires specific information on current conditions and estimated projected changes. Although most project features are defined in terms of type, size, and function their specific locations are not available at this programmatic level of analysis. Therefore, potential impacts to quality have been described in general terms.

3.2.3 Area of Agricultural Lands

With the large-scale conversion of native communities to urban and agricultural land uses, some wildlife species have adapted to using agricultural lands to meet some of their life requirements. The value of agricultural lands for associated wildlife largely depends on the type of agricultural land use, associated land use practices, and cropping patterns.

Impacts to agricultural lands were based on CDFG's Central Valley Wetland and Riparian GIS to be compatible with the assessment of impacts to natural plant communities. Results of preliminary analyses utilizing these data were compared to results of preliminary analyses utilizing the DWR land use GIS data mapped in 1991. These analyses resulted in somewhat different results, probably because of different methods of data acquisition and differences in land-cover classification criteria. These differences do not affect the pattern of differences among Alternatives or the conclusions of the assessment. Approximate ranges of acreages were presented only, because locations of potential conveyance facilities were known only in concept or approximately.

In addition published reports were used, including:

- CVPIA PEIS Vegetation and Wildlife Technical Appendix
- Draft EIR/EIS for the Interim South Delta Program (Entrix and Resource Insights 1996)
- Draft EIR/EIS for the Delta Wetlands Project (Jones & Stokes Associates 1995)

Potentially affected common wildlife species associated with impacted agricultural cover types were derived from review of the WHR database.

3.2.4 Habitat Patterns

Changes in habitat patterns may affect some wildlife species by creating or obstructing potential movement corridors that enhance a species' ability to migrate and exchange genes among populations. Generally accepted principles of island biogeography (MacArthur and Wilson 1967) hold that large, contiguous patches of habitat are conducive to population stability, while smaller fragmented habitat patches increase the probability of

population extinction in an area. Changes in habitat pattern could also potentially affect species that are dependent on more than one habitat type if the distance among required habitats changes. Habitat pattern was considered to be affected if an alternative could potentially result in substantially changing the pattern of habitats from the No Action conditions.

This assessment was conducted for species or species groups that are sensitive to changes in habitat pattern.

3.2.5 Number of Known Special-Status Species or Communities

The impacts of various CALFED actions on special-status species, their critical habitat, rare natural communities, or significant natural areas may result from the direct loss or reduction in numbers of individuals in a local area. Most special-status species occur in distinct areas or in some cases, such as for some plants, very small discrete sites. Since the location of specific alternative features in relation to specific special-status species cannot be determined, a broad approach to impacts has been taken.

The following assessment tools were used in evaluating the impacts of the alternatives on special-status species and/or areas with critical habitat designation:

- Natural Heritage Division's NDDB RAREFIND
- California Native Plant Society's (CNPS) Electronic Inventory of Rare and Endangered Vascular Plants of California (1994)
- CVPIA PEIS Vegetation and Wildlife Technical Appendix
- Literature reviews

Approximate impact footprints corresponding to proposed alternative features were generated using GIS and the NDDB. A list of special-status plant and animal species potentially occurring within these footprints was produced.

The habitat requirements of each species, as defined in the literature (RAREFIND and CNPS), were used to evaluate the effect of changes resulting from alternative features on these special-status species. Each species was identified as potentially being either positively impacted, negatively impacted, or not significantly impacted. Possible negative impacts were described further, and mitigation measures were presented that would minimize or eliminate these negative impacts.

It is assumed that the distribution and abundance of special-status species is proportional to the amount and quality of habitat available. Assessment of impacts is based on the potential to impact a special-status species, its critical habitat, and/or its range.

3.2.6 Area and Quality of Habitat Occupied by Special-Status Species

Impacts to specific plant communities that support special-status species were assessed by determining which plant communities previously identified as being impacted (as described in Section 3.2.1) provide the habitat subtypes required by special-status species based on published

descriptions of the habitat subtypes (e.g., Sawyer and Keeler-Wolf 1995).

Similarly, the changes in quality of habitat occupied by special-status species are based on an assessment of the effect of CALFED actions on the quality of plant communities previously identified as being impacted (as described in Section 3.2.2.) A qualitative assessment was made of the effect of CALFED actions on those components of the habitat subtypes that affect the particular special-status species under consideration.

Species-habitat relationships, and range information, were obtained from the following sources:

- CNPS inventory digital files (Skinner and Pavlik 1994)
- NDDB digital files (RAREFIND) and GIS
- Federal Register
- CVPIA PEIS Vegetation and Wildlife Technical Appendix

An assessment of impacts to habitat subtypes required by special-status species was made based on the likelihood that the subtypes would fall within the potentially impacted area.

3.2.7 Area and Quality of Special-Status Plant Communities

Special-status plant communities are subtypes of wetlands and riparian habitats and other communities that are considered rare by CDFG. Impacts to large-scale wetlands and riparian communities have been considered as described in Section 3.2.1. Other vegetation subtypes that cannot be considered using the large-scale tools, including vernal pools, sycamore riparian woodlands and others, have been considered separately.

Information to assess the impacts to area and quality of special-status vegetative communities was obtained from the following sources:

- NDDB GIS data files
- CNPS Series Description of Vegetation (Sawyer and Keeler-Wolf 1995)
- U.S. Fish and Wildlife Service vernal pool GIS data (May 1997)
- CVPIA PEIS Vegetation and Wildlife Technical Appendix
- Interviews with experts

Impacted area of special-status communities were assessed using the NDDB GIS data, and other data sources. Assessment of changes in quality of special-status communities as a result of CALFED actions was based on an analysis of changes in the environmental factors that determine the reproduction and growth of plant species that constitute the communities.

4.0 SIGNIFICANCE CRITERIA

4.1 Definition

The development of significance criteria is required by CEQA to determine the thresholds at which impact magnitudes constitute significant impacts. The CEQA statutes and guidelines define a Asignificant effect on the environment@ in Chapter 2.5, Section 21068, as a substantial, or potentially substantial, adverse change in the environment (Governor's Office of Planning Research 1997). The guidelines (Section 15382) define significant effect on the environment as a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. However, the CEQA guidelines do not establish mandatory thresholds or levels at which an adverse impact is considered significant. Appendix G of CEQA provides a list of actions that might Anormally have a significant effect on the environment, but use of these criteria is not mandatory, and CEQA thus allows the lead agency discretion in the selection, use, and application of significance criteria that are appropriate for the setting and circumstances of each project.

NEPA does not have the same mandatory finding of significance as does CEQA, but NEPA does discuss how significance of impacts can be defined in terms of context and intensity (Section 1508.27). In considering context, the action must be analyzed under several contexts such as society as a whole, the affected region, any notable interest and issues, and the locality. Consideration of context means that the setting of the proposed action should be taken into account. Intensity refers to the severity of the impact.

The advantage of establishing thresholds of significance for the CALFED Bay-Delta Program and subsequent projects is the consistency and predictability provided to the environmental impact analysis of alternatives and their components. Significance criteria will be applied at both the Programmatic EIR/EIS level as well as later project-specific EIR/EISs. Given the breadth and complexity of the Bay-Delta Program, and the fact that it will be implemented over an extended time period, establishing and documenting significance criteria at the programmatic stage will provide a basis from which later environmental impact analysis can be drawn.

4.2 Determining Impact Significance Thresholds

The significance of an activity varies depending on the environmental setting in which the activity occurs. Thresholds of significance for a given impact may include flexible standards that recognize differences in the environmental setting. Thresholds may also be qualitative or quantitative. The general nature of the planning and the broad range of settings and impacts involved with the Phase II Bay-Delta Program dictate the use of qualitative thresholds of significance at this programmatic stage. The thresholds can and will be made more definitive and more quantitative at the project-specific level.

The methodology used to develop proposed thresholds for vegetation and wildlife resources includes the following guidelines:

- **Thresholds Should be Qualitative**

  Because the Phase II Bay-Delta document is programmatic, quantitative data are limited. Therefore, thresholds are phrased in qualitative terms indicating potential changes from either baseline (existing or historical) conditions or future conditions under the No Action Alternative. These comparisons provide indications of the potential for significant impacts for use in the Programmatic EIR/EIS. These qualitative and general thresholds provide the basis for the establishment of more specific or quantitative thresholds in the project-specific Phase III EIR/EISs. At the time when specific actions are identified, thresholds will be expressed in quantitative terms based on site-specific data and existing or baseline conditions.

- **Thresholds Should be Applicable to Anticipated Actions and the Study Area**

  Each threshold needs to address the actions and components as identified for the No Action Alternative and Alternatives 1-3 within the overall study area identified for the programmatic document and for specific geographic regions, e.g., Delta Region.

- **Consolidation of Thresholds**

  An attempt was made to consolidate threshold subjects (e.g., single or multiple locations, species, or facilities) as much as possible, keeping in mind the fact that the programmatic document will need to address broad categories of impacts in the Bay-Delta and larger areas at only a general level of detail.

- **Thresholds Apply only to Adverse Impacts**

  As stated in Section 15382 of the CEQA Guidelines ASignificant effect on the environment@ means a substantial, or potentially adverse change in any of the physical conditions...

Selected Significance Criteria:

1. Temporary or permanent removal, filling, grading, or disturbance of wetlands and riparian communities

2. Substantial decrease in the area of important wildlife habitats or use areas in watersheds of major tributaries to the Sacramento and San Joaquin Rivers

3. Substantial fragmentation or isolation of wildlife habitats or movement corridors, especially riparian and wetland habitats

4. Decrease in the amount of available forage for wintering waterfowl

5. Increase in the potential for outbreaks of wildlife diseases

6. Result in the permanent loss of occupied special-status species habitat or direct mortality of special-status species

7. Reduction in the area or extent of special-status communities

8. Reduction in area or habitat value of critical habitat areas designated under the Federal ESA

The impact analysis in Section 5 includes reference to both temporary and permanent impacts (e.g., significance criteria number 1). The definitions of these terms as used in this document follow:

Temporary Impacts: Impacts expected to result in short-term loss of habitat area or quality as a result of construction or restoration activities.

Permanent Impacts: Impacts expected to result in long-term loss of habitat area or quality as a result of construction or restoration activities.

5.0 ENVIRONMENTAL IMPACTS

The impact assessment presented in this section begins with a description of the No Action Alternative and a comparison to existing conditions, followed by an assessment for each of the geographic regions, in which the CALFED Alternatives are compared to the No Action Alternative. At the level of detail possible for this programmatic assessment only small differences were identified between the No Action Alternative and existing conditions. Therefore, the analysis of the CALFED actions compared to existing conditions is similar to the comparison to the No Action Alternative.

At the beginning of the assessment for each geographic region a summary is provided, which includes a listing of potential significant impacts, mitigation strategies, and unavoidable impacts. Following each of the summaries for geographic regions, a more detailed evaluation is provided in which all of the variations included in the three Alternatives are evaluated.

In the summaries that begin the assessment for each geographic region, both adverse impacts and beneficial impacts are identified. It is important to note that many of the benefits that would result from implementation of CALFED are directly attributable to the Ecosystem Restoration Program (ERP). The ERP has been designed to restore and enhance thousands of acres of habitat in the Delta Region, as well as other geographic regions, which would result in an overall positive habitat gain for each of the regions considering both adverse and beneficial impacts. However, this concept of overall benefit does not imply that the ERP restoration activities mitigate for those habitat losses that would result from storage or conveyance actions or actions associated with the common programs. Each of the adverse impacts identified would require separate mitigation to compensate for or avoid adverse impacts. Mitigations are proposed as strategies in this programmatic document and are conceptual in nature. Final mitigations would need to be approved by responsible agencies as specific projects are approved by subsequent environmental review. The ERP therefore provides benefits above and beyond the mitigations proposed for any adverse impacts resulting from CALFED actions.

In both the impact summaries and detailed evaluations the potential impacts resulting from changes in flow are acknowledged, but cannot be quantitatively addressed without modeled flow data. At the time that modeled flow data are available, qualitative and quantitative assessments of such issues as vegetation changes due to salinity distribution, flow velocity effects on erosion and sedimentation rates, and changes in water level that could impact vegetative and wildlife communities could be assessed.

5.1 No Action Alternative Impacts

Effects of the No Action Alternative are evaluated relative to the existing conditions. The differences between the No Action Alternative and existing conditions result from changes in water project operations in response to new or modified facilities, increased or reduced

demands, and new water resource projects that could affect the area and quality of existing habitat. New or modified facilities include new surface water and groundwater storage, new conveyance, and modified reservoir discharge structures. Changes in demand for water could result from increased CVP and SWP needs, land retirement, full use of existing water rights, revised environmental flow needs, and increased wildlife refuge needs.

The time frame identified for the No Action Alternative is the year 2020. To determine which water resource projects were appropriate to include in the No Action Alternative, CALFED developed screening criteria and held public workshops to identify projects that were defined and reasonably foreseeable. Table 5-1 includes those projects that met all of the screening criteria and that were included in the No Action Alternative and their expected changes over existing conditions.

During a series of meetings with agency and stakeholder representatives in the fall of 1996, CALFED presented initial-draft assumptions for identification of major/operational/ regulatory issues. At subsequent meetings, CALFED prepared and conducted a more detailed discussion of the items carried forward and discussed additional assumptions for the No Action Alternative.

5.1.1 No Action Impacts - Delta Region

Although operations and surface-water and groundwater storage would change under the No Action Alternative, Delta inflow and outflow would most likely be similar to flows under existing conditions. Operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns and the associated salinity distribution in the Delta. As a result, the quantity and quality of wetland and riparian vegetation in the Delta would not change appreciably. Changes that could occur are not quantifiable at a programmatic level of analysis.

Sediment supply and movement could be affected by the Delta Levees Subvention Project and actions upstream of the Delta, including land retirement and the Sacramento River Flood Control Project. None of the projects would substantially change the structure of the existing ecosystem, and change in sediment supply and movement would most likely be minimal. Any changes to quantity or quality of habitat could not be quantified at this programmatic level of analysis.

Contaminant input and movement could be reduced by land retirement and, possibly, by restoration associated with the Stone Lakes National Wildlife Refuge. Contaminant input under the 2020 level of development, however, could increase or decrease and could negate any reduction attributable to other land retirement and restoration. Relative to existing sources of contaminants, the change in contaminant input would most likely be small. Change in flow could also affect the movement and dilution of contaminants; however, information on flow change is currently unavailable.

Productivity and nutrient input is affected by the processes discussed above and changes in structural characteristics

Table 5-1
Major Features of the No Action Alternative Relative to Existing Conditions

Criteria, Assumption, or Project	Change from Existing Conditions				
	Flow	Diversion	Storage	Water Quality	Habitat
2020 Level of Development	Yes	Yes	Yes		
Increase CVP Demands	Yes	Yes	Yes		
Increase SWP Demands	Yes	Yes	Yes		
Refuge Demands: Change from Level II to Level IV	Yes	Yes	Yes		Yes
Mokelumne River flow	Yes	Yes	Yes		
Land Retirement: 45,000 acres	Yes	Yes	Yes	Yes	Yes
No Agricultural Crop Subsidies					
Coastal Aqueduct	Yes	Yes	Yes		Yes
CVPIA (partial)	Yes	Yes	Yes		Yes
Kern Water Bank	Yes	Yes	Yes		Yes
Los Vaqueros Reservoir Project	Yes	Yes	Yes		Yes
MWD Easts: de Reservoir Project	Yes	Yes	Yes		Yes
MWD Inland Feeder Project					
New Melones Conveyance	Yes	Yes	Yes		Yes
Sacramento River Flood Control					Yes
Delta Levees Subvention Project					Yes
Semitropic Groundwater Banking	Yes	Yes	Yes		Yes
Shasta Temperature Control				Yes	
Stone Lakes NWR					Yes
Endangered Species Listings					
Assume No New listings					

described below. Relative to existing conditions, projects under the No Action Alternative that could increase biological productivity and nutrient input and movement in the terrestrial ecosystem include changes in wildlife refuge operations, and restoration associated with the Stone Lakes National Wildlife Refuge, Delta Levees Subvention Project, and Sacramento River Flood Control Project. Restoration of riparian, shaded riverine aquatic, and tidal marsh areas could slightly increase productivity through increased production and input of organic carbon and provide a small benefit to Delta species.

Structural characteristics of the Delta would be similar for both the No Action Alternative and existing conditions. Projects that could affect structural characteristics of the Delta ecosystem and species habitat include the Delta Levees Subvention Project and Stone Lakes National Wildlife Refuge. Change in structural characteristics is consideredc to have a beneficial effect when the change moves toward a natural condition. Restoration of tidal marsh and connecting sloughs in Stone Lakes National Wildlife Refuge and changes in levee maintenance practices to allow development of natural riparian and marsh communities would have small beneficial effect relative to the existing Delta system. For example, an additional 1,300 acres of habitat added to Stone Lakes National Wildlife Refuge under the No Action Alternative would benefit several plant communities (including wetlands) by assisting the recovery of special-status species and adding to linkage between refuge habitats.

5.1.2 No Action Impacts - Bay Region

Under the No Action Alternative, effects on vegetative and wildlife communities in the Bay Region would primarily be dependent on movement of contaminants, sediment, nutrients, and production from the Delta Region. The small increase in productivity and nutrient input identified for the Delta could be transported to the Bay and provide small benefits to the wetlands and adjacent upland habitats surrounding waters in the Bay Region.

5.1.3 No Action Impacts - Sacramento River Region

Differences between the No Action Alternative and existing conditions would primarily be reflected by flow changes. Although operations and surface-water and groundwater storage would change under the No Action Alternative, Sacramento River and tributary flows would most likely be similar to flows under existing conditions. Operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns. Changes to the quality and quantity of riparian and wetland communities would be small and not measurable at a programmatic level of analysis.

The Sacramento River Flood Control Project could affect structural characteristics of the Sacramento and American rivers. Change in structural characteristics is considered to have a beneficial effect when the change moves toward a more natural condition. Changes

in levee maintenance practices to allow development of natural riparian and shaded riverine aquatic communities would have small beneficial effects relative to the existing levee system. The structural changes could result in a slight increase in quantity and quality of habitats supporting species (including special-status species) associated with riparian and shaded riverine terrestrial habitats.

5.1.4 No Action Impacts - San Joaquin River Region

As on the Sacramento River, changes in flow between the No Action Alternative and existing conditions would occur. San Joaquin River and tributary flows would most likely be similar to flows under existing conditions. Mokelumne and Tuolumne river flows could be altered to improve spawning and rearing conditions, providing a beneficial impact primarily on chinook salmon but could also provide small benefits to riparian vegetation. The New Melones Conveyance Project could reduce water available for release down the Stanislaus River, adversely affecting flow conditions and possibly riparian vegetation.

Water quality conditions in most rivers in the San Joaquin River Region under the No Action Alternative would be similar to water quality conditions under existing conditions. The retirement of 45,000 acres of agricultural land would, however, most likely occur in the San Joaquin River Region. Land retirement could reduce input of contaminants (primarily selenium and salts) to the San Joaquin River and have a beneficial impact on plant and animal species that obtain materials and food supply from areas affected by contaminants.

The water supplied to ten national wildlife refuges, four wildlife management areas, and private wetlands within the Grasslands Water District would be at Level 4 under the No Action Alternative. Level 4 is the amount of water required for full development of the land lying within the 1988 refuge boundaries, in contrast to Level 2 under existing conditions, which is the average amount of water the refuges had received for approximately 10 years. In general, Level 4 water supplies would allow for greater flexibility and consistency in providing water for full development of wetlands and water to support waterfowl and other species relying on refuge habitat. The increasing quantity and quality of habitat supported by Level 4 water supplies is not quantifiable at a programmatic level of detail.

5.1.5 No Action Impacts - SWP and CVP Service Areas

The impact of the 2020 level of development on upland, wetland, and riparian habitat in the SWP and CVP service areas outside of the Central Valley could not be quantified with available information.

In general, the projects proposed consist of new water conveyance (e.g., Coastal Aqueduct), water storage (e.g., Eastside Reservoir Project), and groundwater storage/groundwater recharge (e.g., Semitropic Groundwater Banking Project). Projects such as the Eastside Reservoir Project would displace up to 4,500 acres of

habitat but would support smaller acreages of wetlands bordering the reservoir. Groundwater storage/recharge projects such as the Semitropic Groundwater Banking Project would remain terrestrial habitat as a result of conveyance groundwater wells and pumps but could also provide benefits to vegetation communities able to tap groundwater, particularly near springs. Groundwater recharging involving spreading basins would also add open-water habitat and small wetlands areas that could be used by waterfowl and other species.

5.2 Environmental Impacts in the Delta Region

5.2.1 Summary of Regional Effects by Alternative

This section presents a summary of potential significant impacts, mitigation strategies, and unavoidable adverse impacts. Adverse impacts (called impacts) and beneficial impacts (called benefits) are numbered for ease in cross-referencing to Table 5-2, which summarizes and compares all impacts identified for each of the variations associated with Alternatives (i.e., 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, etc.). In text each adverse impact is followed by the appropriate mitigation strategy.

In the summary, as in the more detailed evaluation following, the CALFED Alternatives are compared to the No Action Alternative. Thus, all of the potential impacts associated with each of the common programs and storage and conveyance facilities are addressed.

Table 5-3 summarizes the number of wildlife species that could be adversely or beneficially impacted from decreases or increases, respectively, in the area or quality of open-water, wetland, riparian, grassland, and agricultural habitats in the Delta Region with implementation of Alternatives 1, 2, or 3. Table 5-4 summarizes the potential habitat area that could be impacted or created as a result of construction and operation of conveyance facilities, for Alternative 1, 2, and 3 variations. Table 5-5 compares the adverse and beneficial impacts of storage facilities on open water, nonagricultural habitat, and agricultural habitat for Alternative 1, 2, and 3 variations. Table 5-6 lists the potential occurrence of special-status species that could be impacted in the Delta by habitat type.

Alternative 1 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Construction of conveyance facilities and associated infrastructure under Alternative 1 could result in temporary or permanent loss or degradation of less than 100 acres of natural habitats, i.e., wetland, riparian, grassland, ruderal communities, and agricultural lands.

Implementation of the ERP under Alternative 1 would potentially restore, enhance, or protect up to approximately 133,000 acres of aquatic habitat and native plant communities (CALFED 1997a, Appendices A through E; regional handout summaries), which would primarily result in the loss of agricultural lands. Aquatic, wetland, riparian, grassland, and ruderal

Table 5-2
Summary of Impacts and Benefits for the Delta Region

CALFED Program	Impact Category		Impact/ Benefit	No Action Alterna-tive	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Common Programs	Habitat Area and Associated Wildlife	Impact 1.1	Temporary loss or disturbance of wetland and riparian communities		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.2	Permanent loss of wetland and riparian communities		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Impact 1.3	Temporary loss or disturbance of wintering waterfowl foraging habitat		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.4	Permanent loss of wintering waterfowl foraging habitat		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Benefit 1.1	Increase in open-water and wetland communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.2	Increase in riparian communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.3	Protection of existing wetland and riparian communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Habitat Quality and Pattern	Impact 1.5	Potential for increased incidence of waterfowl disease		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Impact 1.6	Temporary fragmentation of riparian habitats		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.7	Permanent fragmentation of riparian habitats		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Benefit 1.4	Improved wetland habitat quality		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.5	Improved riparian habitat quality		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.6	Reduction in nonnative invasive plant abundance		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.7	Improved habitat patterns		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.8	Improved connectivity of riparian habitat		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Special-Status Species and Communities	Impact 1.8	Loss of foraging habitat for special-status species		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.9	Loss of portions of rare natural communities and significant natural areas		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Benefit 1.9	Increase in habitats for special-status species		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 1.10	Expansion of rare natural communities and significant natural areas		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Conveyance	Habitat Area and Associated Wildlife	Impact 1.1	Temporary loss or disturbance of wetland and riparian communities		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.2	Permanent loss of wetland and riparian communities		0	-	-	-	-	-	--	--	-	-	-	-	-	--	-	--	-
		Impact 1.3	Temporary loss or disturbance of wintering waterfowl foraging habitat		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.4	Permanent loss of wintering waterfowl foraging habitat		0	-	-	-	-	-	--	--	-	-	-	-	-	--	-	--	-
		Benefit 1.1	Increase in open-water and wetland communities		0	0	0	+	+	+	++	++	+	+	+	+	+	0	+	++	+
		Benefit 1.2	Increase in riparian communities		0	0	0	+	+	+	++	++	+	+	+	+	+	0	+	++	+
		Benefit 1.3	Protection of existing wetland and riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Habitat Quality and Pattern	Impact 1.5	Potential for increased incidence of waterfowl disease		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Impact 1.6	Temporary fragmentation of riparian habitats		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 1.7	Permanent fragmentation of riparian habitats		0	-	-	-	-	-	--	--	-	-	-	-	-	--	-	--	-

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Table 5-2 (continued)

CALFED Program	Impact Category		Impact/ Benefit	No Action Alternative	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Conveyance (continued)	Habitat Quality and Pattern (continued)	Benefit 1.4	Improved wetland habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.5	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.6	Reduction in nonnative invasive plant abundance		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.7	Improved habitat patterns		0	0	+	+	+	++	++	++	+	+	+	+	+	0	+	++	+
		Benefit 1.8	Improved connectivity of riparian habitat		0	0	+	+	+	++	++	++	+	+	+	+	+	0	+	++	+
	Special-Status Species and Communities	Impact 1.8	Loss of foraging habitat for special-status species		0	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-
		Impact 1.9	Loss of portions of rare natural communities and significant natural areas		0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Benefit 1.9	Increase in habitats for special-status species		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.10	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	Habitat Area and Associated Wildlife	Impact 1.1	Temporary loss or disturbance of wetland and riparian communities		0	0	0	0	0	-	0	0	0	-	0	-	-	0	-	0	-
		Impact 1.2	Permanent loss of wetland and riparian communities		0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	0	--
		Impact 1.3	Temporary loss or disturbance of wintering waterfowl foraging habitat		0	0	0	0	0	-	0	0	0	-	0	-	-	0	-	0	-
		Impact 1.4	Permanent loss of wintering waterfowl foraging habitat		0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	0	--
		Benefit 1.1	Increase in open-water and wetland communities		0	0	0	0	0	++	0	0	0	++	0	++	++	0	++	0	++
		Benefit 1.2	Increase in riparian communities		0	0	0	0	0	++	0	0	0	++	0	++	++	0	++	0	++
		Benefit 1.3	Protection of existing wetland and riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Habitat Quality and Pattern	Impact 1.5	Potential for increased incidence of waterfowl disease		0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	0	--
		Impact 1.6	Temporary fragmentation of riparian habitats		0	0	0	0	0	-	0	0	0	-	0	-	-	0	-	0	-
		Impact 1.7	Permanent fragmentation of riparian habitats		0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	0	--
		Benefit 1.4	Improved wetland habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.5	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.6	Reduction in nonnative invasive plant abundance		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.7	Improved habitat patterns		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 1.8	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Special-Status Species and Communities	Impact 1.8	Loss of foraging habitat for special-status species		0	0	0	0	0	-	0	0	0	-	0	-	-	-	-	0	-
		Impact 1.9	Loss of portions of rare natural communities and significant natural areas		0	0	0	0	0	-	0	0	0	-	0	-	-	-	-	0	-
		Benefit 1.9	Increase in habitats for special-status species		0	0	0	0	0	+	0	0	0	+	0	+	+	+	+	0	0
		Benefit 1.10	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 5-3
Number of Wildlife Species Associated with Habitat Types Potentially Created, Improved, or Impacted with Implementation of Alternatives 1, 2, and 3 in the Delta Region

Habitat Type	Number of Associated Wildlife Species
Open Water[1]	46
Wetlands	
Seasonal Wetland[2]	71
Saline Emergent Wetland[3]	54
Fresh Emergent Wetland[4]	73
Wetland Subtotal	113
Valley Foothill Riparian	137
Grassland	82
Agricultural Lands[5]	119

Note: Numbers of species determined form Attachment A.

1 Includes species listed in Attachment A under deep open-water and shallow open-water habitats.

2 Includes species listed in Attachment A under agriculture-wetland and mudflat (nontidal species only) habitats.

3 Includes species listed in Attachment A under saline emergent wetland and mudflat habitats.

4 Includes species listed in Attachment A under fresh emergent wetland and mudflat habitats.

5 Includes species listed in Attachment A under agriculture-wetland and agriculture-upland habitats.

Table 5-4
Estimated Potentially Created and Impacted Habitat Acreages By CALFED Actions that Improve Conveyance for the Delta Region [6,7]

Variation	Potentially Created Habitat[1] (Acres)	Potentially Affected Nonagricultural Habitat[2] (Acres)	Potentially Affected Agricultural Habitat (Acres)	Total Potentially Affected Habitat[3] (Acres)
1A	0	0	0	0
1B	< 100	< 100	< 100	< 200
1C	< 100	< 100	< 100	< 200
2A	2,800 - 3,000	300 - 500	2,700 - 2,900	3,000 - 3,400
2B	2,800 - 3,000	300 - 500	2,700 - 2,900	3,000 - 3,400
2C	500 - 700	100 - 200	900 - 1,100	1,100 - 1,300
2D	18,000 - 20,000	1,800 - 2,000	17,000 - 19,000	19,000 - 21,000
2E	25,000 - 27,000	2,300 - 2,500	25,000 - 27,000	27,000 - 29,000
3A	1,200 - 1,400	300 - 500	1,900 - 2,100	2,300 - 2,500
3B	1,200 - 1,400	300 - 500	1,900 - 2,100	2,300 - 2,500
3C	1,200 - 1,400	300 - 500[4]	1,900 - 2,100[4]	2,300 - 2,500[4]
3D	1,200 - 1,400	300 - 500[4]	1,900 - 2,100[4]	2,300 - 2,500[4]
3E	1,200 - 1,400	300 - 500	1,900 - 2,100	2,300 - 2,500
3F	1,200 - 1,400	3,500 - 3,700[5]	35,000 - 37,000[5]	39,000 - 41,000[5]
3G	1,200 - 1,400	600 - 800	1,400 - 1, 600	2,200 - 2,400
3H	25,000 - 27,000	2,300 - 2,500	25,000 - 27,000	27,000 - 29,000
3I	500 - 700	200 - 400	1,500 - 1,700	1,900 - 2,100

Notes:

[1] Includes shallow open-water habitat and wetland, riparian, grassland and ruderal plant communities.

[2] Includes wetland, riparian, grassland, and ruderal plant communities.

[3] Includes wetland, riparian, grassland, ruderal, and agricultural plant communities.

[4] Potentially impacted acreage for spur conveyance links to Bay Region and area east of Delta Region are not included.

[5] Acreages represent an approximate upper limit.

[6] Acreage ranges represent broad approximations and are presented for comparitive purposes only.

[7] Data source: CDFG (1997).

Table 5-5
Comparison of Levels of Benefit and Impact of Storage Facilities Among Alternatives 2 and 3 Variations on Habitat Types in the Delta Region

Variation	Potentially Open Water	Potentially Affected Nonagricultural Habitat	Potentially Affected Agricultural Habitat
2C	+	-	-
3B	+ +	- -	- -
3D	+ +	- -	- -
3E	+ +	- -	- -
3F	+ + +	- - -	- - -
3G	+ +	- -	- -
3I	+	-	-

Note: "+" indicates increase in habitat acres and "-" indicates a decrease in habitat acres. The larger number of symbols represents a greater degree of change in habitat acres.

Table 5-6
Potential Occurrence of Special-Status Species by General Community Type - Delta Region

Species Common Name	Valley-Foothill Riparian	Inland Dunes	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh	Aquatic	Agricultural
Animals							
Ambystoma californiense California tiger salamander			X			X	
Anthicus sacramento Sacramento anthicid beetle		X					
Apodemia mormo langei Lange's metalmark butterfly		X					
Archoplites interruptus Sacramento perch						X	
Buteo swainsoni Swainson's hawk	X						X
Clemmys marmorata marmorata northwestern pond turtle				X		X	
Coelus gracilis San Joaquin dune beetle		X					
Desmocerus californicus dimorphus valley elderberry longhorn beetle	X						
Grus canadensis tabida greater sandhill crane			X				X
Hygrotus curvipes curved foot hygrotus diving beetle						X	
Laterallus jamaicensis coturniculus California black rail				X	X		
Lytta molesta Molestan blister beetle			X				
Thamnophis gigas giant garter snake				X		X	X
Vulpes macrotis mutica San Joaquin kit fox			X				
Plants							
Aster lentus Suisun marsh aster				X	X		
Astragalus tener var. *tener* alkali milk-vetch			X				
Atriplex cordulata heartscale			X				
Atriplex depressa brittlescale			X				

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Table 5-6 (concluded)

Species Common Name	Valley-Foothill Riparian	Inland Dunes	Grassland	Freshwater Emergent Marsh	Saline Emergent Marsh	Aquatic	Agricultural
Atriplex joaquiniana San Joaquin saltbush			X				
Carex comosa bristly sedge				X			
Cirsium crassicaule slough thistle	X			X			
Cordylanthus mollis ssp. *hispidus* hispid bird's beak			X				
Delphinium recurvatum recurved larkspur			X				
Erysimum capitatum ssp. *angustatum* Contra Costa wallflower		X					
Hibiscus lasiocarpus California hibiscus	X			X			
Juglans hindsii N. Calif. black walnut	X						
Lathyrus jepsonii var. *jepsonii* Delta tule pea				X	X		
Lepidium latipes var. *heckardii* Heckard's pepper-grass			X				
Lilaeopsis masonii Mason's lilaeopsis	X			X	X		
Limosella subulata Delta mudwort	X			X	X		
Madia radiata showy madia			X				
Oenothera deltoides ssp. *howellii* Antioch Dunes evening primrose		X					
Scutellaria galericulata marsh skullcap				X	X		
Tropidocarpum capparideum caper-fruited tropidocarpum			X				

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communities would also be temporarily or permanently lost or degraded with implementation of the ERP. The magnitude of impact on native plant communities, however, is dependent on the siting and design of habitat restoration and enhancement actions.

Implementation of the Levee System Integrity Program could result in the loss of up to approximately 2,800 acres of riparian habitat (regional handout summaries) and up to approximately 63,800 acres of agricultural lands.

Impact 1.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Wetland and riparian communities would be temporarily lost or degraded as a result of construction and operation of conveyance facilities and implementation of the ERP and Levee System Integrity Program. Temporary decreases in area or disturbance to these communities could adversely affect approximately 113 species of wetland- and 137 species of riparian-associated wildlife in the Delta Region. Therefore, this impact is considered significant.

Mitigation 1.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Potential mitigation strategies for reducing temporary impacts on wetland and riparian communities associated with construction of conveyance facilities and implementation of the ERP and Levee System Integrity Program could include:

- Avoiding wetland and riparian communities
- Restoring or enhancing sufficient in-kind wetland and riparian habitat area at off-site locations before or at the time that project impacts associated with the Conveyance Facilities and Levee System Integrity Program are incurred to offset habitat losses
- Initially implementing the ERP, to the extent feasible, to restore sufficient wetland and riparian habitats in nonwetland/riparian habitat areas before or at the time that project impacts associated with the ERP are incurred to offset temporary habitat losses
- Restoring wetland and riparian communities temporarily disturbed by on-site construction activities immediately following construction

Impact 1.2: Permanent Loss of Wetland and Riparian Communities. Wetland and riparian communities would be permanently lost or degraded as a result of construction and operation of conveyance facilities if sufficient area of the types of affected wetland and riparian habitats necessary to offset impacts do not naturally reestablish following project implementation. Implementation of the Levee System Integrity Program could also result in permanent loss in the area of riparian communities. Decreases in wetland and riparian habitat area could adversely affect approximately 113 species of wetland- and 137 species of riparian-associated wildlife in the Delta Region. Therefore, this impact is considered significant.

Mitigation 1.2: Permanent Loss of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on wetland and riparian communities associated with construction of conveyance facilities and

implementation of the Levee System Integrity Program could include:

- Avoiding wetland and riparian habitats
- Restoring or enhancing sufficient in-kind wetland and riparian habitat area at off-site locations before or at the time that project impacts are incurred to offset habitat losses
- Restoring wetland and riparian vegetation on site immediately following construction

Impact 1.3: Temporary Loss or Disturbance of Wintering Waterfowl Foraging Habitat. Large acreages of agricultural lands could be lost or disturbed as a result of implementation of the ERP and island subsidence control element of the Levee System Integrity Program. These actions could result in substantial loss of corn, wheat, pasture, and other agricultural lands that provide high value forage habitat for wintering waterfowl. Loss of these foraging habitats could temporarily adversely affect forage availability for waterfowl that winter in the Delta Region. Therefore, this impact is considered significant, because sufficient waterfowl foraging replacement habitats would not be restored at the time impacts occur.

Mitigation 1.3: Temporary Loss or Disturbance of Wintering Waterfowl Foraging Habitat. Potential mitigation strategies for reducing the potential for temporary decreases in the abundance of forage for wintering waterfowl as a result of implementation of the ERP and island subsidence control element of the Levee System Integrity Program could include:

- Initially implementing the ERP, to the extent feasible, to restore native waterfowl foraging habitats on agricultural lands that provide little or no existing waterfowl forage values to defer potential adverse impacts on waterfowl until sufficient natural habitat with high waterfowl forage value develops
- Initially implementing the ERP, to the extent feasible, to focus habitat restoration efforts on restoring sufficient high forage value wetland habitat area to offset anticipated loss of agricultural foraging habitats
- Restoring or enhancing sufficient waterfowl foraging habitat to offset impacts of the Levee System Integrity Program and construction of conveyance facilities on the abundance, quality, and availability of waterfowl forage; specific types of actions potentially include planting crops that produce high forage value on agricultural lands currently planted with low forage value crops or planting winter forage crops on fallowed agricultural lands

Impact 1.4: Permanent Loss of Wintering Waterfowl Foraging Habitat. Less than 100 acres of agricultural lands could be permanently lost as a result of construction and operation of conveyance facilities. These actions could result in loss of corn, wheat, pasture, and other agricultural lands that provide high value forage habitat for wintering waterfowl. Loss of these foraging habitats could adversely affect forage availability for waterfowl that winter in the Delta Region. Therefore, this impact is considered significant.

Mitigation 1.4: Permanent Loss of Wintering Waterfowl Foraging Habitat. Mitigation strategies for reducing the potential for decreased abundance of forage for wintering waterfowl as a result of construction and operation of conveyance facilities could include restoring or enhancing sufficient waterfowl foraging habitat to offset impacts on the abundance, quality, and availability of waterfowl forage.

Benefit 1.1: Increase in Open-Water and Wetland Habitat Area. Implementation of the ERP and Levee System Integrity Program would substantially increase the area of wetland habitats in the Delta Region, including channel island habitats. Increases in open-water and wetland habitats would benefit approximately 46 species of open-water and 113 species of wetland-associated wildlife in the Delta. Specific benefits would include increased availability of suitable breeding and/or foraging habitat for waterfowl and other water birds, shorebirds, and wading birds dependent on the Delta. Therefore, this impact is considered beneficial.

Benefit 1.2: Increase in Riparian Communities. Implementation of the ERP would substantially increase the area of riparian habitats in the Delta Region. Increases in riparian habitats would benefit approximately 137 species of wildlife in the Delta. Specific benefits could include increased availability of suitable breeding and/or foraging habitat for neotropical migrant songbirds, raptors, egrets and herons, woodpeckers, deer, furbearers, and riparian-associated reptiles and amphibians dependent on the Delta. Therefore, this impact is considered beneficial.

Benefit 1.3: Protection of Existing Wetland and Riparian Habitats. Implementation of the ERP and Levee System Integrity Program would reduce the rate of loss of existing wetland and riparian habitats adjacent to Delta channels and on channel islands to wave erosion and would acquire and protect existing riparian habitats from potential future loss or degradation associated with current or potential future land uses. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. The pattern of native habitats could be substantially temporarily or permanently reduced with implementation of the ERP and Levee System Integrity Program. Habitat quality and pattern, however, would be substantially improved with full implementation of the ERP.

Impact 1.5: Potential for Increased Incidence of Waterfowl Disease. Implementation of the ERP and the island subsidence control element of the Levee System Integrity Program would restore and enhance up to approximately 170,000 acres of wetlands in the Delta Region. These wetlands are expected to substantially increase the abundance and availability of forage for wintering waterfowl throughout the Delta Region. Substantial increases in wintering waterfowl habitat could increase the numbers of waterfowl that winter in the Delta. Substantial increases in wintering populations could result in concentrating large numbers of waterfowl in foraging habitat areas, potentially increasing the

existing rate of waterfowl mortalities attributable to botulism, avian cholera, and other waterfowl diseases within a larger segment of the Pacific Flyway waterfowl population. It is likely that sufficient waterfowl foraging habitat would be restored to meet or exceed the needs of wintering waterfowl populations, reducing the likelihood that catastrophic disease outbreaks would occur from overcrowding of waterfowl as a result of limited availability of foraging habitat area. However, because the distribution of wintering waterfowl in foraging habitats in future years is unpredictable, this impact is considered significant.

Mitigation 1.5: Potential for Increased Incidence of Waterfowl Disease. Potential mitigation strategies for reducing the potential for increased incidence of waterfowl diseases as a result of implementing the ERP could include:

- Monitoring waterfowl use of restored and enhanced wetlands to locate incidences of waterfowl disease moralities
- Removing carcasses from affected restored and enhanced wetlands to reduce the rate of disease transmission
- Hazing waterfowl from restored and enhanced wetlands affected by disease outbreaks to reduce the likelihood of disease transmission
- Where feasible and consistent with habitat restoration objectives, designing wetlands to allow for rapid dewatering during disease outbreaks to discourage use of the affected habitat area by waterfowl

Impact 1.6: Temporary Fragmentation of Riparian Habitats. Riparian habitats associated with levees could be fragmented as a result of construction of setback levees, levee improvements, and other features associated with the ERP and Levee System Integrity Program that could remove riparian vegetation. These impacts would be temporary until sufficient riparian corridor habitat necessary to offset impacts reestablish following implementation of these common programs.

Mitigation 1.6: Temporary Fragmentation of Riparian Habitats. Potential mitigation strategies for reducing impacts on riparian communities that could fragment riparian habitat corridors as a result of implementation of the ERP and Levee System Integrity Program could include:

- Avoiding riparian vegetation
- Restoring or enhancing sufficient riparian habitat area at off-site locations in a manner that reduces the degree of existing habitat fragmentation in the Delta before or at the time that project impacts are incurred to offset habitat losses
- Initially implementing the ERP, to the extent feasible, to restore sufficient riparian habitat before or at the time that project impacts on riparian corridors associated with the ERP are incurred to offset temporary habitat losses
- Restoring riparian vegetation disturbed by on-site construction activities immediately following construction
- Phasing the implementation of modifications to levees that would be necessary to meet PL-99 standards

over a sufficient period to minimize the effects of fragmentation of riparian habitats and associated wildlife

Impact 1.7: Permanent Fragmentation of Riparian Habitats. Sufficient riparian habitat necessary to offset fragmentation of riparian habitats associated with levee improvements would potentially not naturally reestablish following implementation of the Levee System Integrity Program. Therefore, this impact is considered significant.

Mitigation 1.7: Permanent Fragmentation of Riparian Habitats. Potential mitigation strategies for reducing impacts on riparian communities that could fragment riparian habitat corridors as a result of implementation of the Levee System Integrity Program and construction of conveyance facilities could include:

- Avoiding riparian vegetation
- Restoring or enhancing sufficient riparian habitat area in a manner that reduces the degree of existing habitat fragmentation in the Delta before or at the time project impacts are incurred to offset habitat losses
- Restoring riparian vegetation disturbed by on-site construction activities immediately following construction
- Phasing the implementation of modifications to levees that would be necessary to meet PL-99 standards over a sufficient period that would minimize the effects of fragmentation of riparian habitats and associated wildlife

Benefit 1.4: Improved Wetland Habitat Quality. Implementation of the ERP would improve the quality of up to 4,000 acres of existing degraded seasonal wetland habitat areas. Therefore, this impact is considered beneficial.

Benefit 1.5: Improved Riparian Habitat Quality. Implementation of the ERP would improve the quality of existing riparian vegetation in the Delta Region as a result of modifying levee and berm maintenance practices. Modification of vegetation maintenance practices to allow riparian vegetation to attain greater maturity would increase foraging and cover value for associated wildlife. Therefore, this impact is considered beneficial.

Benefit 1.6: Reduction in Nonnative Invasive Plant Abundance. Implementation of the ERP would result in reductions of nonnative and invasive plants in existing open-water and riparian habitats. Open-water habitats that are currently covered by mat-forming aquatic plants provide relatively low wildlife values. Control or eradication of aquatic mat-forming plants would create open-water areas for use by water birds, allow native aquatic plants to establish, and improve the abundance and availability of associated forage for wildlife. Control or eradication of nonnative invasive plants in existing riparian habitats would increase habitat quality because treated habitats would increasingly become dominated by native plants as result of lessening competition with exotic species. Therefore, this impact is considered beneficial.

Benefit 1.7: Improved Habitat Patterns. Implementation of the ERP would create a more historic pattern of open-water, wetland, and riparian habitats

in the Delta Region. Restoration of large tracts of wetlands among existing agricultural lands would also create a habitat pattern that would potentially increase the distribution in the Delta of wildlife that breed or rest in wetlands and forage in agricultural habitats by creating wetlands in closer proximity to agricultural lands. Therefore, this impact is considered beneficial.

Benefit 1.8: Improved Connectivity of Riparian Habitat. Implementation of the ERP would restore approximately 220 miles of riparian habitat along Delta channels and levees. Restored habitat would increase the connectivity among existing fragmented riparian areas in the Delta. Establishment of more continuous habitat corridors would benefit wildlife, such as neotropical migrant birds, that require riparian vegetation for cover during migration or local movements, and would increase the potential for genetic interchange among currently isolated riparian wildlife populations. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 1, habitat loss associated with construction of conveyance facilities within the Delta Region could impact up to 14 special-status species, 4 rare natural communities, and 7 significant natural areas. Implementation of the ERP, which would result in the loss of large areas of agricultural lands as they are converted to wetland and shallow-water habitats, could adversely impact several special-status species (including Swainson's hawks) that are dependent upon such communities for foraging habitat. Some amounts of aquatic, wetland, riparian, and grassland communities would be lost or degraded due to implementation of the Levee System Integrity Program. However, the common programs as a whole would expand these habitat types in particular areas, mostly through restoration and enhancement programs associated with the ERP. These gains would benefit most of the Delta Region's rare natural communities and significant natural areas. The rare natural communities and significant natural areas would also benefit from increased consistency and quality of water resulting from the Water Quality Program and Water Use Efficiency Program.

Impact 1.8: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for species such as Swainson's hawk, would be lost due to inundation in order to create aquatic and riparian habitats as stated under the ERP. Although these aquatic and riparian habitats are beneficial to the Swainson's hawk, the loss of agricultural lands used for foraging is still important. Therefore, this impact is considered significant.

Mitigation 1.8: Loss of Foraging Habitat for Special-Status Species. Potential mitigation strategies for reducing impacts on special-status species in the Delta Region caused by foraging habitat loss within agricultural lands would include:

- Restoring additional grasslands to serve as alternative foraging habitat over and above that restored as part of the ERP

- Managing agricultural lands for multiple foraging special-status species (i.e., flooding fields in the fall to provide wintering waterfowl habitat, while leaving the fields drier in the spring and summer for other species to utilize)
- Maximizing the habitat quality of remaining agricultural lands by utilizing various wildlife-friendly techniques such as planting crops of highest forage value

Impact 1.9: Loss of Portions of Rare Natural Community and Significant Natural Areas. Construction of conveyance facilities and implementation of the Levee System Integrity Program could disturb or eliminate portions of rare natural communities and significant natural areas. This impact is considered to be significant.

Mitigation 1.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Potential mitigation strategies for reducing impacts to rare natural communities and significant natural areas resulting from implementation of the Levee System Integrity Program would include:

- Avoiding rare natural communities and significant natural areas altogether
- Restoring or enhancing disturbed rare natural communities or significant natural areas at other locations before or at the time that Levee System Integrity Program impacts are incurred
- Restoring rare natural communities or significant natural areas back into impacted locations once Levee System Integrity Program activities are completed

Benefit 1.9: Increase in Habitats for Special-Status Species. Implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program would expand or improve aquatic, riparian, and some grassland habitats. These habitat improvements would benefit the majority of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 1.10: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Delta Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon, or occur exclusively in, the aforementioned habitat types. In addition, eradication of many nonnative invasive plants would return some areas to favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by the nonnative species. Therefore, this impact is considered beneficial.

Alternative 1 - Summary of Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified for Alternative 1.

Alternative 2 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Under Alternative 2, the types of impacts on habitat area and associated wildlife of the common programs and proposed conveyance and storage facilities would be the same as under Alternative 1; the magnitude, however, would differ. Mitigation strategies for offsetting the Alternative 2 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 1.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Vegetation and wildlife resources that would be affected by this impact would be the same as under Alternative 1. The habitat area affected by implementation of the ERP and the Levee System Integrity Program would be the same as under Alternative 1, except that under Variation 2C, habitat area affected by the Levee System Integrity Program would be less because fewer miles of levee would be improved.

The acreage of wetland and riparian habitat that would be temporarily impacted by construction and operation of conveyance facilities would potentially be greater under Variations 2B-2E than under Alternative 1. Construction of storage facilities, which is not a feature of Alternative 1, under Variation 2C would also increase the habitat area temporarily impacted beyond that described for Alternative 1.

Impact 1.2: Permanent Loss of Wetland and Riparian Communities. Vegetation and wildlife resources that would be affected by this impact would be the same as under Alternative 1. The habitat area that would be affected by implementation of the Levee System Integrity Program would be the same as under Alternative 1, except that under Variation 2C, habitat area affected by the Levee System Integrity Program would be less because fewer miles of levee would be improved.

The area of wetland and riparian habitat created as a result of construction and operation of conveyance and storage facilities would potentially be greater under all variations than the area that would be adversely affected. Wetland and riparian communities, however, would be permanently lost or degraded as a result of construction and operation of conveyance and storage facilities if sufficient area of the types of affected wetland and riparian habitats necessary to offset impacts did not naturally reestablish following project implementation. Therefore, this impact is considered significant.

Impact 1.3: Temporary Loss or Disturbance of Wintering Waterfowl Foraging Habitat. Implementation of the ERP and Levee System Integrity Program would have the same level of temporary impact on wintering waterfowl habitat as described for Alternative 1. Under Alternative 2, construction of conveyance and storage facilities would similarly temporarily impact the availability of forage for wintering waterfowl until wetland habitats associated with these facilities develop sufficient forage to offset

impacts. Therefore, this impact is considered significant.

Impact 1.4: Permanent Loss of Wintering Waterfowl Foraging Habitat. Sufficient high quality wetland habitat to offset losses of waterfowl forage associated with affected agricultural lands potentially would not naturally reestablish following construction of conveyance and storage facilities. Therefore, this impact is considered significant.

Benefit 1.1: Increase in Open-Water and Wetland Habitat Area. Benefits associated with implementation of the ERP and Levee System Integrity Program would be the same as under Alternative 1. In addition, from approximately 600 to 27,000 acres of native habitats would potentially be created as a result of construction of conveyance and storage facilities. A significant portion of this habitat area would potentially support open-water and wetland habitats. Therefore, this impact is considered beneficial.

Benefit 1.2: Increase in Riparian Communities. Benefits associated with implementation of the ERP would be the same as under Alternative 1. In addition, from approximately 600 to 27,000 acres of native habitats would potentially be created as a result of construction of conveyance and storage facilities. A portion of this habitat area would potentially support riparian habitats. Therefore, this impact is considered beneficial.

Benefit 1.3: Protection of Existing Wetland and Riparian Habitats. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 2, the types of impacts on the quality and pattern of native habitats that would be associated with the common programs and proposed storage and conveyance facilities would be the same as under Alternative 1; however, the magnitude would differ. Mitigation strategies for offsetting the Alternative 2 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 1.5: Potential for Increased Incidence of Waterfowl Disease. This impact would be the same as under Alternative 1. Therefore, this impact is considered significant.

Impact 1.6: Temporary Fragmentation of Riparian Habitats. Implementation of the ERP and the Levee System Integrity Program would have the same level of temporary impact on riparian corridors as under Alternative 1, except that under Variation 2C, impacts of implementing the Levee System Integrity Program would be potentially less because fewer miles of levee would be improved.

Under Alternative 2, construction of conveyance and storage facilities would similarly temporarily fragment riparian corridors until sufficient riparian habitat necessary to offset impacts naturally reestablishes following facility construction. Therefore, this impact is considered significant.

Impact 1.7: Permanent Fragmentation of Riparian Habitats. Implementation of the Levee System Integrity Program would have the same level of impact on riparian corridors as under Alternative 1, except that under Variation 2C, impacts of implementing the Levee System Integrity Program would be potentially less because fewer miles of levee would be improved.

Riparian habitat would be permanently lost or degraded as a result of construction and operation of conveyance and storage facilities if sufficient riparian habitat necessary to offset impacts did not naturally reestablish following project implementation. Therefore, this impact is considered significant.

Benefit 1.4: Improved Wetland Habitat Quality. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.5: Improved Riparian Habitat Quality. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.6: Reduction in Nonnative Invasive Plant Abundance. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.7: Improved Habitat Patterns. Under Alternative 2, habitat patterns would be improved as under Alternative 1. The level of benefit, however, would be potentially greater under Alternative 2 because additional native habitat area would be created as a result of construction of conveyance and storage facilities. Therefore, this impact is considered beneficial.

Benefit 1.8: Improved Connectivity of Riparian Habitat. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 2, habitat loss associated with construction of conveyance facilities within the Delta Region could impact 8 to 14 special-status species, 4 rare natural communities, and 7 significant natural areas. The flooding of an island to create new surface storage would cause additional impacts to 11 of these special-status species. Implementation of the ERP, which would result in the loss of large areas of agricultural lands as they are converted to wetland and shallow-water habitats, could adversely impact several special-status species (including Swainson's hawks) that are dependent upon such communities for foraging habitat. Some amounts of aquatic, wetland, riparian, and grassland communities would be lost or degraded due to implementation of the Levee System Integrity Program. However, the common programs as a whole would expand these habitat types in particular areas, mostly through restoration and enhancement programs associated with the ERP. These net gains would benefit most of the Delta Region's rare natural communities and significant natural areas. The rare natural communities and significant natural areas would also benefit from increased consistency and quality of

water resulting from the Water Quality Program and Water Use Efficiency Program. Mitigation strategies for special-status species and communities would be the same as under Alternative 1.

Impact 1.8: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for special-status species such as Swainson's hawks would be lost due to the creation of aquatic and riparian habitats under the ERP and from inundation of islands to create new conveyance and surface storage. Although the creation of aquatic and riparian habitats through the ERP would be beneficial to the Swainson's hawk, the loss of agricultural lands used for foraging is still important. Therefore, this impact is considered significant.

Impact 1.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Construction of conveyance and storage facilities and implementation of the Levee System Integrity Program could disturb or eliminate portions of rare natural communities and significant natural areas. Therefore, this impact is considered significant.

Benefit 1.9: Increase in Habitats for Special-Status Species. Aquatic, riparian, and some grassland habitats would be increased in a few areas through implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program. In addition, aquatic and riparian habitats would be increased in a few areas due to new surface storage. These habitat enhancements would benefit the majority of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 1.10: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Delta Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon, or occur exclusively in, the aforementioned habitat types. In addition, eradication of many nonnative invasive plants would return some areas to favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by the nonnative species. Therefore, this impact is considered beneficial.

Alternative 2 - Summary of Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified for Alternative 2.

Alternative 3 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Under Alternative 3, the types of impacts on habitat area and associated wildlife that would be associated with the common programs and proposed conveyance and

storage facilities would be the same as under Alternative 1; however, the magnitude of impacts would differ. Mitigation strategies for offsetting the Alternative 3 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 1.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Vegetation and wildlife resources that would be affected by this impact would be the same as under Alternative 1. The habitat area that would be affected by implementation of the ERP and the Levee System Integrity Program would be the same as under Alternative 1, except that under Variation 3I, habitat area affected by the Levee System Integrity Program would be less because fewer miles of levee would be improved.

The acreage of wetland and riparian habitat temporarily impacted by construction and operation of conveyance facilities would be potentially greater under all variations than under Alternative 1 and, among the range of variations, would be approximately the same as Alternative 2. Construction of storage facilities, which is not a feature of Alternative 1, under some variations, would also increase the habitat area temporarily impacted beyond that under Alternative 1. Variations that would construct 200,000 acre-feet of storage could temporarily affect a greater amount of wetland and riparian habitat than the 50,000-100,000 acre-feet storage proposed under Variation 2C.

Impact 1.2: Permanent Loss of Wetland and Riparian Communities. Vegetation and wildlife resources affected by this impact would be the same as under Alternative 1. The habitat area affected by implementation of the Levee System Integrity Program would be the same as under Alternative 1, except that under Variation 3I, habitat area affected by the Levee System Integrity Program would be less because fewer miles of levee would be improved.

This impact would be the same as under Alternative 2, except that within the range of variations, Alternative 3 could create fewer acres of additional wetland and riparian habitats than Alternative 2. Consequently, some Alternative 3 variations would be more likely to permanently impact or have a greater magnitude of permanent impact on wetland and riparian habitats. Therefore, this impact is considered significant.

Impact 1.3: Temporary Loss or Disturbance of Wintering Waterfowl Foraging Habitat. This impact would be the same as under Alternative 2, except the level of impact would potentially be greater under variations affecting greater acreages of agricultural lands as a result of construction of conveyance and storage facilities. Therefore, this impact is considered significant.

Impact 1.4: Permanent Loss of Wintering Waterfowl Foraging Habitat. This impact would be the same as under Alternative 2, except that Alternative 3 would potentially be more likely to result in permanent loss of forage habitat because construction of conveyance and storage facilities would create less replacement habitat under some variations than under Alternative 2. Therefore, this impact is considered significant.

Benefit 1.1: Increase in Open-Water and Wetland Habitat Area. Benefits associated with implementation of the ERP and Levee System Integrity Program would be the same as under Alternative 1. In addition, from approximately 600 to 26,000 acres of native habitats would potentially be created as a result of construction of conveyance and storage facilities. A significant portion of this habitat area would potentially support open-water and wetland habitats. Therefore, this impact is considered beneficial.

Benefit 1.2: Increase in Riparian Communities. Benefits associated with implementation of the ERP would be the same as under Alternative 1. In addition from approximately 600 to 26,000 acres of native habitats would potentially be created as a result of construction of conveyance and storage facilities. A portion of this habitat area would potentially support riparian habitats. Therefore, this impact is considered beneficial.

Benefit 1.3: Protection of Existing Wetland and Riparian Habitats. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 3, the types of impacts on the quality and pattern of native habitats that would be associated with the common programs and proposed storage and conveyance facilities would be the same as under Alternative 1; however, the magnitude would differ. Mitigation strategies for offsetting the Alternative 3 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 1.5: Potential for Increased Incidence of Waterfowl Disease. This impact would be the same as under Alternative 1. Therefore, this impact is considered significant.

Impact 1.6: Temporary Fragmentation of Riparian Habitats. Implementation of the ERP and the Levee System Integrity Program would have the same level of temporary impact on riparian corridors as under Alternative 1, except that under Variation 3I, impacts of implementing the Levee System Integrity Program would be potentially less because fewer miles of levee would be improved.

The degree of temporary habitat fragmentation that would result from construction and operation of conveyance facilities would potentially be greater under all variations than under Alternative 1 and, among the range of variations, would be approximately the same as under Alternative 2. Variations with construction of 200,000 acre-feet of storage could temporarily fragment a greater amount of riparian habitat than the 50,000-100,000 acre-feet of storage proposed under Variation 2C.

Impact 1.7: Permanent Fragmentation of Riparian Habitats. Implementation of the Levee System Integrity Program would have the same level of impact on riparian corridors as under Alternative 1, except that under Variation 3I, impacts of implementing the Levee System Integrity Program would be

potentially less because fewer miles of levee would be improved.

This impact would be the same as under Alternative 2, except that within the range of variations, Alternative 3 could create fewer acres of additional riparian habitat than Alternative 2. Consequently, some Alternative 3 variations would be more likely to permanently fragment a greater area of riparian habitat. Therefore, this impact is considered significant.

Benefit 1.4: Improved Wetland Habitat Quality. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.5: Improved Riparian Habitat Quality. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.6: Reduction in Nonnative Invasive Plant Abundance. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 1.7: Improved Habitat Patterns. This benefit would be the same as under Alternative 2, except that under Alternative 3 the level of benefit would potentially be less than Alternative 2 under some variations. Therefore, this impact is considered beneficial.

Benefit 1.8: Improved Connectivity of Riparian Habitat. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 3, habitat loss associated with construction of conveyance facilities within the Delta Region as well as isolated facilities could impact from 6 to 25 special-status species, 5 rare natural communities, and 7 significant natural areas. Creation of new surface storage would cause impacts to between 11 and 16 special-status species. More species and communities would be impacted under Alternative 3 than under Alternatives 1 and 2 due to the use of isolated facilities in Alternative 3. Implementation of the ERP, which would result in the loss of large areas of agricultural lands, could adversely impact several special-status species (including Swainson's hawks) that are dependent upon such communities for foraging habitat. Some amounts of aquatic, wetland, riparian, and grassland communities would be lost or degraded due to implementation of the Levee System Integrity Program. However, the common programs as a whole would expand these habitat types in particular areas, mostly through restoration and enhancement programs associated with the ERP. These net gains would benefit most of the Delta Region's rare natural communities and significant natural areas. The rare natural communities and significant natural areas would also benefit from increased consistency and quality of water resulting from the Water Quality Program and Water Use Efficiency Program. Mitigation strategies for special-status species and communities would be the same as under Alternative 1.

Impact 1.8: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for special-status species such as Swainson's hawks would be lost due to the creation of aquatic and riparian habitats under the ERP and from inundation of islands to create new conveyance and surface storage. Although the creation of aquatic and riparian habitats through the ERP is beneficial to species such as the Swainson's hawk, the loss of agricultural lands that serve as foraging habitat is still important. Therefore, this impact is considered significant.

Impact 1.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Construction of conveyance and storage facilities and implementation of the Levee System Integrity Program could disturb or eliminate portions of rare natural communities and significant natural areas. Therefore, this impact is considered significant.

Benefit 1.9: Increase in Habitats for Special-Status Species. Aquatic, riparian, and some grassland habitats would be increased through implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program. In addition, aquatic and riparian habitats would be increased in a few areas due to new surface storage. These habitat enhancements would benefit the majority of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 1.10: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Delta Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon or occur exclusively in aquatic, riparian, or grassland habitats. Therefore, this impact is considered beneficial. In addition, eradication of many nonnative invasive plants would return some areas to favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by nonnative species.

Alternative 3 - Summary of Potential Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified for Alternative 3.

5.2.2 Alternative 1 Impact Evaluation by Variation - Delta Region

Alternative 1 consists of three variations (1A, 1B, and 1C) that implement the common program. Diversions and reservoir operations under Alternative 1, including storage and discharge, change relative to the No Action Alternative and existing conditions. Diversions and reservoir operations are also different

under all three variations because of changes in the export facilities (Variations 1B and 1C) and increased storage north and south of the Delta (Variation 1C).

The common program actions called for under Alternative 1 involve substantial changes in the disposition of land and water resources throughout the Bay-Delta river system. Agricultural land currently protected by levees would be converted to aquatic habitat (permanently wetted acreage) or to periodically flooded riparian acreage. Additional high spring flow would be allowed to pass down the rivers and through the Delta without being stored, diverted, or exported. A greater proportion of the water being diverted or exported from the system would be passed through fish screens; the toxicant load entering the system from agricultural acreage, abandoned mines, industrial facilities, and other sources would be substantially reduced; and a large-scale effort to control the spread of water hyacinth and other invasive nonnative plant species would be undertaken.

Discussion of each of the common programs and storage and conveyance facilities is addressed first for plant communities and wildlife and then for special-status species and communities. To avoid redundant discussions of impacts, preceding discussions will be referred to for information on actions that occur in several Alternatives. For example, actions included in the common program would be implemented under all Alternatives and are discussed in detail under Alternative 1. The other Alternatives do not include a discussion of the common program actions and refer the reader to Alternative 1. An exception would occur when the Alternative specifically identifies a change in the common program or when actions in the conveyance and storage components affect the impact of actions in the common program. The direct and interactive effects would then be discussed under the appropriate Alternative.

Variation 1A - Plant Communities and Associated Wildlife

Under Variation 1A, the **ERP** would be implemented as described in Phase 2 Alternative Descriptions except that restoration identified for the South Delta would be relocated to the northern and western Delta to avoid the South Delta pumping facilities. The ERP would create or restore the following natural plant community types: 33,000 - 45,000 acres of tidal freshwater emergent wetland, up to 16,000 acres of nontidal freshwater emergent wetland, 900 - 2,300 acres of tidally influenced channels and distributary sloughs, up to 7,000 acres of shallow-water habitat, up to 500 acres of shoals, 500 acres of open-water areas within restored freshwater emergent wetland areas, 1,500 - 2,000 acres of shallow open-water areas within restored freshwater emergent wetland areas, up to 30,000 acres of seasonal wetlands, 700 - 8,000 acres of riparian habitat, 15,000 acres of nontidal emergent wetlands, and 180 - 720 acres of channel islands, and would protect 500-1,000 acres of vernal pools and adjacent buffer lands. The ERP would also protect 500 acres of existing riparian woodland, protect and enhance 20-80 acres of channel islands, and enhance up to 4,000 acres of seasonal wetland. Most habitats would be restored on existing agricultural lands and relatively small acreage of some

natural plant communities would be lost or converted to open-water or other natural plant communities.

The four different plant community categories are **highlighted in bold** below. Typical wildlife species associated with plant communities of the Delta Region are presented in Attachment A.

Existing **natural terrestrial communities** (such as grassland and ruderal habitats) would be affected by restoration of shallow-water, wetland, and riparian habitats. Affected communities are generally dominated by exotic grasses and forbs and are typically associated with levee slopes and abandoned agricultural lands. Direct impacts on these habitats would result from construction of levee setbacks and breaching or removal of levees to restore shallow-water, wetland, and riparian habitats. Indirect impacts associated with these actions include changes in hydrology (e.g., flooding of Delta islands) that would result in converting uplands to wetlands. Losses of grassland and ruderal habitats would be partially or completely offset by natural reestablishment of herbaceous vegetation on setback levees and along higher elevation margins of restored wetland and riparian habitats that are not farmed.

Other actions that would affect grassland and ruderal habitats include altering existing vegetation management practices on levees to encourage natural reestablishment of riparian vegetation and control of exotic plant species that compete with native plants in existing habitat areas. The area of habitat affected by these actions cannot be estimated because the area to be treated is unknown and the success of these treatments is expected to vary among treated locations. The quality of grassland and ruderal habitats in areas that are treated to control exotic plant species would increase because treated habitats would become increasingly dominated by native plants as a result of reducing competition with exotic species.

Changes in the area, quality, and pattern of grassland and ruderal habitats would be too small to substantially affect the distribution or number of associated wildlife.

Because the type of **riparian community** that would be restored is dependent on site-specific conditions, such as local hydrology and soils, the area of each type of riparian community that would be restored is not predictable. In some portions of the Delta, existing riparian scrub, woodland, and forest would be affected by restoration of shallow-water, wetland, and riparian habitats. Potentially affected riparian habitats are typically associated with levee berms and shorelines along unleveed channels. Direct impacts on these riparian habitats would result from construction of levee setbacks and breaching or removal of levees to restore shallow-water, wetland, and riparian habitats, representing a temporary local reduction in the area supporting riparian communities.

Riparian plants that would benefit from restoration include species currently present in the Delta, such as Fremont cottonwood, valley oak, western sycamore, white alder, box elder, blackberry, wild rose, and several willow tree and shrub species. Approximately 137 species of wildlife that are known to use riparian

habitats in the Delta would also benefit from restoration of riparian habitats (Table 5-3).

Restoration of riparian corridors along Delta channels would increase the connectivity among existing fragmented riparian areas in the Delta. Establishment of more continuous habitat corridors would benefit wildlife, such as neotropical migrant birds, that require riparian vegetation for cover during migration or local movements, and would increase the potential for genetic interchange among currently isolated riparian wildlife populations. Similarly, restoration of habitat adjacent to existing riparian habitat areas would increase the quality of existing riparian habitats for riparian-associated wildlife. When compared to the No Action Alternative, restoration of riparian habitat in conjunction with shallow-water and wetland habitats would also restore a more historic pattern of habitats to the Delta, where these habitats would establish along an elevational gradient from open-water at lower elevations, gradually transitioning to wetland and then riparian habitat at higher elevations.

Restoration of habitat corridors of greater than typical width present in the Delta would increase habitat area for species that require large continuous tracts of habitat. Wider riparian corridors would also reduce the likelihood of nest parasitism on passerine birds by brown-head cowbirds, which typically parasitize nests along the edge of riparian habitats. The quality of existing riparian vegetation would also be increased as a result of modifying levee and berm maintenance practices and control of exotic plant species that compete with native plants. Modification of vegetation maintenance practices to allow riparian vegetation to attain greater maturity would increase foraging and cover value for associated wildlife. The quality of existing riparian habitats that are treated to control exotic plant species would increase because treated habitats would become increasingly dominated by native plants as a result of a reduction of competition with exotic species.

An unknown quantity of riparian vegetation would also naturally reestablish as a result of restoration of other habitat types. Riparian vegetation is expected to establish along the margins of restored tidal slough, shallow-water, and wetland habitat areas where soil moisture conditions are suitable to sustain riparian vegetation. Riparian vegetation would also establish on portions of restored mid-channel islands with suitable soil moisture. Existing riparian vegetation associated with mid-channel islands and Delta shorelines would be protected from future potential loss to erosion as a result of reducing boat wake-induced erosion and protecting mid-channel islands from further erosion. The area of riparian vegetation would also increase as a result of modifying levee and berm vegetation maintenance practices to allow riparian vegetation to naturally reestablish in locations where its establishment is currently prevented.

In some portions of the Delta, existing **wetland habitats** would be affected by restoration of shallow-water, wetland, and riparian habitats. Affected wetlands are primarily tidal freshwater emergent wetlands associated with shallow-water margins of sloughs and Delta channels. A

temporary local reduction in wetland habitat acreage would potentially result from construction of levee setbacks and breaching or removal of levees to restore shallow-water, wetland, and riparian habitats. Wetland vegetation growing adjacent to the island side of levees would also be affected by construction of levee setbacks. The potential natural reestablishment of similar wetland vegetation along the island side of setback levees, however, would partially offset this impact. Nontidal freshwater emergent wetlands associated with island interiors, such as low elevation sites that pond or maintain groundwater near the surface for a sufficient duration to support wetland vegetation, canals, and ditches, would be expanded in area and converted, depending on location, to tidal shallow-water, wetland, or riparian habitat as a result of breeching levees to flood islands.

Restoration of large areas of tidal shallow **open-water habitat** would benefit wildlife species that forage or rest in shallow-water habitats (Attachment A). Shallow-water areas of the Delta typically attract small fish that provide forage for grebes, herons, terns, and other fish eating wildlife. An unpredictable quantity of sparsely or unvegetated tideflats would be created as a result of restoration of shallow-water habitats at elevations that are exposed during low tides, but are sufficiently inundated during other periods to preclude establishment of emergent vegetation. Tideflats are important foraging and resting habitats for shorebirds that migrate through or winter in the Delta (Attachment A).

Deep and shallow open-water areas would also be restored in addition to nontidal fresh emergent marsh. These open-water areas enhance the wildlife value of associated emergent vegetation by providing wildlife access to otherwise densely vegetated habitat. These open-water habitats provide brood habitat for ducks and other water birds that breed in the Delta, and forage and resting habitat for waterfowl, grebes, terns, and other Delta species that use open-water (Attachment A).

Large tracts of tidal emergent wetland would be restored by breeching levees to flood Delta islands and setting back levees. Some wetland would also become established as a result of restoration of mid-channel islands. Tidal freshwater emergent wetlands provide foraging and nesting habitat for waterfowl and other water birds, rails, herons and egrets, marsh wrens, several species of blackbirds, and other wetland-associated species (Attachment A). Proposed actions to reduce or eliminate erosion of existing mid-channel islands would also protect associated freshwater emergent wetland vegetation from future loss to erosion. Nontidal freshwater emergent wetlands would be restored on the interior of Delta islands and would provide wildlife habitat value similar to that described for tidal freshwater emergent wetland.

Restoration of tidal sloughs would result in establishment of deep and shallow open-water, tideflat, and freshwater emergent wetland habitats. The area of each habitat type that would be restored is dependent on local site conditions.

Restoration of large tracts of seasonal wetlands throughout the Delta would provide foraging and resting habitat for

many species of wildlife. During the winter period, flooded seasonal wetlands would provide foraging and resting habitat for wintering waterfowl, wintering and migrant shorebirds, and other water birds. Habitat quality would be increased on approximately 1,000 acres of existing seasonal wetlands in the Yolo Bypass by improving land and water management practices. Mudflats that would be exposed as water levels recede during spring provide foraging habitat for migrant shorebirds. Unflooded seasonal wetland vegetation would provide nesting habitat for ground-nesting birds, such as the mallard and ring-necked pheasant, and foraging habitat for raptors.

Overall, restoration and enhancement of these habitats would substantially increase available waterfowl breeding, foraging, and resting habitat for waterfowl in the Delta compared to the No Action Alternative. Suitable duck nesting and breeding habitat under the No Action Alternative is limited in the Delta. Restoration of wetlands in conjunction with open-water habitat would increase the area of suitable nesting and breeding habitat and potentially substantially increase the number of ducks annually produced in the Delta. Restoration of tidal emerging wetland and shallow-water habitat, seasonal wetlands, and associated mudflats and tideflats would substantially increase the availability of foraging and resting habitat for migrant and wintering shorebirds in the Delta compared to the No Action Alternative.

As described for restoration of riparian habitat, restoration of wetlands would create a more historic pattern of open-water, wetland, and riparian habitat areas in the Delta. Restoration of large tracts of wetlands among existing agricultural lands would also create a habitat pattern that potentially would result in a more uniform distribution in the Delta of wildlife that breed or rest in wetlands and forage in agricultural habitats by creating wetlands in closer proximity to agricultural lands.

Major **agricultural land** cover types include grain and hay crops, row crops, truck crops, pasture, and orchards and vineyards. Under Alternative 1, approximately up to 115,000 acres of shallow-water, wetland, and riparian habitat would be restored. Most of this habitat restoration would be implemented on agricultural lands. The impact of the loss of agricultural land on Delta wildlife is dependent on the affected cover type and agricultural land use practices. Approximately 119 species of wildlife are known to make use of agricultural lands in the Delta (Table 5-3). Although agricultural lands provide important habitat for some species and species groups, the diversity of wildlife associated with any particular agricultural cover type is generally much lower than the diversity of wildlife associated with native habitats. Wildlife habitat values provided by agricultural lands are also limited by seasonal changes in habitat structure (e.g., harvested compared to unharvested fields or flooded compared to unflooded fields), frequent disturbances associated with farming (e.g., operation of farm equipment), use of pesticides, and clean farming practices that eliminate habitat areas near field borders.

Loss of large acreages of some cover types, such as corn- and grainfields and pasture, however, would result in a

substantial loss of foraging habitat area for wintering waterfowl and sandhill cranes, which are heavily dependent on agricultural lands in the Delta during the winter period, compared to the No Action Alternative. Most agricultural crop types (e.g., asparagus and other truck crops, safflower, and orchards and vineyards), provide little or no forage value for wintering waterfowl and sandhill cranes. Agricultural lands restored to wetland habitats would also result in a substantial loss of forage and cover for wildlife species, such as ring-necked pheasant, mourning dove, red-tailed hawk, and California vole, that are dependent on upland habitats.

Implementation of the **Water Quality Program** would reduce loadings of organic and inorganic constituents (e.g., metals and insecticides) to the Delta and its tributaries from mine drainage, urban and industrial runoff, wastewater and industrial discharge, and agricultural drainage. Loadings of these constituents would be reduced through source control and treatment.

Implementation of these actions would be beneficial; however, the magnitude of benefits is not predictable. Implementation of best management practices for application of insecticides could reduce drift to adjacent habitats. Reduction of insecticide drift would increase the availability of prey for species that feed on invertebrates and reduce the likelihood for bioaccumlation of compounds in the foodweb. Reduction in loadings of organic and inorganic constituents in the aquatic ecosystem would reduce bioaccumulation of these compounds in the Delta's foodweb and, as a consequence, in wildlife that feed directly on aquatic organisms or on terrestrial organisms that feed on aquatic species. Sufficient reduction of toxins in the foodweb could result in greater reproductive success of wildlife species that would potentially be adversely affected by these compounds under the No Action Alternative.

Specific actions that could affect plant communities and associated wildlife in the CALFED problem and solution areas are not identified for the **Water Use Efficiency Program**; therefore, the potential impacts of the program cannot be determined.

Impacts of actions to implement the Special Habitat Improvements and Levee Stabilization, Subsidence Control, Levee Associated Habitat, and Delta In-Channel Islands elements of the **Levee System Integrity Program** would be the same as under ERP restoration actions that affect levees or flood Delta islands and are described under that section. Potential impacts of the Delta Flood Conveyance Improvements element of the program are described under the analysis for conveyance facilities. Specific actions that potentially could affect plant communities and associated wildlife in the CALFED problem and solution areas are not identified for the Beneficial Reuse of Dredge Material, Delta Levee Emergency Response, Delta Levee Seismic Susceptibility, and Levee Associated Recreation elements of the program; therefore, the potential impacts of the program cannot be determined.

The Delta Levee Base Level of Funding program element would upgrade

approximately 1,100 miles of levees to PL-99 standards. Implementation of the program would affect approximately 7,500 to 11,250 acres of existing levee habitats and increase the area of existing levees by approximately 2,500 to 3,750 acres. Approximately 75 percent of the existing levee area supports grassland and ruderal vegetation or largely unvegetated riprap and 25 percent supports riparian vegetation (regional handout summaries). Increasing the landbase of levees would affect primarily agricultural land and some grassland adjacent to existing levees. Habitat values associated with grassland, ruderal, riparian, and agricultural habitats are the same as described for the ERP.

No new **Storage or Conveyance Facilities** would be planned for the Delta under Variation 1A.

Variation 1A - Special-Status Species and Communities

This shift from agricultural lands to natural plant communities in the Delta as a result of implementation of the **ERP** would likely result in a benefit to many of the special-status species listed in Table 5-6. The exact numbers to benefit would depend on specific facility locations not known at this time. Although loss of agricultural lands could have an initial negative impact on the foraging areas of the Swainson's hawk, there would be a net overall benefit since the primary limiting factors for this species, nesting/roosting trees, would be increased by the ERP.

Eleven rare natural communities and 29 significant natural areas (Section IV of Affected Environment Technical Appendix) occur or have the potential to occur in the Delta. The ERP would have an overall positive impact to these communities. While some communities could suffer because of immediate construction activities, such as disturbance of Great Valley willow scrub due to the construction of levee setbacks, a long-term gain is expected over the life of the project as the old levees are allowed to revegetate naturally.

The **Water Quality Program** would improve water quality throughout the Delta by reducing mercury loadings, pesticide levels, and oxygen depletion. These improvements in water quality under Variation 1A would benefit the 34 special-status species listed in Table 5-6 either directly, by improving the health of individuals of the species, or indirectly by improving the quality of their habitat. Similarly these water quality improvements are expected to positively impact the 11 rare communities and 29 significant natural areas (Section IV of Affected Environment Technical Appendix) of the Delta.

The **Water Use Efficiency Program** includes programs whose goals are to reduce existing use and future demand on the states limited water supply. However, some elements of the program are voluntary and some are already in use or planned as part of other programs so the benefits that can be attributed to CALFED actions are limited. Therefore, to the extent that the Water Use Efficiency Program reduces existing water use and future demand, more water can be left in the Delta channels that would have either positive or no impacts to special-status

species, rare natural communities, and significant natural areas.

Many of the features of the **Levee System Integrity Program** would result in increased natural habitat and are identified in the ERP, the impacts of which are discussed above. The goal of the Levee System Integrity Program is to reduce the risk of levee failure, which would further benefit 19 special-status species that occur on inland dunes, grassland, and agricultural plant communities, as listed in Table 5-6 by protecting Delta lands within existing levees from flood damage.

No new **Storage or Conveyance Facilities** would be planned for the Delta under Variation 1A.

Variation 1B - Plant Communities and Associated Wildlife

South Delta Modifications under **Conveyance Facilities** would include direct impacts related to the construction of a barrier at the head of Old River and flow and stage control facilities. Impacts resulting from construction of new access roads, control buildings, and other facilities would potentially remove and disturb **natural communities** that could include emergent wetland, riparian shrub and woodland, and grassland and ruderal vegetation. Specific acreages of habitats would depend on the specific design and location of facilities that would be constructed.

South Delta Modifications would potentially result in the removal of up to 5 acres of emergent wetland and up to 15 acres of riparian scrub and woodland and would potentially affect up to 50 acres of ruderal vegetation. The barrier at the head of Old River, depending on how it is operated, could disrupt tidal flow sufficiently to result in the loss of tidal wetlands or change the plant species composition of wetlands upstream of the barrier.

Construction of an intertie between the Tracy Pumping Plant and Clifton Court Forebay would potentially affect emergent marsh, riparian scrub and woodland, and grassland and ruderal vegetation. The impacted acreages would depend on the location and design of the intertie.

Potentially affected common plant species would include Fremont cottonwood, willow species, western sycamore, blackberry, common tule, and cattails. Associated common wildlife species that would potentially be affected include emergent wetland wildlife, riparian wildlife, and grassland wildlife (Attachment A).

South Delta Modifications would include direct impacts on **agricultural lands** related to the construction of a barrier at the head of Old River and flow and stage control facilities. Impacts resulting from construction of new access roads, control buildings and other facilities would remove agricultural communities that could include grain and hay crops, corn and sorghum, other row crops, truck crops, pasture, orchards and vineyards, and idled lands. Specific impacted acreages would depend on the selected location of the facilities.

The direct potential impacts of South Delta Modifications were assumed to be

removal of less than 50 acres of agricultural habitats.

Construction of an intertie between the Tracy Pumping Plant and Clifton Court Forebay would potentially affect agricultural habitat. The impacted acreage would depend on the location and design of the intertie.

Associated common wildlife that would potentially be affected would include agricultural wildlife (Attachment A).

The impacts of implementing the **ERP, Water Quality Program, Water Efficiency Program,** and **Levee System Integrity Program** under Variation 1B would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 1B.

Variation 1B - Special-Status Species and Communities

Conveyance Facilities included in Variation 1B could impact up to 12 special-status species, 3 rare natural communities, and 5 significant natural areas.

The impacts of implementing the **ERP, Water Quality Program, Water Efficiency Program,** and **Levee System Integrity Program** under Variation 1B would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 1B.

Variation 1C - Plant Communities and Associated Wildlife

The impacts of new **Conveyance Facilities** on **natural terrestrial, riparian, and wetland communities** would be the same as under Variation 1B, except for the addition of impacts associated with a new Clifton Court Forebay intake structure and channel enlargement along a 4.9-mile reach in Old River. The Clifton Court Forebay intake structure would potentially impact 15-20 acres of natural plant communities including emergent wetland, riparian, grassland, and ruderal habitat. Dredging along a 4.9-mile reach of Old River could affect riparian and emergent wetland vegetation along the river. Dredge material would be disposed of on agricultural lands and, therefore, would not affect natural communities. Impacts to natural communities from disposal of dredge material would depend on the location of disposal.

The impacts of new conveyance facilities on **agricultural lands** would be the same as under Variation 1B, except for the additional potential temporary effect of the processing of dredge material, which is assumed to be held for 2 years on crop land for draining and settling. This would only temporarily disturb agricultural habitat, because the habitat would return to production after removal of the dredged material.

The impacts of implementing the **ERP, Water Quality Program, Water Efficiency Program,** and **Levee System Integrity Program** under Variation 1C would be the same as under Variation 1A. No new **Storage Facilities** would be

planned for the Delta Region under Variation 1C.

Variation 1C - Special-Status Species and Communities

Variation 1C **Conveyance Facilities** would be the same as under Variation 1B plus a new Clifton Court Forebay intake structure, a channel enlargement along a 4.9-mile reach in Old River, an operable barrier at the head of Old River, and various flow and stage control measures. The channel enlargement along Old River could impact as many as 14 special-status species (see Table 5-7), 4 rare natural communities, and 7 significant natural areas due to construction in Old River.

The impacts of implementing the **ERP, Water Quality Program, Water Efficiency Program,** and **Levee System Integrity Program** under Variation 1C would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 1C.

5.2.3 Alternative 2 Impact Evaluation by Variation - Delta Region

Variation 2A - Plant Communities and Associated Wildlife

Typical wildlife species associated with plant communities of the Delta Region are presented in Attachment A. The impacts of implementing the **ERP** on plant communities and associated wildlife under Variation 2A would be similar to Variation 1A except that some restored shallow-water habitat areas would be located in the East Delta, restored and enhanced habitat areas identified in the ERP for the South Delta (Phase 2 Alternative Descriptions) would be located west of flow and stage control structures proposed for the South Delta, and restoration along the North Fork of the Mokelumne River would be limited to establishing a riparian habitat corridor associated with setback levees.

Under **Conveyance Facilities** construction of a 10,000 cubic feet per second (cfs) intake facility at Hood would include construction of the intake, pumping plant, fish bypass structures, and relocation of Highway 160 and bridge. These activities would potentially disturb and remove **natural communities** that could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation.

Construction of an open channel from Hood to Lambert Road would potentially remove and disturb natural communities within a 200-foot corridor, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation.

Construction of a setback channel on the southwestern portion of Glanville Tract would remove and disturb natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. Approximately 350-450 acres of habitat would be created including open-water, emergent wetland, riparian scrub, and riparian woodland communi-ties. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage. New

Table 5-7
Special-Status Species Potentially Adversely Affected by Proposed Conveyance Facilities - Delta Region

Species Common Name	Status			Alt. 1[a]			Alt. 2					Alt 3								
	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Animals																				
Anthicus sacramento Sacramento anthicid beetle	SC	--	--															X		
Apodemia mormo langei Lange's metalmark butterfly	E	--	--															(+)		
Ambystoma californiense California tiger salamander	SC	SC	--															(+)		
Buteo swainsoni Swainson's hawk	--	T	--		X	X	X	X		X	X	X	X	X	X	X			X	X
Clemmys marmorata marmorata northwestern pond turtle	SC	--	--		X	X	X	X		X	X	X	X	X	X	X			X	X
Coelus gracilis San Joaquin dune beetle	C	--	--															(+)		
Desmocerus californicus dimorphus valley elderberry longhorn beetle	T	--	--		(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Grus canadensis tabida greater sandhill crane	--	T	--		(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Hygrotus curvipes curved foot hygrotus diving beetle	SC	--	--															X		
Laterallus jamaicensis coturniculus California black rail	--	T	--			X			X	X	X	X	X	X	X	X		(+)	X	X
Lytta molesta Molestan blister beetle	SC	--	--															X		
Thamnophis gigas giant garter snake	T	T	--		(+)	(+)	(+)	(+)		(+)	(+)	X	X	X	X	X		X	X	X
Vulpes macrotis mutica San Joaquin kit fox	E	T	--																X	
Plants																				
Aster lentus Suisun marsh aster	SC	--	1B			X			(+)	X	X	(+)	(+)	(+)	(+)	(+)		X	X	(+)
Astragalus tener var. *tener* alkali milk-vetch	--	--	1B															(+)		
Atriplex cordulata heartscale	SC	--	1B															(+)		
Atriplex depressa brittlescale	--	--	1B															(+)		
Atriplex joaquiniana San Joaquin saltbush	SC	--	1B															X		
Carex comosa bristly sedge	--	--	2						X			X	X	X	X	X			X	X
Cirsium crassicaule slough thistle	SC	--	1B		(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)

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Table 5-7 (concluded)

Species / Common Name	Status			Alt. 1[a]			Alt. 2					Alt 3								
	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Delphinium recurvatum recurved larkspur	SC	--	1B															X		
Erysimum capitatum ssp. *angustatum* Contra Costa wallflower	E	E	1B															(+)		
Hibiscus lasiocarpus California hibiscus	--	--	2		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Juglans hindsii N. Calif. black walnut	SC	--	1B		X	X	X	X		X	X	X	X	X	X	X		X	X	X
Lathyrus jepsonii var. *jepsonii* Delta tule pea	SC	--	1B		X	X	X	X		X	X	X	X		X	X	X	X	X	
Lilaeopsis masonii Mason's lilaeopsis	SC	R	1B		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Limosella subulata Delta mudwort	--	--	2		X	X	X	X		X	X	X	X		X	X	X	X	X	
Oenothera deltoides ssp. *howellii* Antioch Dunes evening primrose	E	E	1B															X		
Scutellaria galericulata marsh skullcap	--	--	2																	
Tropidocarpum capparideum caper-fruited tropidocarpum	SC	--	1A		X	X	X	X		X	X	X	X		X			X	X	X
Total Special-Status Species:					12	14	12	12	8	14	14	15	15	12	15	14	6	25	16	13
Vernal Pool Landscape (acres)[b]	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	147	0	0

Notes:

[a] Proposed actions considered under Alternative 1A would not directly affect wetland or terrestrial special-status species.

[b] Vernal pool special-status species landscape includes the watershed areas that support several of the species indicated in this table. The database used for estimating acres affected is Holland (1997), a more accurate database than the NDDB database used for evaluating presence of individual species.

Source: California Natural Diversity Data Base (NDDB 1997)

Symbols:

X = indicates a known occurrence of a species within the footprint of an alternative

(+) = indicates a presumed occurrence of a species based on the likely presence of suitable habitat

Status Abbreviations:

Federal (NDDB 1997)

E = endangered

T = threatened

C = candidate

SC = species of concern

State (NDDB 1997)

E = endangered

T = threatened

R = rare

SC = species of concern

CNPS (Skinner and Pavlik 1994)

1A = presumed extinct

1B = species that are rare, threatened, or endangered throughout their range

2 = species that are rare, threatened, or endangered in California but more common elsewhere

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grassland and ruderal communities would establish on the new levee slopes.

Construction of a setback channel at McCormack Williamson Tract would potentially remove and disturb natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. However, the flooding of McCormack Williamson Tract would create approximately 1,600-1,700 acres of shallow-water habitat, including open-water, and emergent wetland. Riparian scrub and woodland would establish along the levees that would line the flooded island. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

North Delta channel modifications would include setback levees, set approximately 500 feet back from the existing levees, along the North Mokelumne River from Interstate 5 to the San Joaquin River. Some acreage of existing natural communities would potentially be removed and disturbed in locations where levees are breeched. These communities could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. Setting back the levees would create approximately 1,200-1,400 acres of habitat that would include open-water, and emergent wetland, and would create riparian scrub and woodland along the levees, and grassland and ruderal vegetation on levee slopes. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

Effects of South Delta Modifications and CVP-SWP improvements would be the same as under Variation 1C.

Effects of setback levees on common plant and wildlife species would be the same as under the ERP.

Construction of an intake facility at Hood would result in impacts to **agricultural lands**, and an open channel from Hood to Lambert Road would remove agricultural communities. Construction of a setback channel on Glanville Tract would remove up to approximately 450 acres of agricultural communities. Flooding McCormack Williamson Tract would remove approximately 1,400-1,600 acres of agricultural communities. North Delta channel modifications would remove approximately 1,000-1,200 acres of agricultural communities.

Potential impacts of South Delta Modifications and CVP-SWP improvements would be identical to those discussed under Variation 1C.

The removal of approximately 2,700-2,900 acres of agricultural communities would affect agricultural wildlife species (Attachment A). These effects would be the same as under the ERP.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 2A would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2A.

Variation 2A - Special-Status Species and Communities

Approximately 111,000 acres of agricultural lands would be converted to natural plant communities under the **ERP** for Variation 1A. This shift from agricultural lands to natural plant communities discussed above would result in a benefit to all 34 special-status species listed in Table 5-6. Although the loss of agricultural lands could have a negative impact on the foraging areas of the Swainson's hawk, there would be a net overall beneficial impact to this species since the primary limiting factors for this species, nesting/roosting trees, would be increased by the ERP.

Eleven rare natural communities and 29 significant natural areas (Section IV of Affected Environment Technical Report) occur or have the potential to occur in the Delta. The ERP would have an overall positive impact to these communities. While some communities could suffer because of immediate construction activities, such as disturbance of Great Valley willow scrub due to the construction of levee setbacks, a long-term gain is expected over the life of the project as the old levees are allowed to revegetate naturally.

Variation 2A **Conveyance Features** include a 10,000-cfs screened intake at Hood, widening Snodgrass Slough, flooding McCormack Williamson Tract, widening the Mokelumne River, and constructing setback levees, plus a new Clifton Court Forebay intake structure, channel enlargement along a 4.9-mile reach in Old River, an operable barrier at the head of Old River, and various flow and stage control measures. Variation 2A would impact 12 special-status species (listed in Table 5-7) and 4 rare natural communities. Impacts to significant natural areas would depend on the location and alignment of Variation 2A features.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 2A would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2A.

Variation 2B - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP** and **Conveyance Facilities** under Variation 2B would be the same as under Variation 2A, and the **Water Quality Program, Water Use Efficiency Program, and Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2B.

Variation 2B - Special-Status Species and Communities

The impacts of implementing the **ERP** and **Conveyance Facilities** under Variation 2B would be the same as under Variation 2A, and the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2B.

Variation 2C - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP** under Variation 2C would be similar to Variation 1A except that some restored shallow-water habitat areas would be located in the East Delta and restored and enhanced habitat areas identified in the ERP for the South Delta (Phase 2 Alternative Descriptions) located near the proposed new diversions would be relocated to the northern and western Delta.

Storage Facilities would be tied in with the 15,000 cubic feet per second cfs western conveyance facility. For example, if Holland Tract would be selected for this purpose it would potentially affect 600-700 acres of **natural communities** including emergent wetland, riparian scrub, riparian wetland, grassland, and ruderal vegetation . The precise acreages that would actually be removed or disturbed would depend on the design of the storage facility. Approximately 4,200-4,400 acres of open-water habitat, varying in depth, would be created. Periodically, seasonal wetland and mudflats would potentially be supported in the Delta Region storage facility, which would temporarily support shorebirds and water fowl. In addition, a 500-foot-wide zone on the eastern side of Holland Tract would be dedicated to conveyance.

If storage facilities were to be sited on Holland Tract, approximately 3,500-3,700 acres of **agricultural lands** would be affected.

Construction of western, northern, and eastern South Delta intakes and isolated **Conveyance Facility** channels would potentially disturb and remove **natural communities**, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation.

Construction of setback levees set approximately 500 feet back along the western side of Old River would potentially disturb and remove natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. New emergent wetland, riparian scrub, and woodland would be created. Approximately 500-600 acres of habitat would be created to include shallow open-water, emergent wetland, and riparian scrub and woodland. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

New herbaceous upland communities, including grassland and ruderal vegetation, would be created on the new levee slopes.

Potential impacts of a Clifton Court Forebay intake structure would be the same as under Variation 1C, and of CVP-SWP improvements would be the same as under Variation 1B.

Construction of western, northern, and eastern South Delta intakes and isolated conveyance channels, and the 500-foot setback levee along Old River, would remove approximately 900-1,100 acres of **agricultural lands**.

Potential impacts of a Clifton Court Forebay intake structure would be the same as under Variation 1C and of CVP-

SWP improvements would be the same as under Variation 1B.

The impacts of implementing the **Water Quality Program** and **Water Use Efficiency Programs** under Variation 2C would be the same as under Variation 1A. The impacts of implementing the **Levee System Integrity Program** under Variation 2C would be the same as under Variation 1A; however, the magnitude would be less because levees breached along the eastern side of the South Fork of the Mokelumne River would not be improved to reduce flood risk.

Variation 2C - Special-Status Species and Communities

Variation 2C water **Storage Facilities** would include 50,000 - 100,000 acre-feet of storage on a Delta island, resulting in the loss of approximately 600-700 acres of nonagricultural communities and 3,500 to 3,700 acres of agricultural habitat to flooding as described above. This loss of habitat could affect 11 special-status species as shown in Table 5-8. The following rare natural communities would also gain in acreage: valley freshwater marsh and Great Valley willow scrub. There would be no impact to significant natural areas.

Conveyance Facilities associated with Variation 2C include setback levees along the western side of Old River, and could affect eight special-status species (listed in Table 5-7) and four rare natural communities. There would be no impacts to significant natural areas. The impacts of implementing the **ERP** under Variation 2C would be the same as under Variation 2A, and the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 2D - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP** under Variation 2D would be similar to Variation 1A except that restored and enhanced habitat areas identified for the South Delta would be implemented as described in the ERP (Phase 2 Alternative Descriptions) and that a portion of shallow-water, tidal freshwater emergent wetland, and riparian habitats in the South Delta would be restored in association with setback levees along Old River.

Under **Conveyance Facilities** potential impacts of construction of an intake facility at Hood, an open channel from Hood to Lambert Road, a setback channel on Glanville Tract, and flooding of McCormack Williamson Tract on **natural terrestrial, riparian,** and **wetland communities** are described under Variation 2A.

Creation of a Mokelumne River Floodway and East Delta Wetlands Habitat would disturb and remove existing natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. However, approximately 15,000-16,000 acres of habitat would be created would include shallow open-water, emergent marsh, and riparian woodland and scrub. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

Table 5-8
Special-Status Species Potentially Adversely Affected by Proposed Storage Facilities - Delta Region

Species	Status			Alt. 1[a]			Alt. 2[a]					Alt 3[a]								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Animals																				
Buteo swainsoni Swainson's hawk	--	T	--														X			
Branchinecta lynchi Vernal Pool Fairy Shrimp	T	--																(+)		
Clemmys marmorata marmorata northwestern pond turtle	SC	--	--						(+)				(+)		(+)	(+)	X	(+)		(+)
Desmocerus californicus dimorphus valley elderberry longhorn beetle	T	--	--														(+)			
Grus canadensis tabida greater sandhill crane	--	T	--						(+)				(+)		(+)	(+)	(+)	(+)		(+)
Laterallus jamaicensis coturniculus California black rail	--	T	--						X				X		X	X	X	X		X
Thamnophis gigas giant garter snake	T	T	--						(+)				(+)		(+)	(+)	(+)	(+)		(+)
Plants																				
Aster lentus Suisun marsh aster	SC	--	1B						(+)				(+)		(+)	(+)	X	(+)		(+)
Carex comosa bristly sedge	--	--	2						(+)				(+)		(+)	(+)	(+)	(+)		(+)
Cirsium crassicaule slough thistle	SC	--	1B						(+)				(+)		(+)	(+)	(+)	(+)		(+)
Hibiscus lasiocarpus California hibiscus	--	--	2						X				X		X	X	X	X		X
Juglans hindsii N. Calif. black walnut	SC	--	1B														X			
Lathyrus jepsonii var. *jepsonii* Delta tule pea	SC	--	1B						(+)				(+)		(+)	(+)	X	(+)		(+)
Lilaeopsis masonii Mason's lilaeopsis	SC	R	1B						X				X		X	X	X	X		X
Limosella subulata Delta mudwort	--	--	2						(+)				X		X	X	X	X		(+)
Scutellaria galericulata marsh skullcap	--	--	2														X			
Tropidocarpum capparideum caper-fruited tropidocarpum	SC	--	1A														X			
Total Special-Status Species:									11				11		11	11	16	11		11
Vernal Pool Special-Status Species Habitat (acres)[b]	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 5-8 (concluded)

Species Common Name	Status			Alt. 1[a]			Alt. 2[a]					Alt 3[a]								
	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I

Notes:

[a] No storage components are associated with Alternatives 1, 2A-2B, 2D-E, 3A, 3C, and 3H

[b] Vernal pool special-status species landscape includes the watershed areas that support several of the species indicated in this table. The database used for estimating acres affected is Holland (1997), a more accurate database than the NDDB database used for evaluating presence of individual species.

Source: California Natural Diversity Data Base (NDDB 1997)

Symbols:

X = indicates a known occurrence of a species within the footprint of an alternative

(+) = indicates a presumed occurrence of a species based on the likely presence of suitable habitat

Status Abbreviations:

Federal (NDDB 1997)
E = endangered
T = threatened
C = candidate
SC = species of concern

State (NDDB 1997)
E = endangered
T = threatened
R = rare

CNPS (Skinner and Pavlik 1994)
1A = presumed extinct
1B = species that are rare, threatened, or endangered throughout their range
2 = species that are rare, threatened, or endangered in California but more common elsewhere

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Construction of setback levees along Old River on Palm Tract, Orwood Tract, Byron Tract, and Virginia Island set approximately 3,000 feet back from the channel would disturb and remove existing natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation, and result in approximately 100-200 acres of habitat that would include open-water, emergent wetland, and riparian scrub and woodland. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

Potential impacts of an operable barrier at the head of Old River and a new Clifton Court Forebay intake structure are described under Variations 1B and 1C, respectively.

Potential impacts on **agricultural lands** of construction of an intake facility at Hood, an open channel from Hood to Lambert Road, a setback channel on Glanville Tract, and flooding of McCormack Williamson Tract are described under Variation 2A.

Creation of a Mokelumne River Floodway and East Delta Wetlands Habitat would remove up to approximately 13,000-15,000 acres of agricultural communities. Construction of setback levees along Old River would remove approximately 2,600 to 2,900 acres of agricultural communities.

Potential impacts of an operable barrier at the head of Old River and a new Clifton Court Forebay intake structure are described under Variations 1B and 1C, respectively.

The **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2D.

Variation 2D - Special-Status Species and Communities

The impacts of implementing the **ERP** under Variation 2D would be the same as under Variation 2A.

Variation 2D includes the following **Conveyance Facilities** that would impact special-status species and communities: setback levee along the eastern side of Snodgrass Slough, flooding of McCormack Williamson Tract, setback levees on New Hope Tract, flooding of Canal Ranch or Brack Tracts, setback levees on Terminous Tract, setback levees on Staten Island, flooding portions of Bouldin Island, and setback levees along Old River. Variation 2D could impact 14 special-status species (listed in Table 5-7) and 4 rare natural communities. Impacts to significant natural areas would depend on the location and alignment of Variation 2D features.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 2D would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2D.

Variation 2E - Plant Communities and Associated Wildlife

A Mokelumne River Floodway and East Delta Wetlands Habitat would be constructed the same as under Variation 2D, except for the addition of the flooding of Tyler Island. The construction of the Floodway and Wetlands Habitat would disturb and remove existing **natural communities**, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. However, a total of 14,000-16,000 acres of habitat would be created that would include shallow open-water, emergent marsh, and riparian woodland and scrub. The created acreage of wetland and riparian communities is expected to exceed the affected existing acreage.

Flooding of Tyler Island would create approximately 8,000-9,000 acres of habitat, which could include shallow open-water, emergent wetland, and riparian scrub and woodland. Removal of existing levee sections would remove and disturb existing natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation.

The created acreage of wetland and riparian communities is expected to exceed the affected existing acreage. New grassland and ruderal communities would establish on the new levee slopes.

Potential impacts of South Delta habitat modifications and CVP-SWP are described under Variation 1C.

The Mokelumne River Floodway and East Delta Wetlands Habitat and flooding of Tyler Island would remove approximately 21,000-23,000 acres of **agricultural lands**.

Potential impacts of South Delta habitat modifications and CVP-SWP are described under Variation 1C.

The impacts of implementing the **ERP** under Variation 2E would be the same as under Variation 2D, and the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2E.

Variation 2E - Special-Status Species and Communities

The impacts of implementing the **ERP** under Variation 2E would be the same as under Variation 2D.

Conveyance Facilities associated with Variation 2E that would affect special-status species and communities include setback levees along Georgiana Slough, flooding of Tyler Island and McCormack Williamson Tract, setback levees on New Hope Tract, flooding of Canal Ranch or Brack Tracts, setback levees on Terminous Tract, setback levees on Staten Island, flooding of a portion of Bouldin Island, and setback levees along Old River. Variation 2E could impact 14 special-status species (listed in Table 5-7) and four rare natural communities. The number and location of significant natural areas that could be impacted would depend on the location and alignment of Variation 2E features.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 2E would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 2E.

5.2.4 Alternative 3 Impact Evaluation by Variation - Delta Region

Variation 3A - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP** under Variation 3A would be similar to Variation 1A except that all restored shallow-water habitat areas would be located in the East Delta and restoration along the North Fork of the Mokelumne River would be limited to establishing a riparian-habitat corridor associated with setback levees.

Under **Conveyance Facilities** the impacts of North Delta channel modifications would be the same as under Variation 2A. The impacts of South Delta Modifications and CVP-SWP improvements would be the same as under Variation 1C.

A 45-mile, isolated open channel facility would be constructed along the eastern side of the Delta. The channel would include an intake facility at Hood, a Highway 160 bridge relocation site, a fish bypass structure, a pumping plant, access roads, staging areas, and outlet facilities. Potential impacts associated with the intake facility and fish bypass structure are described under Variation 2A.

Construction of the isolated conveyance facility would potentially disturb and remove **natural communities**, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. The acreage of nonagricultural communities removed was estimated as approximately 100-200 acres. The precise area of affected plant communities would depend on the design and location of the facilities.

Potentially affected common plant species would include Fremont cottonwood, willow species, box elder, western sycamore, blackberry, common tule, and cattails. Potentially affected common wildlife species would include wetland and riparian species listed in Attachment A.

Permanent direct impacts to large riparian areas and associated wetlands at major stream crossings would be avoided by properly designed siphons, but construction of the siphons could disturb riparian scrub and woodland and emergent wetland and associated wildlife.

Construction of the isolated open channel facility would potentially result in removal and temporary disturbance of **agricultural lands** at the intake facility, at the Highway 160 bridge relocation site, at the fish bypass structure, at the pumping plant, along the 45-mile channel, along access roads, at staging areas, and at a buried outlet. The potentially impacted acreage of agricultural communities was estimated as approximately 700-900 acres. The precise affected area would depend on the design of the facilities.

The impacts of the North Delta channel modifications would be the same as described under Variation 2A.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 3A would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 3A.

Variation 3A - Special-Status Species and Communities

This shift from agricultural lands to natural plant communities in the Delta as a result of implementation of the **ERP** would result in a benefit to all 34 special-status species listed in Table 5-6. Although the loss of agricultural lands could have a negative impact on the foraging areas of the Swainson's hawk, there would be a net overall beneficial impact, since the primary limiting factors for this species, nesting/roosting trees, would be increased by the ERP.

Eleven rare natural communities and 29 significant natural areas (Section IV of Affected Environment Technical Report) occur or have the potential to occur in the Delta. The ERP would have an overall positive impact to these communities. While some communities could suffer because of immediate construction activities, such as disturbance of Great Valley willow scrub due to construction of levee setbacks, a long-term gain is expected over the life of the project as the old levees are allowed to revegetate naturally.

Variation 3A **Conveyance Facilities** would include a new levee set back 500 feet from the existing Mokelumne River channel converting agricultural lands into open-water and freshwater emergent marsh plant communities. The old levee would be breached and would create channel islands with new riparian and freshwater emergent marsh plant communities. In addition, Variation 3A would include a new channel to be constructed from Hood to Clifton Court forebay, which would result in a loss of agricultural community. The acreage of loss for the conveyance features would depend on location and alignment of each feature. Variation 3A could impact 15 special-status species (listed in Table 5-7), and the valley freshwater marsh and Great Valley willow scrub rare natural communities. However, during the life of the project Variation 3A could benefit all the special-status species and rare natural communities as the vegetation along the setback levees matures. The extent to which Variation 3A would impact significant natural areas would depend on the location and alignment of the features.

The impacts of implementing the **Water Quality Program, Water Use Efficiency Program,** and **Levee System Integrity Program** under Variation 3A would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 3A.

Variation 3B - Plant Communities and Associated Wildlife

Construction of a 200,000 acre-foot in-Delta **Storage Facility** under Variation 3B would remove and disturb **natural communities,** which could include

emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. Specific affected acreages would be dependent on the size and location of the storage facility. Approximately 10,000 acres of open-water habitat of varying depth would be created. Periodically, seasonal wetland and mudflats would potentially be supported in the Delta Region storage facility, which would temporarily support shorebirds and waterfowl.

A 200,000 acre-foot storage facility in the Delta Region would potentially remove approximately 10,000 acres of **agricultural lands**.

The impacts of implementing the **ERP** and **Conveyance Facilities** under Variation 3B would be the same as under Variation 3A, and the **Water Quality Program**, **Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3B - Special-Status Species and Communities

Up to 200,000 acre-feet of **Storage Facilities** would be provided in the Delta Region. This surface storage could impact up to 11 special-status species (listed in Table 5-8) depending on the location of the storage facility. There could also be a gain in acreage of the following rare natural communities: valley freshwater marsh and Great Valley willow scrub. The significant natural areas in the central Delta could be impacted depending on the location of the storage facilities.

The impacts of implementing the **ERP** and **Conveyance Facilities** under Variation 3B would be the same as under Variation 3A, and **Water Quality Program**, **Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3C - Plant Communities and Associated Wildlife

Conveyance Facilities under Variation 3C would be the same as under Variation 3A, except that in addition a 45-mile-long, 18-foot-diameter pipeline would be constructed along the eastern side of the Delta. The pipeline facility would include an intake facility at Hood, a Highway 160 bridge relocation site, a fish bypass structure, a pumping plant, buried pipe, conveyance links to the San Francisco Bay Area and areas east of the Delta, access roads, staging areas, and a buried outlet. Potential impacts associated with the intake facility and fish bypass structure are described under Variation 2A. Construction of the isolated conveyance facility would potentially disturb and remove **natural communities**, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. The acreage removed was estimated as approximately 100-200 acres. The precise acres of affected plant communities would depend on the design and location of the facility.

Permanent direct impacts to large riparian areas and associated wetlands that line Stone Lake, sloughs, and rivers that are crossed by the pipe would be avoided by properly designed siphons, but construction of the siphons could disturb riparian scrub and woodland and emergent wetland and associated wildlife.

Construction of the pipeline facility would potentially result in removal and temporary disturbance of **agricultural lands** at the intake facility, at the Highway 160 bridge relocation site, at the fish bypass structure, at the pumping plant, along the 45-mile pipeline and conveyance links to the San Francisco Bay Area and areas east of the Delta, along access roads, at staging areas, and at a buried outlet. The potentially impacted acreage was estimated as approximately 700-900 acres. The precise affected area would depend on the design of the facilities.

The impacts of implementing the **ERP** under Variation 3C would be the same as under Variation 3A, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 3C.

Variation 3C - Special-Status Species and Communities

Variation 3C **Conveyance Facilities** could impact 12 special-status species (listed in Table 5-7). The elimination of the aboveground channel with an underground pipe would greatly reduce the impacts to the agricultural community in the eastern Delta. This would reduce but not eliminate the impacts to those special-status species such as Swainson's hawk found in agricultural communities.

The impacts of implementing the **ERP** under Variation 3C would be the same as under Variation 3A, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 3C.

Variation 3D - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP** under Variation 3D would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B, **Conveyance Facilities** would be the same as under Variation 3B, except for potential impacts of the facilities associated with the pipeline described under Variation 3C, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3D - Special-Status Species and Communities

Variation 3D **Conveyance Facilities** could impact 15 special status species (Table 5-7). The impacts of implementing the **ERP** under Variation 3D would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3E - Plant Communities and Associated Wildlife

Potential impacts under Variation 3E **Conveyance Facilities** of the North Delta channel modifications would be the same as under Variation 2A, of an operable

barrier at the head of Old River and CVP-SWP improvements would be the same as under Variation 1B, of the Clifton Court Forebay intake structure would be the same as under Variation 1C, and of the 15,000 cfs open channel facility would be similar to Variation 3A.

The impacts of implementing the **ERP** under Variation 3E would be the same as under Variation 3B, **Storage Facilities** would be the same as under Variation 3B, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3E - Special-Status Species and Communities

Variation 3E **Conveyance Facilities** could impact 14 special-status species (listed in Table 5-7), the **ERP** would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3F - Plant Communities and Associated Wildlife

Under Variation 3F **Conveyance Facilities** connected chain of up to eight flooded Delta islands and associated facilities would transfer water from the Sacramento River to Clifton Court Forebay. For example, an isolated facility created by flooding of up to 36,000-37,000 acres of land consisting of major portions of Tyler, Bouldin, Venice, Mandeville, Bacon, Woodward, and Victoria islands would result in removal of approximately 2,000-4,000 acres of nonagricultural habitat within the island levees. **Natural communities**, such as wetlands, riparian scrub, and woodland, and grassland and ruderal vegetation, would also be removed. Additional natural communities would potentially be disturbed or removed by construction of additional facilities including enlargement of the Delta Cross Channel, and construction of pump stations, new bridges, and roadways.

Up to approximately 36,000-37,000 acres of open-water habitat of varying depths would be created.

Potential impacts on an operable barrier or equivalent at the head of Old River would be the same as under Variation 1B, of CVP-SWP improvements would be the same as under Variation 1C, and of North Delta channel modifications would be the same as under Variation 2A.

Flooding of major portions of Tyler, Bouldin, Venice, Mandeville, Bacon, Woodward, and Victoria islands would remove up to 34,000-36,000 acres of **agricultural lands**.

Potential impacts on agricultural communities of an operable barrier or equivalent at the head of Old River would be the same as under Variation 1B, of CVP-SWP improvements would be the same as under Variation 1C, and of North Delta channel modifications would be the same as under Variation 2A.

The impacts of implementing the **ERP** under Variation 3F would be the same as under Variation 3A, **Storage Facilities** are described under Conveyance Facilities

above, as the isolated island conveyance facilities also function as storage facilities, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3F - Special-Status Species and Communities

The Chain of Lakes **Storage Facility** would result in the loss of existing habitat on Tyler, Venice, Mandeville, Bacon, Woodward, and Victoria islands. The loss would be primarily to agricultural community but losses would also occur to riparian, grassland, and freshwater emergent marsh plant communities. This could negatively impact 16 special-status species (See Table 5-8) and valley freshwater marsh and Great Valley willow scrub, two rare natural communities. This configuration could also impact 8 of the 29 significant natural areas in the Delta Region.

The isolated island **Conveyance Facilities** would impact 6 special-status species (Table 5-7). The conveyance features of Variation 3F would include a new levee set back 500 feet from the existing Mokelumne River channel, converting agricultural lands into open-water and freshwater emergent marsh plant communities, and siphons connecting the Chain of Lakes. The old levee would be breached and would create channel islands with new riparian and freshwater emergent marsh plant communities. Variation 3F would also create new valley freshwater marsh and Great Valley willow scrub rare natural communities. Impacts to special-status species and communities resulting from the Chain of Lakes storage features are presented under Storage Facilities.

The impacts of implementing the **ERP** under Variation 3F would be the same as under Variation 3A, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3G - Plant Communities and Associated Wildlife

Variation 3G would have a **Conveyance Facility** that includes the Deepwater Ship Channel, a West Delta pipeline, and an open channel.

Construction of facilities at the Deep Water Ship Channel, including a pumping plant, new levees, a sedimentation basin, a fish bypass system, a control building, access roads, locks, and a rock dam would potentially remove and disturb **natural communities**, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation.

In addition, construction of the West Delta pipeline from Sacramento River Mile 19 to Brentwood and the open channel from Brentwood to Clifton Court Forebay would potentially remove and disturb natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. The affected acreage of nonagricultural communities was estimated as approximately 400-600 acres. The actual acreage and composition of the impact would depend on the design and location of the facilities.

Potential impacts of North Delta Channel modifications would be the same as under Variation 2A, and of South Delta modifications and CVP-SWP improvements would be the same as under Variation 1C.

Construction of facilities associated with operation of the Deepwater Ship Channel as a 5,000 cfs screened conveyance facility and construction of a West Delta pipeline and open channel would remove approximately 300-500 acres of **agricultural lands**. The precise affected acreage would depend on the design and location of the facilities.

Potential impacts of North Delta Channel modifications would be the same as under Variation 2A, and of South Delta modifications and CVP-SWP improvements would be the same as under Variation 1C.

The impacts of implementing the **ERP** under Variation 3G would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3G - Special-Status Species and Communities

The impacts under Variation 3G would be the same as under Variation 3A except for the replacement of the isolated **Conveyance Facility** with a combination of using the existing Sacramento Ship Channel and a pipeline around the western Delta. Variation 3G could impact 25 special-status species (listed in Table 5-7) since the alignment would take the pipeline through several significant natural areas. The exact number and location of the significant natural areas impacted would depend on the location and exact alignment of the pipeline.

The impacts implementing the **ERP** under Variation 3G would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

Variation 3H - Plant Communities and Associated Wildlife

Under Variation 3H **Conveyance Facilities** the impacts of the Mokelumne River Floodway and East Delta wetlands habitat and South Delta habitat modifications would be the same as under Variation 2D, of the open channel isolated facility would be the same as under Variation 3E, and of CVP-SWP improvements would be the same as under Variation 1C.

The impacts of implementing the **ERP** under Variation 3H would be the same as under Variation 2D, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta Region under Variation 3H.

Variation 3H - Special-Status Species and Communities

Variation 3H would include isolated **Conveyance Facilities** in the southern and northern Delta areas. Other conveyance features would include the construction of a Mokelumne River floodway, East Delta Wetlands, and South Delta habitat modifications. Some of the beneficial impacts of these features are described under Storage Configuration for Variation 3H. These features could impact 16 special-status species (listed in Table 5-7).

The impacts of implementing the **ERP** under Variation 3H would be the same as under Variation 3A. **The Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the Delta under Variation 3H.

Variation 3I - Plant Communities and Associated Wildlife

Under Variation 3I **Conveyance Facilities** the potential impacts of the western and southern South Delta intakes and conveyance channels on **natural communities** would be the same as under Variation 2C.

The northern isolated Sacramento River intake and conveyance channel would include a screened intake at Hood and an open 15,000 cfs conveyance channel from Hood to the diversion on the San Joaquin River. The potential impacts of this facility in combination with the eastern South Delta intake and conveyance facility would be the same as the potential impacts of the 15,000 cfs isolated facility described under Variation 3E, except for additional potential impacts of the intake facility on the San Joaquin River. This intake facility could include a low lift pumping facility and other structures. These facilities would potentially disturb and remove natural communities, which could include emergent wetland, riparian scrub and woodland, and grassland and ruderal vegetation. The affected acreages would depend on the design and location of the facilities.

Potential impacts of CVP-SWP improvements would be the same as under Variation 1B, and of the Clifton Court Forebay intake structure would be the same as under Variation 1C.

The potential impacts of the western and southern South Delta intakes and conveyance channels on **agricultural lands** would be the same as under Variation 2C.

The potential impacts of the northern isolated Sacramento River facility in combination with the eastern South Delta intake and conveyance facility would be the same as the potential impacts of the isolated facility described under Variation 3E, except for additional potential impacts of the intake facility on the San Joaquin River. This facility would potentially remove agricultural communities. The affected acreage would depend on the design and location of the facilities.

Potential impacts of CVP-SWP improvements would be the same as under Variation 1B, and of the Clifton Court

Forebay intake structure would be the same as under Variation 1C.

The types of impacts on plant communities and associated wildlife associated with implementing the **Levee System Integrity Program** under Variation 3I would be the same as under Variation 1A; the magnitude, however, would be less because levees breached along the eastern side of the South Fork of the Mokelumne River would not be improved to reduce flood risk.

The impacts of implementing the **ERP** and **Storage Facilities** under Variation 3I would be the same as under Variation 2C, if the storage facility were located on Holland Tract, and the **Water Quality Program** and **Water Use Efficiency Program** would be the same as under Variation 1A.

Variation 3I - Special-Status Species and Communities

Variation 3I would include the construction of isolated channels in the southern Delta and around the eastern Delta with no through Delta **Conveyance Facility**. Variation 3I would primarily impact the agricultural community with the potential to impact 13 special-status species (listed in Table 5-7). Variation 3I could also impact many of the significant natural areas in the southern Delta area. The exact number would depend on location and alignment of the features.

The impacts of implementing the **ERP** under Variation 3I would be the same as under Variation 3A, **Storage Facilities** would be the same as under Variation 3B if the facility was located on Holland Tract, and the **Water Quality Program, Water Use Efficiency Program**, and **Levee System Integrity Program** would be the same as under Variation 1A.

5.3 Environmental Impacts in the Bay Region

5.3.1 Summary of Regional Effects by Alternative

This section presents a summary of potential significant impacts, mitigation strategies, and unavoidable adverse impacts. Adverse impacts (called impacts) and beneficial impacts (called benefits) are numbered for ease in cross-referencing to Table 5-9, which summarizes and compares all impacts identified for each of the variations associated with Alternatives (i.e., 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, etc.). In text each adverse impact is followed by the appropriate mitigation strategy.

Table 5-10 summarizes the number of wildlife species and Table 5-11 summarizes the number of special-status species that could be adversely affected or that could benefit from decreases or increases, respectively, in the area or quality of open-water, wetland, riparian, upland habitats, and agricultural lands in the Bay Region with implementation of Alternatives 1, 2, or 3. The level of impact and benefit on terrestrial biological resources is the same for each Alternative, except that implementation of Alternative 3 would have additional impacts on native and agricultural habitats and associated wildlife as a result of construction of spur conveyance facilities from the Delta to the Bay Area.

Table 5-9
Summary of Impacts and Benefits for the Bay Region

CALFED Program	Impact Category		Impact/ Benefit	No Action Alterna-tive	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Common Programs	Habitat Area and Associated Wildlife	Impact 2.1	Temporary loss or disturbance of wetland and riparian communities		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 2.2	Potential for increased incidence of waterfowl disease		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Benefit 2.1	Increase in open-water and wetland communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 2.2	Increase in riparian communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Habitat Quality and Pattern	Benefit 2.3	Improved wetland habitat quality		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 2.4	Reduction in nonnative invasive plant abundance		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 2.5	Improved habitat patterns		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 2.6	Improved connectivity of riparian habitat		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Special-Status Species and Communities	Impact 2.3	Loss of foraging habitat for special-status species		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Benefit 2.7	Increase in habitats for special-status species		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 2.8	Expansion of rare natural communities and significant natural areas		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Conveyance	Habitat Area and Associated Wildlife	Impact 2.1	Temporary loss or disturbance of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 2.2	Potential for increased incidence of waterfowl disease		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.1	Increase in open-water and wetland communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
	Habitat Quality and Pattern	Benefit 2.3	Improved wetland habitat quality		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.4	Reduction in nonnative invasive plant abundance		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.5	Improved habitat patterns		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.6	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0

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Table 5-9 (continued)

CALFED Program	Impact Category		Impact/ Benefit	No Action Alterna-tive	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Conveyance (continued)	Special-Status Species and Communities	Impact 2.3	Loss of foraging habitat for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.7	Increase in habitats for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 2.8	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
Storage	Habitat Area and Associated Wildlife	Impact 2.1	Temporary loss or disturbance of wetland and riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Impact 2.2	Potential for increased incidence of waterfowl disease		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.1	Increase in open-water and wetland communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Habitat Quality and Pattern	Benefit 2.3	Improved wetland habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.4	Reduction in nonnative invasive plant abundance		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.5	Improved habitat patterns		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.6	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Special-Status Species and Communities	Impact 2.3	Loss of foraging habitat for special-status species		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.7	Increase in habitats for special-status species		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 2.8	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note:

U = Unknown impacts/benefits resulting from spur conveyance

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Table 5-10
Number of Wildlife Species Associated with Habitat Types Potentially Created, Improved, or Impacted with Implementation of Alternatives 1, 2, and 3 in the Bay Region

Habitat Type	Number of Associated Wildlife Species
Open Water[1]	50
Wetlands	
Seasonal Wetland[2]	71
Saline Emergent Wetland[3]	54
Wetland Subtotal	**82**
Valley Foothill Riparian	114
Grassland	79
Agricultural Lands[4]	109

Note: Numbers of species determined form Attachment A.
[1] Includes species listed in Attachment A under deep open-water and shallow open-water habitats.
[2] Includes species listed in Attachment A under agriculture-wetland and mudflat (nontidal species only) habitats.
[3] Includes species listed in Attachment A under saline emergent wetland and mudflat habitats.
[4] Includes species listed in Attachment A under agriculture-wetland and agriculture-upland habitats.

Table 5-11
Potentially Affected Special-Status Species - Bay Region

Species	Status		
Common Name	Fed. List	CA List	CNPS
Animals			
Agelaius tricolor tricolored blackbird	SC	--	--
Antrozous pallidus pallid bat	--	--	--
Aquila chrysaetos golden eagle	--	--	--
Ardea herodias great blue heron	--	--	--
Asio flammeus short eared owl	--	--	--
Athene cunicularia burrowing owl	--	--	--
Charadrius alexandrinus nivosus western snowy plover	T	--	--
Danaus plexippus monarch butterfly	--	--	--
Elanus leucurus white-tailed kite	--	--	--
Geothlypis trichas sinuosa saltmarsh common yellowthroat	SC	--	--
Laterallus jamaicensis coturniculus California black rail	SC	T	--
Lepidurus packardi vernal pool tadpole shrimp	E	--	--
Melospiza melodia maxillaris Suisun song sparrow	SC	--	--
Pandion haliaetus osprey	--	--	--
Pogonichthys macrolepidotus Sacramento splittail	PE	--	--
Rallus longirostris obsoletus California clapper rail	E	E	--
Rana aurora draytoni California red-legged frog	PE	--	--
Reithrodontomys raviventris salt marsh harvest mouse	E	E	--
Sorex ornatus sinuosus Suisun shrew	C	--	--
Sterna antillarum browni California least tern	E	E	--
Sterna caspia caspian tern	--	--	--
Syncaris pacifica California freshwater shrimp	E	E	--

Table 5-11 (continued)

Species	Status		
Common Name	Fed. List	CA List	CNPS
Plants			
Aster lentus Suisun marsh aster	SC	--	1B
Astragalus tener var tener alkali milk-vetch	--	--	1B
Atriplex depressa brittlescale	--	--	1B
Atriplex joaquiniana San Joaquin saltbush	SC	--	1B
Balsamorhiza macrolepis var macrolepis big-scale balsamroot	--	--	1B
Blepharizonia plumosa ssp plumosa big tarplant	--	--	1B
Calochortus pulchellus Mount Diablo fairy-lantern	--	--	1B
Castilleja affinis ssp neglecta Tiburon Indian paintbrush	E	T	1B
Cirsium hydrophilum var hydrophilum Suisun thistle	PE	--	1B
Cordylanthus mollis ssp hispidus hispid bird's-beak	SC	--	1B
Cordylanthus mollis ssp mollis soft bird's-beak	PE	R	1B
Delphinium recurvatum recurved larkspur	SC	--	1B
Downingia pusilla dwarf downingia	C3	--	2
Fritillaria liliacea fragrant fritillary	SC	--	1B
Hemizonia parryi ssp congdonii Congdon's tarplant	C	--	1B
Isocoma arguta Carquinez goldenbush	SC	--	1B
Lasthenia conjugens Contra Costa goldfields	PE	--	1B
Lathyrus jepsonii var jepsonii delta tule pea	SC	--	1B
Lilaeopsis masonii Mason's lilaeopsis	SC	R	1B
Limosella subulata delta mudwort	--	--	2
Madia radiata showy madia	--	--	1B

Table 5-11 (continued)

Species	Status		
Common Name	Fed. List	CA List	CNPS
Monardella villosa ssp globosa round-head coyote mint	--	--	1B
Oenothera deltoides ssp howellii Antioch dunes evening-primrose	E	E	1B
Polygonum marinense Marin knotweed	SC	--	3
Senecio aphanactis Rayless ragwort	--	--	2
Trifolium amoenum showy Indian clover	PE	--	1B
Total Special-Status Species:			
Vernal Pool Special-Status Species Habitat (acres)[a]	NA	NA	NA

Notes:

[a] Vernal pool special-status species landscape includes the watershed areas that support several of the species indicated in this table. The database used for estimating acres affected is Holland (1997), a more accurate database than the NDDB database used for evaluating presence of individual species.

Source: California Natural Diversity Data Base (NDDB 1991)

Symbols:

X = indicatesoccurrences of potential occurences of species that could be present if spur conveyance is constructed. Impacts would occur in lowland habitats such as wetlands, riparian, etc.

Status Abbreviations:

Federal (NDDB 1997)
E = endangered
T = threatened
PE = proposed endangered
C = candidate
SC = species of concern
C3 = common

State (NDDB 1997)
E = endangered
T = threatened
R = rare

CNPS (Skinner and Pavlik 1994)
1B = species that are rare, threatened, or endangered throughout their range
2 = species that are rare, threatened, or endangered in California but more common elsewhere
3 = species where more information is needed to determine listing

Alternative 1 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Implementation of the ERP under Alternative 1 could result in a potential increase in native plant communities up to approximately 23,000 acres and would result in the loss of agricultural lands and temporary loss of native communities as a result of habitat restoration activities.

Impact 2.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Wetland and riparian communities would be temporarily lost or degraded as a result of implementation of the ERP. Temporary decreases in area of disturbance to these communities could adversely affect approximately 82 species of wetland- and 114 species of riparian-associated wildlife in the Bay Region. Therefore, this impact is considered significant.

Mitigation 2.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on wetland and riparian communities could include:

- Avoiding wetland and riparian habitats
- Initially implementing the ERP, to the extent feasible, to restore sufficient wetland and riparian habitats in nonwetland/riparian habitat areas before or at the time that project impacts associated with the ERP are incurred to offset temporary habitat losses
- Restoring wetland and riparian vegetation temporarily disturbed by on-site restoration activities immediately following construction

Impact 2.2: Potential for Increased Incidence of Waterfowl Disease. Implementation of the ERP would restore and enhance up to approximately 7,000 acres of seasonal wetlands in the Bay Region. These wetlands are expected to substantially increase the abundance and availability of forage for wintering waterfowl. Substantial increases in wintering waterfowl habitat could increase the numbers of waterfowl that winter in the Suisun Marsh/Bay and San Pablo Bay areas. Substantial increases in wintering populations could result in concentrating large numbers of waterfowl in foraging habitat areas, potentially increasing the existing rate of waterfowl moralities attributable to botulism, avian cholera, and other waterfowl diseases within a larger segment of the Pacific Flyway waterfowl population. It is likely that sufficient waterfowl foraging habitat would be restored to meet or exceed the needs of wintering waterfowl populations, reducing the likelihood that catastrophic disease outbreaks would occur from overcrowding of waterfowl as a result of limited availability of foraging habitat area. However, because the distribution of wintering waterfowl in foraging habitats in future years is unpredictable, this impact is considered significant.

Mitigation 2.2: Potential for Increased Incidence of Waterfowl Disease. Potential mitigation strategies for reducing the potential for increased incidence of waterfowl diseases could include:

- Monitoring waterfowl use of restored and enhanced wetlands to locate incidences of waterfowl disease moralities
- Removing carcasses from affected restored and enhanced wetlands to reduce the rate of disease transmission
- Hazing waterfowl from restored and enhanced wetlands affected by disease outbreaks to reduce the likelihood of disease transmission
- Where feasible and consistent with habitat restoration objectives, designing wetlands to allow for rapid dewatering during disease outbreaks to discourage use of the affected habitat area by waterfowl

Benefit 2.1: Increase in Open-Water and Wetland Habitat Area. Implementation of the ERP would substantially increase the area of wetland habitats in the Bay Region. Increases in open-water and wetland habitats would benefit approximately 50 species of open-water- and 82 species of wetland-associated wildlife in the Bay Region. Specific benefits would include increased availability of suitable breeding and/or foraging habitat for waterfowl and other water birds, shorebirds, and wading birds dependent on the Delta. Therefore, this impact is considered beneficial.

Benefit 2.2: Increase in Riparian Communities. Implementation of the ERP would substantially increase the area of riparian habitats in the Bay Region. Increases in riparian habitats could benefit approximately 114 species of wildlife in the Bay Region. Specific benefits would include increased availability of suitable breeding and/or foraging habitat for neotropical migrant songbirds, raptors, egrets and herons, woodpeckers, deer, furbearers, and riparian associated reptiles and amphibians dependent on the Delta. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 1, the quality and pattern of native habitats would be substantially improved with full implementation of the ERP.

Benefit 2.3: Improved Wetland Habitat Quality. Implementation of the ERP would improve the quality of up to 14,000 acres of existing degraded diked saline emergent and seasonal wetland habitat areas. Improved wetland habitat quality could benefit approximately 81 species of wildlife in the Bay Region. This impact is considered beneficial.

Benefit 2.4: Reduction in Nonnative Invasive Plant Abundance. Implementation of the ERP would result in reductions of nonnative and invasive plants in existing open-water and riparian habitats. Open-water habitats that are currently covered by mat-forming aquatic plants provide relatively low wildlife values. Control or eradication of aquatic mat-forming plants would create open-water areas for use by water birds, allow native aquatic plants to establish, and improve the abundance and availability of associated forage for wildlife. Control or eradication of nonnative invasive plants in existing riparian habitats would increase habitat quality because treated habitats would increasingly become dominated by native plants as result of lessening competition with exotic species. Improved

habitat quality could benefit approximately 50 species of open-water and 114 species of riparian-associated wildlife in the Bay Region. Therefore, this impact is considered beneficial.

Benefit 2.5: Improved Habitat Patterns. Implementation of the ERP would create a more historic pattern of open-water, wetland, riparian, and grassland habitats in the Bay Region. Restoration of large tracts of wetlands among existing agricultural lands would also create a habitat pattern that would potentially increase the distribution in the Bay Region of wildlife that breed or rest in wetlands and forage in agricultural habitats by creating wetlands in closer proximity to agricultural lands. Therefore, this impact is considered beneficial.

Benefit 2.6: Improved Connectivity of Riparian Habitat. Implementation of the ERP would restore up to approximately 75 miles of riparian habitat along channels and sloughs. Restored habitat would increase the connectivity among existing fragmented riparian areas in the Bay Region. Establishment of more continuous habitat corridors would benefit wildlife, such as neotropical migrant birds, that require riparian vegetation for cover during migration or local movements, and would increase the potential for genetic interchange among currently isolated riparian wildlife populations. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 1, habitat alteration associated with implementation of the ERP would result in the loss of some agricultural lands, potentially impacting several special-status species (including white-tailed kite and burrowing owl) that use agricultural lands as foraging habitat. On the other hand, the habitat restoration and enhancement common programs, especially those under the ERP, would increase areas of riverine, riparian, and wetland communities. Also, rare natural communities and significant natural areas would benefit from increased consistency and quality of water resulting from implementation of the Water Quality Program and Water Use Efficiency Program.

Impact 2.3: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for species such as the white-tailed kite and the burrowing owl, would be lost due to inundation in order to create aquatic and riparian habitats (as stated under the ERP). Although these aquatic and riparian habitats would be beneficial to the white-tailed kite, the loss of agricultural lands used for foraging is still important. Therefore, this impact is considered significant.

Mitigation 2.3: Loss of Foraging Habitat for Special-Status Species. Potential mitigation strategies for reducing impacts caused by foraging habitat loss as a result of ERP implementation would include:

- Restoring or enhancing natural grasslands to serve as alternative foraging habitat over and above that restored as part of the ERP
- Avoiding inundation of lands that are of high forage value for special-status species when creating aquatic habitats

- Managing agricultural lands for multiple foraging special-status species (i.e., flooding agricultural lands in the fall to provide wintering waterfowl habitat, while leaving the fields drier in the spring and summer for other species to utilize)

Benefit 2.7: Increase in Habitats for Special-Status Species. Implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program would expand or improve aquatic, riparian, and some grassland habitats. These habitat improvements would benefit most of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 2.8: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Bay Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon, or occur exclusively in, the aforementioned habitat types. In addition, eradication of many nonnative invasive plants would return some areas to favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by the nonnative species. Therefore, this impact is considered beneficial.

Alternative 1 - Summary of Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified for Alternative 1.

Alternative 2 - Summary of Significant Impacts and Mitigation Strategies

Significant impacts and mitigation strategies under Alternative 2 would be the same as under Alternative 1.

Alternative 2 - Summary of Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified for Alternative 2.

Alternative 3 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area, Quality, Pattern, and Associated Wildlife. Impacts and mitigation strategies for habitat area, quality, pattern, and associated wildlife under Alternative 3 would be the same as under Alternative 1, except that additional areas of native plant communities and agricultural lands would be affected by construction of spur conveyance links to the Bay Area from the Delta. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction of spur conveyance facilities are unknown.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 3, implementation of the ERP would result in the loss of some agricultural lands as they are converted to wetland and shallow-water habitats. This loss could impact species that utilize agricultural areas as foraging habitat (e.g., white-tailed kite and burrowing owl).

The habitat restoration and enhancement programs associated with the ERP would increase areas of riverine, riparian, and wetland communities. In addition, rare natural communities and significant natural areas would benefit from increased consistency and quality of water resulting from implementation of the Water Quality Program and Water Use Efficiency Program. Mitigation strategies for special-status species and communities would be the same as under Alternative 1.

Impact 2.3: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for species such as the white-tailed kite and the burrowing owl, would be lost due to inundation in order to create aquatic and riparian habitats (as stated under the ERP). Although these aquatic and riparian habitats are beneficial to the white-tailed kite, the loss of agricultural lands used for foraging is still important. Therefore, this impact is considered significant.

Benefit 2.7: Increase in Habitats for Special-Status Species. Implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program would expand or improve aquatic, riparian, and some grassland habitats. These habitat improvements would benefit most of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 2.8: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Bay Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon, or occur exclusively in, the aforementioned habitat types. In addition, eradication of many nonnative invasive plants would return some areas to favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by the nonnative species. Therefore, this impact is considered beneficial.

Alternative 3 - Summary of Significant Unavoidable Impacts

Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts are identified under Alternative 3.

5.3.2 Alternative 1 Impact Evaluation by Variation - Bay Region

Variation 1A - Plant Communities and Associated Wildlife

Under Variation 1A, the **ERP** would be implemented in the Bay Region as described in Phase 2 Alternative Descriptions.

The ERP would result in a net increase in the following natural plant community types of up to 2,500 acres of shallow tidal perennial aquatic habitat, 12,000 acres of tidally influenced saline emergent wetland, 30 miles of tidally influenced sloughs and 500 acres of deep open-water areas within restored saline emergent wetlands, 4,000 acres of seasonal wetlands, 75 linear miles of riparian scrub (up to approximately 675 acres [assumes mean width of 75 feet]), and 4,000 acres of perennial grassland. The ERP would also improve management of 1,000 acres of existing, degraded, seasonal wetlands. Implementation of the ERP could affect up to approximately 14,5000 acres of existing diked saline emergent wetland as a result of restoring tidal flow. Other actions proposed in the ERP would primarily result in the loss of agricultural lands. Some existing wetland, riparian, and grassland habitats would be lost or converted to open-water or other natural plant communities.

Table 5-10 summarizes the number of wildlife species and Table 5-11 summaries the number of special-status species that could be temporarily adversely affected or that could benefit from decreases or increases, respectively, in the area or quality or open-water, wetland, riparian, grassland, and agricultural habitats in the Bay Region with implementation of the ERP. Typical wildlife species associated with plant communities of the Bay Region are presented in Attachment A.

Existing **natural terrestrial communities** such as grassland and ruderal habitats could be affected by restoration of seasonal wetland, riparian, and perennial grassland habitats. Potentially affected communities are generally dominated by exotic grasses and forbs and are typically associated with rangelands and abandoned agricultural lands. Potential direct impacts on these habitats would result primarily from seasonal flooding to restore seasonal wetlands. Conversion of existing annual grassland to perennial grassland would cause temporary ground disturbance, but improve habitat quality for native plants and wildlife. Relatively small grassland and ruderal habitat areas would potentially be affected by reestablishment of corridors of riparian habitat adjacent to water courses. Losses of grassland and ruderal habitats would be partially or completely offset by restoration of perennial grassland and the natural re-establishment of herbaceous vegetation along higher elevation margins of restored wetland and riparian habitats that are not farmed.

Approximately 700 acres of **riparian communities** such as scrub, woodland, and forest would be directly restored. Because the type of riparian community that would be restored is dependent on site-specific conditions, such as local hydrology and soils, the area of each type of riparian community that would be restored is not predictable. Little or no existing riparian vegetation is expected to

be directly impacted by implementation of the ERP because most restoration activities would occur in the Suisun Marsh and in existing or historic tidal wetland areas adjacent to San Pablo Bay where little or no riparian vegetation is present.

Restoration of riparian corridors along sloughs and channels would increase the connectivity among existing fragmented riparian areas in the Bay Region. Habitat values associated with increasing habitat area and improving habitat quality and pattern and as a result restoring riparian habitats are the same as described for restoration of riparian habitats in the Delta Region. The quality of existing riparian habitats that are treated to control exotic plant species would also increase because treated habitats would become increasingly dominated by native plants as a result of lessening competition with exotic species.

An unknown quantity of riparian vegetation would also naturally reestablish as a result of restoration of other habitat types. Riparian vegetation is expected to establish along the margins of restored tidal slough, shallow-water, and wetland habitat areas where salinity and soil moisture conditions are suitable to sustain riparian vegetation.

Up to approximately 19,500 acres of **open-water and wetland habitats** would be restored or enhanced under the ERP. Existing open-water and wetland habitats would be affected by restoration of tidal perennial aquatic, tidal slough, wetland, and riparian habitats. Affected wetlands are primarily diked saline emergent wetlands that are largely in agricultural land uses. Direct impacts would result from breaching or removal of dikes to restore tidal flows to historic saline emergent wetlands and periodic flooding of diked wetlands to restore seasonal wetland habitats.

Approximately 54 species associated with saline emergent wetlands could benefit from reestablishment of tidal flow to historic saline emergent wetlands (Table 5-10). An unpredictable quantity of tideflats would also be associated with restoration of saline emergent wetlands. Habitat values associated with increasing or enhancing tidal slough, seasonal wetland, tideflat, and tidal shallow open-water habitat areas are the same as described for restoration of these habitats in the Delta Region.

Major agricultural cover types include grain and hay crops, row crops, truck crops, pasture, and orchards and vineyards. An estimated 8,000 to 11,000 acres of agricultural lands could be lost as a result of implementation of the ERP. The impact of the loss of agricultural land on wildlife is dependent on the affected cover type and attendant land use practices. Approximately 109 species of wildlife are known to make use of agricultural lands in the Bay Region (Table 5-10). Habitat values associated with the loss of agricultural lands are similar to the Delta Region.

The impacts of implementing the **Water Quality Program** would be the same as under Variation 1A for the Delta Region. Specific actions that could affect plant communities and associated wildlife in the CALFED problem and solution areas are not identified for the **Water Use Efficiency Program**; therefore, the

potential impacts of the program cannot be determined. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variation 1A.

Variation 1A - Special-Status Species and Communities

The Bay Region is dominated by chaparral communities, and also contains coniferous forests, hardwood forests, riparian areas, beaches and cliffs, grasslands, and wetlands. Proposed habitat restoration under the **ERP** would contain several components. Substantial acreage of leveed land would be converted to tidal wetlands and shallow aquatic habitat. This habitat alteration would benefit most special-status species found in this region (Table 5-11) because many of these species inhabit emergent wetlands and riparian areas. Agricultural lands, some of which would be lost as a result of the ERP, provide foraging areas for the white-tailed kite and the burrowing owl. However, since the primary limiting factor for the white-tailed kite is nesting/roosting trees, there would be a net overall beneficial impact to this species. Other habitat restoration components would include protection and enhancement of agricultural land uses and practices that support wildlife, protection and enhancement of riverine habitats on channel islands, and restoration of riparian and shallow-water habitats along levees. These activities would have positive impacts on most if not all special-status species in the Bay Region.

Six rare natural communities and 26 significant natural areas (see Affected Environment Technical Appendix) occur or have the potential to occur in the Bay Region. These communities and significant natural areas support most of the special-status wildlife species, and would be positively impacted by the ERP in the long term by the expansion and direct restoration of suitable native habitat through the previously mentioned activities. Habitat restoration would have an additional positive impact in the region because it would provide contiguous tracts of habitat where only fragmented portions currently exist.

The **Water Quality Program** would improve water quality throughout the Bay Region by reducing mercury loadings, pesticide levels, urban contaminants, and oxygen depletion through improved management of discharges upstream. These improvements in water quality under Variation 1A would benefit most of the 48 special-status species either directly, by improving the health of individuals of the species, or indirectly by improving the quality of their habitat. Similarly, these water quality improvements are expected to positively impact the 6 rare natural communities and the 26 significant natural areas (see Affected Environment Technical Appendix) of the Bay Region.

The **Water Use Efficiency Program** includes plans whose goals are to reduce existing use and future demands on the state's limited water supply. However, some elements of the program are voluntary and some are already in use or planned as part of other programs, so the benefits that can be attributed to CALFED actions are limited. Therefore, to the extent that the Water Use Efficiency Program reduces existing water use and future demand, more water can be left in

Bay Region waterways, which would have positive or no impacts to special-status species as well as to rare natural communities and significant natural areas.

No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 1A.

Variations 1B-1C - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 1B-1C would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 1B-1C.

Variations 1B-1C - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 1B-1C would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 1B-1C.

5.3.3 Alternative 2 Impact Evaluation by Variation - Bay Region

Variations 2A-2E - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 2A-2E would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 2A-2E.

Variations 2A-2E - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 2A-2E would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 2A-2E.

5.3.4 Alternative 3 Impact Evaluation by Variation - Bay Region

Variations 3A-3I - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3A-3I would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Bay Region under Variations 3A-3I.

Variations 3A-3I - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3A-3I would be the same as under Variation 1A. No new **Storage** or **Conveyance**

Facilities would be planned for the Bay Region under Variations 3A-3I.

5.4 Environmental Impacts in the Sacramento River Region

5.4.1 Summary of Regional Effects by Alternative

This section presents a summary of potential significant impacts, mitigation strategies, and unavoidable adverse impacts. Adverse impacts (called impacts) and beneficial impacts (called benefits) are numbered for ease in cross-referencing to Table 5-12, which summarizes and compares all impacts identified for each of the variations associated with Alternatives (i.e., 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, etc.). In text each adverse impact is followed by the appropriate mitigation strategy.

Table 5-13 summarizes the number of wildlife species that could be adversely affected or that could benefit from decreases or increases, respectively, in the area or quality of open-water, wetland, riparian, and upland habitats in the Sacramento River Region with implementation of Alternatives 1, 2, or 3. The level of impact and benefits on terrestrial biological resources is the same for each Alternative.

Alternative 1 - Summary of Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Construction of storage facilities under Variation 1C could result in temporary and permanent loss or degradation of wetland, riparian, annual grassland, chaparral, valley foothill hardwood, and montane communities and agricultural lands as a result of inundation and construction of roads and other infrastructure assuming storage facilities are constructed in foothill habitats along the west side of the Sacramento Valley. The actual area and habitat types that would be affected by construction of surface and groundwater storage facilities, however, would depend on the siting, design, and operations of facilities. Implementation of the ERP under Alternative 1 would result in a potential increase of up to approximately 77,500 acres of riparian habitat and associated floodplain habitats (e.g., wetlands and open-water) and would result in the temporary or permanent loss of agricultural lands and native plant communities adjacent to the Sacramento River and its major tributaries.

Impact 3.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Wetland and riparian communities would be temporarily lost or degraded as a result of implementing the ERP. Temporary decreases in wetland and riparian habitat area could adversely affect approximately 93 species of wetland- and 181 species of riparian-associated wildlife in the Sacramento River Region (Table 5-13). Therefore, this impact is considered significant.

Mitigation 3.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Potential mitigation strategies for reducing temporary impacts on wetland and riparian communities associated with implementing the ERP could include:

Table 5-12
Summary of Impacts and Benefits for the Sacramento River Region

CALFED Program	Impact Category		Impact/ Benefit	No Action Alterna-tive	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Common Programs	Habitat Area and Associated Wildlife	Impact 3.1	Temporary loss or disturbance of wetland and riparian communities		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 3.2	Permanent loss of wetland and riparian communities		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Impact 3.3	Decrease in important deer and elk use areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Impact 3.4	Decrease in important wildlife habitats		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 3.1	Increase in open-water and wetland communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 3.2	Increase in riparian communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Habitat Quality and Pattern	Impact 3.5	Reduction in quality of wetland and riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 3.3	Improved riparian habitat quality		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 3.4	Improved habitat patterns		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 3.5	Improved connectivity of riparian habitat		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Special-Status Species and Communities	Impact 3.6	Loss of foraging habitat for special-status species		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 3.7	Loss of portions of rare natural communities and signficant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 3.6	Increase in habitats for special-status species		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit3.7	Expansion of rare natural communities and significant natural areas		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Conveyance	Habitat Area and Associated Wildlife	Impact 3.1	Temporary loss or disturbance of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 3.2	Permanent loss of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 3.3	Decrease in important deer and elk use areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 3.4	Decrease in important wildlife habitats		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.1	Increase in open-water and wetland communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
	Habitat Quality and Pattern	Impact 3.5	Reduction in quality of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.3	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.4	Improved habitat patterns		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.5	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0

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Table 5-12 (continued)

Conveyance (continued)	Special-Status Species and Communities	Impact 3.6	Loss of foraging habitat for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 3.7	Loss of portions of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.6	Increase in habitats for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 3.7	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
Storage	Habitat Area and Associated Wildlife	Impact 3.1	Temporary loss or disturbance of wetland and riparian communities		0	0	-	0	-	0	0	-	0	-	0	-	-	-	-	-	-
		Impact 3.2	Permanent loss of wetland and riparian communities		0	0	--	0	--	0	0	--	0	--	0	--	--	--	--	--	--
		Impact 3.3	Decrease in important deer and elk use areas		0	0	--	0	--	0	0	--	0	--	0	--	--	--	--	--	--
		Impact 3.4	Decrease in important wildlife habitats		0	0	--	0	--	0	0	--	0	--	0	--	--	--	--	--	--
		Benefit 3.1	Increase in open-water and wetland communities		0	0	++	0	++	0	0	++	0	++	0	++	++	++	++	++	++
		Benefit 3.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Habitat Quality and Pattern	Impact 3.5	Reduction in quality of wetland and riparian communities		0	0	--	0	--	0	0	--	0	--	0	--	--	--	--	--	--
		Benefit 3.3	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 3.4	Improved habitat patterns		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 3.5	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Special-Status Species and Communities	Impact 3.6	Loss of foraging habitat for special-status species		0	0	0	0	-	0	0	-	0	-	0	-	-	-	-	-	-
		Impact 3.7	Loss of portions of rare natural communities and significant natural areas		0	0	--	0	--	0	0	--	0	--	0	--	--	--	--	--	--
		Benefit 3.6	Increase in habitats for special-status species		0	0	+	0	+	0	0	+	0	+	0	+	+	+	+	+	+
		Benefit 3.7	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note:

U = Unknown impacts/benefits resulting from spur conveyance

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Table 5-13
Number of Wildlife Species Associated with Habitat Types Potentially Created, Improved, or Impacted with Implementation of Alternatives 1,2, and 3 in the Sacramento River Region

Habitat Type	Number of Associated Wildlife Species
Open Water[1]	49
Wetlands[2]	93
Riparian	
Valley Foothill Riparian	152
Montane Riparian	108
Subtotal	181
Grassland	80
Valley Foothill Hardwood	151
Montane Hardwood	66
Chaparral	67
Mixed Hardwood-Conifer	80
Ponderosa Pine	70
Agricultural Lands[3]	129

Note: Numbers of species determined form Attachment A.
1 Includes species listed in Attachment A under deep open-water and shallow open-water habitats.
2 Includes species listed in Attachment A under fresh emergent wetland, mudflat, and agriculture-wetland habitats.
3 Includes species listed in Attachment A under agriculture-wetland and agriculture-upland habitats.

- Avoiding wetland and riparian habitats
- Initially implementing the ERP, to the extent feasible, to restore sufficient riparian vegetation in nonwetland/riparian habitat areas before or at the time that project impacts associated with the ERP are incurred to offset temporary habitat losses
- Restoring wetland and riparian vegetation temporarily disturbed by on-site construction activities immediately following construction

Impact 3.2: Permanent Loss of Wetland and Riparian Communities. Wetland and riparian communities would be permanently lost or degraded as a result of construction and operation of storage facilities. Decreases in wetland and riparian habitat area could adversely affect approximately 93 species of wetland and 181 species of riparian associated wildlife in the Sacramento River Region (Table 5-13). Therefore, this impact is considered significant.

Mitigation 3.2: Permanent Loss of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on wetland and riparian communities associated with construction of storage facilities could include:

- Avoiding wetland and riparian habitats
- Restoring or enhancing sufficient in-kind wetland and riparian habitat area at off-site locations before or at the time that project impacts are incurred to offset habitat losses
- Restoring wetland and riparian vegetation temporarily disturbed by on-site construction activities immediately following construction

Impact 3.3: Decrease in Important Deer and Elk Use Areas. Construction and operation of storage facilities could result in the loss or degradation of CDFG-designated critical deer winter range and fawning habitat, tule elk calving habitat, and other important deer and tule elk use areas. Therefore, this impact is considered significant.

Mitigation 3.3: Decrease in Important Deer and Elk Use Areas. Potential mitigation strategies for reducing impacts on CDFG-designated critical deer winter range and fawning habitat, and tule elk calving habitat as a result of construction of storage facilities could include:

- Avoiding critical deer winter range and fawning habitat, and tule elk calving habitat
- Restoring habitat areas temporarily disturbed by on-site construction activities immediately following construction
- Restoring historic, but currently unsuitable, habitat areas within affected watersheds or other watersheds used by the affected deer or elk population if sufficient historic habitat for restoration is unavailable within the affected watershed
- Enhancing unaffected habitat areas within affected watersheds or other watersheds used by the affected deer or elk population if sufficient habitat for enhancement is unavailable within the affected watershed

Impact 3.4: Decrease in Important Wildlife Habitats. Construction of storage facilities could result in the loss of

important wildlife habitats, such as valley oak woodland, that are currently limited or declining locally or regionally in the Sacramento River Region. Therefore, this impact is considered significant.

Mitigation 3.4: Decrease in Important Wildlife Habitats. Potential mitigation strategies for reducing impacts on important wildlife upland habitat areas as a result of construction of storage facilities could include:

- Avoiding important wildlife habitat areas
- Restoring habitat areas temporarily disturbed by on-site construction activities immediately following construction
- Restoring historic, but currently unsuitable, habitat areas within affected watersheds or other watersheds if sufficient historic habitat for restoration is unavailable within the affected watershed
- Enhancing unaffected habitat areas within affected watersheds or other watersheds if sufficient habitat for enhancement is unavailable within the affected watershed

Benefit 3.1: Increase in Open-Water and Wetland Communities. Implementation of Alternative 1 would substantially increase the area of open-water in the Sacramento River Region as a result of construction of storage facilities. The area of seasonal open-water and wetlands could be increased as a result of increasing the frequency, duration, or amount of floodwater detained in overflow basins. Freshwater emergent wetlands could also increase as a result of actions that restore stream meander and floodplain processes. Increases in these communities could benefit approximately 49 species of open-water and 93 species of wetland-associated wildlife in the Sacramento River Region (Table 5-13). Therefore, this impact is considered beneficial.

Benefit 3.2: Increase in Riparian Communities. Implementation of the ERP would substantially increase the area of riparian habitats associated with the Sacramento River and its tributaries as a result of implementation of the ERP. Increases in valley foothill riparian habitats could benefit approximately 52 species of wildlife in the Sacramento River Region. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 1, the quality and pattern of riparian habitats would be substantially improved along the Sacramento River and some of its tributaries with implementation of the ERP. The quality and pattern of riparian and native terrestrial habitats could be substantially degraded as a result of the construction and operation of storage facilities.

Impact 3.5: Temporary Fragmentation of Riparian Habitats. Riparian habitats associated with levees and protected banks could be fragmented as a result of restoring stream meander corridors, overflow basins, and other features associated with the ERP. These impacts would be temporary until sufficient riparian corridor habitat necessary to offset impacts reestablishes following implementation of the ERP.

Mitigation 3.5: Temporary Fragmentation of Riparian Habitats. Potential mitigation strategies for reducing temporary impacts on riparian communities that could fragment riparian habitat corridors as a result of implementation of the ERP could include:

- Avoiding riparian vegetation
- Restoring riparian vegetation disturbed by on-site construction activities immediately following construction
- Initially implementing the ERP, to the extent feasible, to restore sufficient riparian vegetation in nonwetland/riparian habitat areas before or at the time that project impacts on riparian corridors associated with the ERP are incurred to offset temporary habitat losses

Impact 3.6: Permanent Fragmentation of Riparian Habitats. If off-stream storage reservoirs were constructed along streams supporting riparian vegetation, the reservoir inundation area would permanently fragment the existing riparian corridor. Therefore, this impact is considered significant.

Impact 3.7: Reduction in Quality of Wetland and Riparian Communities. Under Alternative 1, the quality of wetland and riparian communities downstream of proposed off-stream storage reservoirs could be reduced if the volume and timing of reservoir outflow changes sufficiently to affect the vigor, density, or species of riparian and wetland vegetation. Decreases in wetland and riparian habitat quality could adversely affect approximately 93 species of wetland- and 152 species of valley foothill riparian-associated wildlife in the Sacramento River Region (Table 5-13). Therefore, this impact is considered significant.

Mitigation 3.7: Reduction in Quality of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on the quality of wetland and riparian communities as a result of storage operations could include maintaining sufficient downstream flow to maintain the existing condition of wetland and riparian communities.

Benefit 3.3: Improved Riparian Habitat Quality. Implementation of the ERP would provide increased flows during some periods to the Sacramento River and some of its tributaries, and would reduce the abundance of nonnative invasive plants in existing riparian habitats along the Sacramento River. If flows are increased during the growing period of riparian vegetation and are of sufficient magnitude and duration, the vigor and density of riparian vegetation and ability of riparian vegetation to regenerate could be increased. Control or eradication of nonnative invasive plants in existing riparian habitats would increase habitat quality because treated habitats would increasingly become dominated by native plants as result of lessening competition with exotic species. Improved valley foothill riparian habitat quality could benefit approximately 152 species of wildlife in the Sacramento River Region (Table 5-13). Therefore, this impact is considered beneficial.

Benefit 3.4: Improved Habitat Patterns. Implementation of the ERP would create a more historic pattern of open-water, wetland, and riparian habitats

along the Sacramento River and some of its tributaries as a result of restoring stream channel meander and floodplain processes. Therefore, this impact is considered beneficial.

Benefit 3.5: Improved Connectivity of Riparian Habitat. Implementation of the ERP would restore or enhance up to approximately 77,000 acres of riparian habitat along the Sacramento River and its major tributaries. Restored habitat would increase the connectivity among existing fragmented riparian areas in the Sacramento River Region. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 1, habitat loss associated with construction of storage facilities within the Sacramento River Region could impact up to 31 special-status species, 6 rare natural communities, and 18 significant natural areas. Implementation of the ERP, which would result in the loss of large areas of agricultural lands as they are converted to wetland and shallow-water habitats, could adversely impact several special-status species (including Swainson's hawks) that are dependent upon such communities for foraging habitat. However, the common programs as a whole would expand many habitat types, mostly through restoration and enhancement programs associated with the ERP. These gains would benefit most of the Sacramento River Region's rare natural communities and significant natural areas.

Impact 3.8: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for species such as Swainson's hawk, would be lost due to inundation in order to create aquatic and riparian habitats (as stated under the ERP). Although these aquatic and riparian habitats are beneficial to the Swainson's hawk, the loss of agricultural lands used for foraging is still important. Therefore, this impact is considered significant.

Mitigation 3.8: Loss of Foraging Habitat for Special-Status Species. Potential mitigation strategies for reducing impacts caused by loss of agricultural foraging habitat in the Sacramento River Region would include:

- Restoring additional natural areas to serve as alternative foraging habitat over and above that restored as part of the ERP
- Restoring or enhancing natural foraging areas at other undisturbed grassland habitats
- Managing agricultural lands for multiple special-status species (i.e., flooding fields in the fall would provide habitat for wintering waterfowl, while leaving them drier in the spring and summer for other species to utilize)
- Maximizing the habitat quality of remaining agricultural lands through use of various wildlife-friendly techniques

Impact 3.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Construction of storage facilities could disturb or eliminate portions of rare natural communities and significant natural areas. Therefore, this impact is considered to be significant.

Mitigation 3.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Potential mitigation strategies for reducing impacts to rare natural communities and significant natural areas would include:

- Avoiding rare natural communities and significant natural areas altogether
- Restoring or enhancing disturbed rare natural communities or significant natural areas at other locations before or at the time that Levee System Integrity Program impacts are incurred
- Restoring rare natural communities or significant natural areas back into impacted locations once Levee System Integrity Program activities are completed

Benefit 3.6: Increase in Habitats for Special-Status Species. Implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program would expand or improve aquatic, riparian, and grassland habitats. In addition, aquatic and riparian habitats could be increased due to new surface storage. These changes would benefit the majority of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 3.7: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the Sacramento River Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon, or occur exclusively in, the aforementioned habitat types. In addition, the eradication of many nonnative invasive plants would return some areas to more favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment from the nonnative species. Therefore, this impact is considered beneficial.

Alternative 1 - Summary of Significant Unavoidable Impacts

Impacts to Habitat Area and Associated Wildlife.

Impact 3.6: Permanent Fragmentation of Riparian Habitats. Under Alternative 1, existing riparian habitat corridors could be permanently fragmented as a result of inundation of off-stream storage reservoirs, potentially blocking the movement and interchange of populations of some wildlife species from upper to lower watershed locations. This impact cannot be mitigated. Therefore, this impact is considered a significant unavoidable impact.

Impacts to Special-Status Species and Communities. Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts would be incurred by special-status species and communities under Alternative 1.

Alternative 2 - Summary of Significant Impacts and Mitigation Benefits

Significant impacts and mitigation strategies under Alternative 2 would be the same as under Alternative 1.

Alternative 2 - Summary of Significant Unavoidable Impacts

Significant unavoidable impacts under Alternative 2 would be the same as under Alternative 1.

Alternative 3 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Impacts and mitigation strategies for habitat area and associated wildlife under Alternative 3 would be the same as described under Alternative 1, except that additional areas of native plant communities and agricultural lands could be affected by construction of spur conveyance links from the Delta to areas east of the Delta. The number, siting, and design of these facilities have not been developed; therefore, impacts and mitigation strategies associated with construction of spur conveyance facilities are unknown.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Impacts and mitigation strategies for habitat quality and pattern under Alternative 3 would be the same as under Alternative 1.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Impacts and mitigation strategies for special-status species and communities under Alternative 3 would be the same as under Alternative 1.

Alternative 3 - Summary of Significant Unavoidable Impacts

Significant unavoidable impacts under Alternative 3 would be the same as under Alternative 1.

5.4.2 Alternative 1 Impact Evaluation by Variation - Sacramento River Region

Variation 1A - Plant Communities and Associated Wildlife

Under Variation 1A, the **ERP** would be implemented in the Sacramento River Region as described in Phase 2 Alternative Descriptions.

The ERP primary objective for the Sacramento Valley is to improve ecological processes and habitat conditions that are critical to sustaining and improving anadramous fish populations. Proposed program activities that affect terrestrial biological resources include restoration and protection of stream meander belts; maintaining or improving the floodwater and sediment detention and retention capacity of important hydrological basins; restoration of floodplain processes, such as overbank flooding of floodplains and stream channel migration; and restoration, enhancement, or protection of riparian vegetation to provide shaded riverine aquatic (SRA)

cover. Partial restoration of the ecological processes that sustain healthy riverine ecosystems on affected streams would result in a more natural pattern of stream channel migration, bank erosion, and overbank flooding that are important factors in maintaining healthy riparian and other associated floodplain habitats.

The ERP under Alternative 1 would result in the direct and indirect restoration, enhancement, or protection of up to an estimated 77,500 acres of riparian and associated floodplain habitats along the Sacramento River and its major tributaries. Improvements in riparian habitat would primarily result in the loss of agricultural and range lands adjacent to streams and rivers. A relatively small area of native plant communities could be temporarily or permanently affected by riparian habitat improvements, depending on the type of improvement actions that are implemented.

Typical wildlife species associated with plant communities of the Sacramento River Region are presented in Attachment A.

Implementation of the ERP would primarily affect **natural terrestrial communities** such as grassland and ruderal communities located adjacent to stream channels. Types of actions that could affect these communities include levee setbacks, modification of levee maintenance practices to increase the area and quality of riparian vegetation, modification of streamflows, and exclusion of livestock from stream channels and adjacent banks. Grassland and ruderal communities are generally dominated by exotic grasses and forbs and are typically associated with rangelands and abandoned agricultural lands. Potential direct impacts on these habitats that could be associated with levee setbacks and modification of levee maintenance practices are the same as those described for the Delta Region. Setting back levees, reducing the adverse effects of grazing along channels, and changing timing and magnitude of streamflows would change local ground and surface water hydrology. In some locations, these changes would potentially be sufficient to result in the gradual conversion of annual grassland to riparian and wetland communities.

Implementation of the ERP under Alternative 1 would result in the restoration, enhancement, or protection of up to an estimated 77,500 acres of riparian habitat. Because the type of **riparian community** that would be restored is dependent on site-specific conditions, such as local hydrology and soils, the area of each type of riparian community that would be restored is not predictable. Restoration of riparian habitats would primarily be achieved through restoration of floodplain processes that would create the conditions necessary for the natural reestablishment of riparian vegetation. In some portions of the Sacramento River Region, some existing riparian scrub, woodland, and forest could be affected by construction of levee setbacks.

Habitat values associated with increasing habitat area and improving habitat quality and pattern as a result restoring riparian habitats are the same as those described for restoration of riparian habitats in the Delta Region. The quality of existing riparian habitats that are treated to control

exotic plant species would also increase because treated habitats would become increasingly dominated by native plants as a result of lessening competition with exotic species.

Implementation of the ERP could increase the area of **open-water and wetland communities** associated with stream courses and flood basins in the Sacramento Region. Actions that restore channel meander could result in the creation of oxbow lakes in future years as channels migrate across their floodplains. Increasing the area over which floodwaters is detained, the amount of floodwater detained, or the frequency that floodwater is detained in overflow basins of the Sacramento River (e.g., the Yolo Bypass) would potentially increase the area of seasonal wetland and open-water habitats.

Habitat values associated with increasing habitat area and improving habitat quality and pattern as a result restoring open-water and wetland habitats are the same as those described for restoration of riparian habitats in the Delta Region.

Under Alternative 1 implementation of the ERP would restore up to 77,500 acres of riparian habitat and potentially increase the area, duration, or frequency of flooding in some basins. Restoration of riparian habitat would primarily affect **agricultural lands** associated immediately adjacent to the Sacramento River and its tributaries. Some riparian habitat would be restored within existing stream meander belts and along levees that are not in agricultural production. Changes to flood patterns in overflow basins could result in the permanent loss of agricultural lands or a change in agricultural cropping patterns and practices to accommodate changes in flood regimes.

Habitat values associated with the loss of agricultural lands is similar to that described for the Delta Region. Approximately 129 species of wildlife associated with agricultural lands in the Sacramento River Region would potentially be affected by implementation of the ERP.

The impacts of implementing the **Water Quality Program** would be the same as described under Variation 1A for the Delta Region. Specific actions that could affect plant communities and associated wildlife in the CALFED problem and solution areas are not identified for the CALFED **Water Use Efficiency Program**; therefore, the potential impacts of the program cannot be determined. No new **Storage** or **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1A.

Variation 1A - Special-Status Species and Communities

The lowland areas of the Sacramento River Region are dominated by agricultural land. Proposed habitat restoration in the region would permanently convert some agricultural land to natural plant communities such as riparian and wetland. This habitat alteration could benefit many of the 46 special-status species (listed in Table 5-14) because the majority of these species inhabit freshwater emergent wetlands, lakes, rivers on the valley floor, and riparian areas, which could be increased under the restoration plans. Grain crops, some of which would be lost as a result of

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Table 5-14
Special-Status Species - Storage Facilities in the Sacramento River Region

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Animals																				
Ambystoma californiense California tiger salamander	C	CSC	--			X		X			X		X		X	X	X	X	X	X
Aquila chrysaetos golden eagle	--	CSC	--																	
Ascaphus truei tailed frog	SC	CSC	--																	
Branchimnecta lynchi Vernal pool fairy shrimp	T	--	--			(+)		(+)					(+)		(+)	(+)	(+)	(+)	(+)	
Lepidurus packardi Vernal pool tadpole shrimp	E	--	--			(+)		(+)					(+)		(+)	(+)	(+)	(+)	(+)	(+)
Buteo swainsoni Swainson's hawk	--	T	--			(+)		(+)			(+)		(+)		(+)	(+)	(+)	(+)	(+)	(+)
Clemmys marmorata marmorata northwestern pond turtle	SC	CSC	--			X		X			X		X		X	X	X	X	X	X
Coccyzus americanus occidentalis western yellow-billed cuckoo	--	E	--																	
Dendroica petechia brewsteri yellow warbler	--	CSC	--																	
Desmocerus californicus dimorphus valley elderberry longhorn beetle	T	--	--			X		X			X		X		X	X	X	X	X	X
Falco mexicanus prairie falcon	--	CSC	--			X		X			X		X		X	X	X	X	X	X
Grus canadensis tabida greater sandhill crane	--	T	--			(+)		(+)			(+)		(+)		(+)	(+)	(+)	(+)	(+)	(+)
Haliaeetus leucocephalus bald eagle	T	E	--																	
Hydromantes shastae Shasta salamander	SC	T	--																	

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Table 5-14 (continued)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	**Fed. List**	**CA List**	**CNPS**	**A**	**B**	**C**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Martes pennanti pacifica Pacific fisher	SC	CSC	--																	
Monadenia troglodytes Shasta sideband snail	SC	--	--																	
Perognathus inornatus inornatus San Joaquin pocket mouse	--	--	--			X		X			X		X		X	X	X	X	X	X
Plecotus townsendii pallescens pale big-eared bat	--	CSC	--																	
Rana aurora draytonii California red-legged frog	T	CSC	--																	
Rana boylii foothill yellow-legged frog	SC	CSC	--			X		X			X		X		X	X	X	X	X	X
Strix occidentalis caurina northern spotted owl	T	--	--																	
Plants																				
Antirrhinum subcordatum dimorphic snapdragon	--	--	1B			X		X			X		X		X	X	X	X	X	X
Astragalus rattanii var jepsonianus Jepson's milk vetch	--	--	1B			X		X			X		X		X	X	X	X	X	X
Astragalus tener var ferrisiae Ferris's milk vetch	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Brodiaea coronaria ssp rosea Indian Valley brodiaea	SC	E	1B			X		X			X		X		X	X	X	X	X	X
Carex vulpinoidea fox sedge	--	--	2																	
Chlorogalum pomeridianum var minus dwarf soaproot	--	--	1B			X		X			X		X		X	X	X	X	X	X
Cryptantha clevelandii var dissita serpentine cryptantha	--	--	1B																	

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Table 5-14 (continued)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Downingia pusilla dwarf downingia	--	--	2			X		X			X		X		X	X	X	X	X	X
Eriastrum brandegeae Brandegee's eriastrum	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Eriogonum nervulosum Snow Mountain buckwheat	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Fritillaria pluriflora adobe lily	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Hesperolinon bicarpellatum two-carpellate western flax	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Hesperolinon breweri Brewer's western flax	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Hesperolinon drymarioides drymaria-like western flax	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Hesperolinon sp nov "serpentinum" Napa western flax	--	--	1B			X		X			X		X		X	X	X	X	X	X
Hesperolinon tehamense Tehama County western flax	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Juncus leiospermus var leiospermus Red Bluff dwarf rush	--	--	1B			X		X			X		X		X	X	X	X	X	X
Layia septentrionalis Colusa layia	--	--	1B			X		X			X		X		X	X	X	X	X	X
Lewisia cantelovii Cantelow's lewisia	--	--	1B			X		X			X		X		X	X	X	X	X	X
Madia hallii Hall's madia	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Navarretia leucocephala ssp bakeri Baker's navarretia	--	--	1B			X		X			X		X		X	X	X	X	X	X

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Table 5-14 (concluded)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Navarretia rosulata Marin County navarretia	--	--	1B			X		X			X		X		X	X	X	X	X	X
Neviusia cliftonii Shasta snow-wreath	--	--	1B			X		X			X		X		X	X	X	X	X	X
Paronychia ahartii Ahart's paronychia	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Streptanthus morrisonii kruckebergii Kruckeberg's jewel-flower	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Total Special-Status Species:						31		31			31		31		31	31	31	31	31	31
Vernal Pool Special-Status Species Habitat (acres)[a]	NA	NA	NA	0	0	9,873	0	9,873	0	0	9,873	0	9,873		9,873	9,873	9,873	9,873	9,873	9,873

Notes:

[a] Vernal pool special-status species landscape includes the watershed areas that support several of the species indicated in this table. The database used for estimating acres affected is Holland (1997), a more accurate database than the NDDB database used for evaluating the presence of individual species.

Source: NDDB 1997

Symbols:

X = indicates a known occurrence of a species within a storage footprint
(+) = indicates a presumed occurrence of a species within a storage footprint based on the likely presence of suitable habitat

Status Abbreviations:

Federal (CNDDB 1997)
E = endangered
T = threatened
C = candidate
SC = species of concern

State (CNDDB 1997)
E = endangered
T = threatened
R = rare
CSC = species of concern

CNPS (Skinner and Pavlik 1994)
1A = presumed extinct
1B = species that are rare, threatened, or endangered throughout their range
2 = species that are rare, threatened, or endangered in California but more common elsewhere

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the **ERP**, provide habitat for prey species of the Swainson's hawk. However, since the primary limiting factor for the Swainson's hawk is nesting/roosting trees, there would be a net overall beneficial impact to this species.

Seventeen rare natural communities and 188 significant natural areas including vernal pools (Section IV of Affected Environment Technical Report) occur or have the potential to occur in the Sacramento River Region. Many of these communities occur along the Sacramento River or other major regional rivers and tributaries. The rare natural communities include Fremont cottonwood riparian forest, Valley oak riparian forest, mixed riparian forest, Great Valley willow scrub, valley freshwater marsh, and other wetland habitats. These communities support most of the special-status wildlife species, and would be positively impacted by the ERP in the long-term by the expansion of suitable habitat through programs such as the direct restoration of native habitat, enhancement of natural meanders, and conversion of formerly cultivated lands.

The **Water Quality Program** would improve water quality throughout the Sacramento River Region by reducing mercury loadings, pesticide levels, urban contaminants, and oxygen depletion through improved management of discharges. These improvements in water quality under Variation 1A would benefit most of the 46 special-status species (listed in Table 5-14) either directly, by improving the health of individuals of the species, or indirectly, by improving the quality of their habitat. Similarly, these water quality improvements could positively impact the 17 rare natural communities and many of the 188 significant natural areas (Section IV of Affected Environment Technical Report) of the Sacramento River Region.

The **Water Use Efficiency Program** includes plans whose goals are to reduce existing use and future demands on the state's limited water supply. However, some elements of the program are voluntary and some are already in use or planned as part of other programs, so the benefits that can be attributed to CALFED actions are limited. Therefore, to the extent that the Water Use Efficiency Program reduces existing water use and future demand, more water can be left in Sacramento River Region channels, which would have positive or no impacts to special-status species as well as to rare natural communities and significant natural areas.

No new **Storage or Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1A.

Variation 1B - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1B would be the same as under Variation 1A. No new **Storage or Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1B.

Variation 1B - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1B would be the same as under Variation 1A. No new **Storage or Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1B.

Variation 1C - Plant Communities and Associated Wildlife

Under Variation 1C **Storage Facilities** up to 3 million acre-feet of new surface storage and 500,000 acre-feet of groundwater storage would be developed in the Sacramento River Region. New surface storage could be developed by either enlarging existing storage reservoirs or developing new off-stream storage. The analysis of new storage facilities is based on the potential impacts that would be associated with the enlargement of 2 existing reservoirs and 4 hypothetical off-stream storage locations in the foothills surrounding the Sacramento Valley. Consequently, this analysis is only representative of the types of impacts that could occur with implementation of Variation 1C. The habitat types and area that would actually be affected by increasing storage would depend on the siting and design of storage facilities.

Table 5-13 summarizes the numbers of wildlife species typically associated with each of the habitat types that could be affected by construction of storage facilities.

Enlargement of existing reservoirs could result in temporary or permanent loss or disturbance of wetland, riparian, annual grassland, valley foothill hardwood, chaparral, montane hardwood, montane hardwood conifer, and ponderosa pine communities, and agricultural lands as a result of inundation and construction of roads and other infrastructure. For example, enlargement of Shasta Reservoir could affect up to approximately 12,000 acres of wetland, montane, riparian, valley foothill hardwood, montane hardwood, chaparral, mixed hardwood conifer, and ponderosa pine communities and, as a result of inundation, could create up to approximately 12,000 acres of open-water habitat. Construction of new off-stream storage facilities could result in temporary or permanent loss or disturbance of wetland, valley foothill riparian, annual grassland, valley foothill hardwood, montane hardwood, mixed hardwood conifer, and chaparral communities. For example, construction of the previously proposed off-stream Sites/Colusa Reservoir could affect up to approximately 30,000 acres of valley foothill hardwood and montane hardwood habitat and create up to 30,000 acres of open-water habitat. Construction of off-stream reservoirs could also result in the loss or degradation of valley foothill riparian habitat downstream of reservoirs as a result of interrupting sediment supply to the stream channel and altering stream hydrology. Some habitat types that could be lost or degraded as a result of constructing storage facilities, such as valley oak woodland, could have declined locally or regionally sufficiently from historic conditions that additional losses could substantially affect associated wildlife populations.

Implementation of Variation 1C would benefit wildlife species associated with open-water habitats and result in loss of habitat for species associated with affected habitats (Appendix A). The wildlife value of habitats surrounding reservoirs for some species could also be degraded if public access and levels of recreation substantially increase. Construction of offstream reservoirs could fragment important habitats and disrupt wildlife movement patterns. The potential effects of fragmenting riparian habitats would be similar to those described for the Delta Region.

Depending on the siting and design of enlarged or off-stream storage facilities, substantial fragmentation of upland and riparian habitats could disrupt traditional movement patterns of migratory deer herds. Local and migratory deer herds could also be adversely affected if storage reservoirs, attendant facilities, and associated recreational uses result in loss or degradation of CDFG-designated critical deer winter range and fawning habitats, and other important deer use areas. Tule elk populations could also be adversely affected if calving habitat is lost or degraded.

If groundwater storage is achieved by percolating water through water-spreading grounds, construction of water-spreading grounds and associated facilities could result in the temporary or permanent loss of annual grassland and agricultural habitat types, assuming they are constructed in low land areas of the Sacramento River Valley. The actual area and habitat types that would be affected by construction and operation of groundwater recharge facilities, however, would depend on the siting, design, and operations of facilities. Shallow open-water habitat would be created during periods surface water is retained on spreading grounds. Mudflats and bare ground would be created as surface water is drawn down. To maintain percolation efficiency, however, spreading grounds would likely be maintained to be devoid of vegetation. Consequently, these created habitats would likely provide low forage and cover values for associated wildlife.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1C would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1C.

Variation 1C - Special-Status Species and Communities

Variation 1C water **Storage Facilities** would include up to 3,000,000 acre-feet of storage on Sacramento River Region tributaries (either by enlarging existing storage or by creating new off-stream storage), and up to 500,000 acre-feet of groundwater storage in the Sacramento Valley. Although the potential for loss of habitat and impacts to special-status species due to surface storage cannot be precisely determined until a decision is made as to where the expanded and/or new surface storage facilities would be located, 31 special-status species (listed in Table 5-14) could possibly be impacted.

Although direct construction impacts are generally less than for surface storage facilities, special-status species, rare natural communities, and significant

natural areas could be affected by the construction of groundwater storage facilities. In addition, special-status aquatic species and aquatic plant communities could be impacted depending upon the manner in which diversions for groundwater storage are conducted and what effects these diversions have on the water quality itself. Type and extent of impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage facilities would depend on the locations and operations of the storage facilities, which have yet to be determined.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1C would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 1C.

5.4.3 Alternative 2 Impact Evaluation by Variation - Sacramento River Region

Variation 2A - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2A would be the same as under Variation 1A. No new **Storage or Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2A.

Variation 2A - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2A would be the same as under Variation 1A. No new **Storage or Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2A.

Variation 2B - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2B would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 1C. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2B.

Variation 2B - Special-Status Species and Communities

Under Variation 2B **Storage Facilities,** water storage features would include up to 3,000,000 acre-feet of storage on Sacramento River Region tributaries (either by enlarging existing storage or by creating new off-stream storage), and up to 500,000 acre-feet of groundwater storage in the Sacramento Valley. Although the potential for loss of habitat and impacts to special-status species due to surface storage cannot be precisely determined until a decision is made as to where the expanded and/or new surface storage facilities would be located 31 special-

status species (listed in Table 5-14) could be impacted.

Although direct construction impacts are generally less than for surface storage facilities, special-status species, rare natural communities, and significant natural areas could be affected by construction of groundwater storage facilities. In addition, special-status aquatic species and aquatic plant communities could be impacted depending upon the manner in which diversions for groundwater storage are conducted and what effects these diversions have on the water quality itself. Type and extent of impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage facilities would depend on the locations of the storage facilities, which have yet to be determined.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2B would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2B.

Variations 2C-2D - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 2C-2D would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Sacramento River Region under Variations 2C-2D.

Variations 2C-2D - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 2C-2D would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Sacramento River Region under Variations 2C-2D.

Variation 2E - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2E would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 2B. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2E.

Variation 2E - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2E would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 2B. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 2E.

5.4.4 Alternative 3 Impact Evaluation by Variation - Sacramento River Region

Variation 3A - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3A would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 3A.

Variation 3A - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3A would be the same as under Variation 1A. No new **Storage** and **Conveyance Facilities** would be planned for the Sacramento River Region under Variation 3A.

Variation 3B - Plant Communities and Associated Wildlife

Under Variation 3B **Conveyance Facilities,** spur conveyance links from the Delta to east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3A would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 1C.

Variation 3B - Special-Status Species and Communities

Variation 3B **Storage Facilities** would include up to 3,000,000 acre-feet of storage on Sacramento River Region tributaries (either by enlarging existing storage or by creating new off-stream storage), and up to 500,000 acre-feet of groundwater storage in the Sacramento Valley. Although the potential for loss of habitat and impacts to special-status species due to surface storage cannot be precisely determined until a decision is made as to where the expanded and/or new surface storage facilities would be located, 31 special-status species (listed in Table 5-14) could be impacted.

Although direct construction impacts for groundwater storage facilities are generally less than that for surface storage facilities, special-status species, rare natural communities, and significant natural areas could be affected. In addition, special-status aquatic species and aquatic plant communities could be impacted depending upon the manner in which diversions for groundwater storage are conducted and what effects these diversions have on the water quality itself. Type and extent of impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage facilities would depend on the locations and operation of the storage facilities, which have yet to be determined.

Under Variation 3B **Conveyance Facilities,** spur conveyance links from the

Delta to east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3B would be the same as under Variation 1A.

Variation 3C-3D - Plant Communities and Associated Wildlife

Under **Conveyance Facilities** for Variations 3C-3D spur conveyance links from the Delta to the east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3C-3D would be the same as under Variation 1A, and **Storage Facilities** under Variation 3D would be the same as under Variation 1C. No new **Storage Facilities** would be planned for the Sacramento River Region under Variation 3C.

Variations 3C-3D - Special-Status Species and Communities.

Under **Conveyance Facilities** for Variations 3C-3D spur conveyance links from the Delta to the east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3C-3D would be the same as under Variation 1A, and **Storage Facilities** under Variation 3D would be the same as under Variation 3B. No new **Storage Facilities** would be planned for Sacramento River Region under Variation 3C.

Variations 3E-3I - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3E-3I would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 1C. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variations 3E-3I.

Variations 3E-3I - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3E-3I would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 3B. No new **Conveyance Facilities** would be planned for the Sacramento River Region under Variations 3E-3I.

5.5 Environmental Impacts in the San Joaquin River Region

5.5.1 Summary of Regional Effects by Alternative

This section presents a summary of potential significant impacts, mitigation strategies, and unavoidable adverse impacts. Adverse impacts (called impacts) and beneficial impacts (called benefits) are numbered for ease in cross-referencing to Table 5-15, which summarizes and compares all impacts identified for each of the variations associated with Alternatives (i.e., 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, etc.). In text each adverse impact is followed by the appropriate mitigation strategy.

Table 5-16 summarizes the number of wildlife species that could be adversely affected or that could benefit from decreases or increases, respectively, in the area or quality of open-water, wetland, riparian, and upland habitats in the San Joaquin River Region with implementation of Alternatives 1, 2, or 3. Table 5-17 summarizes the relative potential level of impact on habitats and Table 5-18 presents the native plant communities that could be impacted as a result of constructing storage facilities under each Alternative.

Alternative 1 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Construction of storage facilities under Alternative 1 could result in temporary and permanent loss or degradation of wetland, riparian, annual grassland, and valley foothill hardwood communities as a result of inundation and construction of roads and other infrastructure assuming storage facilities are constructed in foothill habitats along the western side of the San Joaquin Valley. The actual area and habitat types that would be affected by construction of off-aqueduct storage facilities, however, would depend on the siting, design, and operations of facilities. Table 5-17 summarizes potential changes in the area of habitat types and habitat available for associated wildlife in the San Joaquin River Region with construction of storage facilities under Alternative 1. Completed implementation of Alternative 1 would result in a potential increase of up to approximately 5,000 acres of riparian habitat and associated floodplain habitats (e.g., wetlands and open-water) and would result in the loss of agricultural lands and native plant communities adjacent to the San Joaquin River and its major tributaries.

Impact 4.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Wetland and riparian communities would be temporarily lost or degraded as a result of implementing the ERP. Temporary decreases in wetland and riparian habitat area could adversely affect approximately 91 species of wetland- and 145 species of riparian-associated wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered significant.

Mitigation 4.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on wetland-

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Table 5-15
Summary of Impacts and Benefits for the San Joaquin River Region

CALFED Program	Impact Category		Impact/ Benefit	No Action Alterna-tive	Alternative 1			Alternative 2					Alternative 3								
					A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Common Programs	Habitat Area and Associated Wildlife	Impact 4.1	Temporary loss or disturbance of wetland and riparian communities		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 4.2	Permanent loss of wetland and riparian communities		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Impact 4.3	Decrease in important deer and elk use areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Impact 4.4	Decrease in important wildlife habitats		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.1	Increase in open-water communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.2	Increase in riparian communities		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Habitat Quality and Pattern	Impact 4.5	Reduction in quality of wetland and riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.3	Improved riparian habitat quality		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 4.4	Improved habitat patterns		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 4.5	Improved connectivity of riparian habitat		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
	Special-Status Species and Communities	Impact 4.6	Loss of foraging habitat for special-status species		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Impact 4.7	Loss of portions of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.6	Increase in habitats for special-status species		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
		Benefit 4.7	Expansion of rare natural communities and significant natural areas		++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Conveyance	Habitat Area and Associated Wildlife	Impact 4.1	Temporary loss or disturbance of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 4.2	Permanent loss of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 4.3	Decrease in important deer and elk use areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 4.4	Decrease in important wildlife habitats		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.1	Increase in open-water communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
	Habitat Quality and Pattern	Impact 4.5	Reduction in quality of wetland and riparian communities		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.3	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.4	Improved habitat patterns		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.5	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0

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able 5-15 (continued)

Conveyance (continued)	Special-Status Species and Communities	Impact 4.6	Loss of foraging habitat for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Impact 4.7	Loss of portions of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.6	Increase in habitats for special-status species		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
		Benefit 4.7	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	U	U	U	0	0	0	0	0
Storage	Habitat Area and Associated Wildlife	Impact 4.1	Temporary loss or disturbance of wetland and riparian communities		0	0	-	0	-	0	-	-	0	-	0	-	-	-	-	-	-
		Impact 4.2	Permanent loss of wetland and riparian communities		0	0	--	0	--	0	--	--	0	--	0	--	--	--	--	--	--
		Impact 4.3	Decrease in important deer and elk use areas		0	0	--	0	--	0	--	--	0	--	0	--	--	--	--	--	--
		Impact 4.4	Decrease in important wildlife habitats		0	0	--	0	--	0	--	--	0	--	0	--	--	--	--	--	--
		Benefit 4.1	Increase in open-water communities		0	0	++	0	++	0	++	++	0	++	0	++	++	++	++	++	++
		Benefit 4.2	Increase in riparian communities		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Habitat Quality and Pattern	Impact 4.5	Reduction in quality of wetland and riparian communities		0	0	--	0	--	0	--	--	0	--	0	--	--	--	--	--	--
		Benefit 4.3	Improved riparian habitat quality		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.4	Improved habitat patterns		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Benefit 4.5	Improved connectivity of riparian habitat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Special-Status Species and Communities	Impact 4.6	Loss of foraging habitat for special-status species		0	0	-	0	-	0	0	-	0	-	0	-	-	-	-	-	-
		Impact 4.7	Loss of portions of rare natural communities and significant natural areas		0	0	-	0	-	0	0	--	0	--	0	--	--	--	--	--	--
		Benefit 4.6	Increase in habitats for special-status species		0	0	+	0	+	0	0	+	0	+	0	+	+	+	+	+	+
		Benefit 4.7	Expansion of rare natural communities and significant natural areas		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note:

U = Unknown impacts/benefits resulting from spur conveyance

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Table 5-16
Number of Wildlife Species Associated with Habitat Types Potentially Created, Improved, or Impacted with Implementation of Alternatives 1, 2, and 3 in the San Joaquin River Region

Habitat Type	Number of Associated Wildlife Species
Open Water	48
Wetlands	91
Valley Foothill Riparian	
Montane Riparian	
Annual Grassland	
Montane Hardwood	
Valley Foothill Hardwood	
Agricultural Lands	128

Table 5-17
Relative Comparison of Levels of Impact and Benefit of Storage Facilities Among Alternatives 1, 2, and 3 on Habitat Types in the San Joaquin River Region

Alternative	Potentially Created Open Water	Potentially Affected Nonagricultural Habitat	Potentially Affected Agricultural Habitat
1	+	-	-
2	+ +	--	--
3	+ +	--	--

Note: "+" indicates increase in habitat acres and "-" indicates a decrease in habitat acres. The larger number of symbols represents a greater degree of change in habitat acres.

Table 5-18
Habitat Types that Potentially Could be Impacted by Construction of Storage Facilities Under Alternatives 1, 2, and 3 in San Joaquin River Region

Habitat Type	Alternative 1	Alternative 2	Alternative 3
Wetlands	X	X	X
Valley Foothill Riparian	X	X	X
Montane Riparian		X	X
Annual Grassland	X	X	X
Montane Hardwood		X	X
Valley Foothill Hardwood	X	X	X
Agricultural Lands	X	X	X

and riparian- communities-associated implementing of the ERP could include:

- Avoiding wetland and riparian habitats
- Initially implementing the ERP, to the extent feasible, to restore sufficient riparian vegetation in nonwetland/riparian habitat areas before or at the time that project impacts associated with the ERP are incurred to offset temporary habitat losses
- Restoring wetland and riparian vegetation temporarily disturbed by on-site construction activities immediately following construction

Impact 4.2: Permanent Loss of Wetland and Riparian Communities. Wetland and riparian communities would be permanently lost or degraded as a result of construction and operation of storage facilities. Decreases in wetland and riparian habitat areas could adversely affect approximately 91 species of wetland- and 145 species of riparian-associated wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered significant.

Mitigation 4.2: Permanent Loss of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on wetland and riparian communities associated with construction of storage facilities could include:

- Avoiding wetland and riparian habitats
- Restoring or enhancing sufficient in-kind wetland and riparian habitat area at off-site locations before or at the time that project impacts are incurred to offset habitat losses
- Restoring wetland and riparian vegetation temporarily disturbed by on-site construction activities immediately following construction

Impact 4.3: Decrease in Important Deer Use Areas. Construction and operation of storage facilities could result in the loss or degradation of CDFG-designated critical deer winter range and fawning habitat, and other important deer use areas. Therefore, this impact is considered significant.

Mitigation 4.3: Decrease in Important Deer Use Areas. Potential mitigation strategies for reducing impacts on CDFG-designated critical deer winter range and fawning habitat as a result of construction of storage facilities could include:

- Avoiding critical deer winter range and fawning habitat
- Restoring habitat areas temporarily disturbed by on-site construction activities immediately following construction
- Restoring historic, but currently unsuitable, habitat areas within affected watersheds or other watersheds used by the affected deer population if sufficient historic habitat for restoration is unavailable within the affected watershed
- Enhancing unaffected habitat areas within affected watersheds or other watersheds used by the affected deer population if sufficient habitat for enhancement is unavailable within the affected watershed

Impact 4.4: Decrease in Important Wildlife Habitats. Construction of storage facilities could result in the loss of important wildlife habitats, such as valley oak woodland, that are currently limited or declining locally or regionally in the San Joaquin River Region. Therefore, this impact is considered significant.

Mitigation 4.4: Decrease in Important Wildlife Habitats. Potential mitigation strategies for reducing impacts on important wildlife upland habitat areas as a result of construction of storage facilities could include:

- Avoiding important wildlife habitat areas
- Restoring habitat areas temporarily disturbed by on-site construction activities immediately following construction
- Restoring historic, but currently unsuitable, habitat areas within affected watersheds or other watersheds if sufficient historic habitat for restoration is unavailable within the affected watershed
- Enhancing unaffected habitat areas within affected watersheds or other watersheds if sufficient habitat for enhancement is unavailable within the affected watershed

Benefit 4.1: Increase in Open-Water Communities. Implementation of Alternative 1 would substantially increase the area of open-water in the San Joaquin River Region as a result of construction of surface and groundwater storage facilities. Increases in open-water habitats could benefit approximately 49 species of wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered beneficial.

Benefit 4.2: Increase in Riparian Communities. Implementation of the ERP would substantially increase the area of riparian habitats associated with the San Joaquin River and its tributaries. Increases in riparian habitats could benefit approximately 145 species of wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 1, the quality and pattern of riparian habitats would be substantially improved along the San Joaquin River and some of its tributaries with implementation of the ERP. The quality and pattern of riparian and native terrestrial habitats could be substantially degraded as a result of the construction and operation of storage facilities.

Impact 4.5: Temporary Fragmentation of Riparian Habitats. Riparian habitats associated with levees and protected banks could be fragmented as a result of restoring stream meander corridors and other features associated with the ERP. These impacts would be temporary until sufficient riparian corridor habitat necessary to offset impacts reestablishes following implementation of the ERP.

Mitigation 4.5: Temporary Fragmentation of Riparian Habitats. Potential mitigation strategies for reducing temporary impacts on riparian communities that could fragment riparian

habitat corridors as a result of implementation of the ERP could include:

- Avoiding riparian vegetation
- Restoring riparian vegetation disturbed by on-site construction activities immediately following construction
- Initially implementing the ERP, to the extent feasible, to restore sufficient riparian vegetation in nonwetland/riparian habitat areas before or at the time that project impacts on riparian corridors associated with the ERP are incurred to offset temporary habitat losses

Impact 4.6: Permanent Fragmentation of Riparian Habitats. If off-stream aqueduct storage reservoirs were constructed along streams supporting riparian vegetation, the reservoir inundation area would permanently fragment the existing riparian corridor. Therefore, this impact is considered significant. No mitigation is identified for this impact.

Impact 4.7: Reduction in Quality of Wetland and Riparian Communities. Under Alternative 1, the quality of wetland and riparian communities downstream of proposed off-aqueduct storage reservoirs could be reduced, if reservoirs are constructed on streams that support wetland and riparian vegetation and if the volume and timing of reservoir outflow changes sufficiently to affect the vigor, density, or species of riparian and wetland vegetation. Decreases in wetland and riparian habitat quality could adversely affect approximately 91 species of wetland- and 145 species of riparian-associated wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered significant.

Mitigation 4.7: Reduction in Quality of Wetland and Riparian Communities. Potential mitigation strategies for reducing impacts on the quality of wetland and riparian communities as a result of storage operations could include maintaining sufficient downstream flow to maintain the existing condition of wetland and riparian communities.

Benefit 4.3: Improved Riparian Habitat Quality. Implementation of the ERP would provide increased flows during some periods to the San Joaquin River and some of its tributaries, and would reduce the abundance of nonnative invasive plants in existing riparian habitats along the San Joaquin River. If flows are increased during the growing period of riparian vegetation and are of sufficient magnitude and duration, the vigor and density of riparian vegetation and ability of riparian vegetation to regenerate could be increased. Control or eradication of nonnative invasive plants in existing riparian habitats would increase habitat quality because treated habitats would increasingly become dominated by native plants as result of lessening competition with exotic species. Improved riparian habitat quality could benefit approximately 145 species of wildlife in the San Joaquin River Region (Table 5-16). Therefore, this impact is considered beneficial.

Benefit 4.4: Improved Habitat Patterns. Implementation of the ERP would create a more historic pattern of open-water, wetland, and riparian habitats along the San Joaquin River and some of

its tributaries as a result of restoring stream channel meander and floodplain processes. Therefore, this impact is considered beneficial.

Benefit 4.5: Improved Connectivity of Riparian Habitat. Implementation of the ERP would restore or enhance up to approximately 5,000 acres of riparian habitat along the San Joaquin River and its major tributaries. Restored habitat would increase the connectivity among existing fragmented riparian areas in the San Joaquin River Region. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Under Alternative 1, habitat loss associated with construction of storage facilities within the San Joaquin River Region could impact up to 44 special-status species, 8 rare natural communities, and 20 significant natural areas. Implementation of the ERP, which would result in the loss of large areas of agricultural lands as they are converted to wetland and shallow-water habitats, could adversely impact several special-status species (including Swainson's hawks) that are dependent upon such communities for foraging habitat. However, the common programs as a whole would expand many habitat types mostly through restoration and enhancement programs associated with the ERP. These gains would benefit most of the San Joaquin River Region's rare natural communities and significant natural areas. The rare natural communities and significant natural areas would also benefit from increased consistency and quality of water resulting from the Water Quality Program and Water Use Efficiency Program.

Impact 4.8: Loss of Foraging Habitat for Special-Status Species. Agricultural lands, which comprise a portion of the foraging habitat for species such as Swainson's hawk, would be lost due to inundation in order to create aquatic and riparian habitats (as stated under the ERP), and to create storage facilities. Although these aquatic and riparian habitats are beneficial to the Swainson's hawk, the loss of agricultural lands used as foraging habitat is still important. Therefore, this impact is considered significant.

Mitigation 4.8: Loss of Foraging Habitat for Special-Status Species. Potential mitigation strategies for reducing some of the impact caused by loss of special-status species agricultural land foraging habitat in the San Joaquin River Region as a result of ERP implementation would include:

- Restoring additional natural areas to serve as alternative foraging habitat over and above that restored as part of the ERP
- Managing agricultural lands to the benefit of multiple special-status species in different guilds (i.e., flooding of fields in the fall to create waterfowl habitat while leaving them drier in the spring and summer for other species to utilize)
- Maximizing habitat quality of remaining agricultural lands through wildlife-friendly techniques

Impact 4.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Construction of storage facilities could eliminate portions of rare natural communities and significant

natural areas. Therefore, this impact is considered to be significant.

Mitigation 4.9: Loss of Portions of Rare Natural Communities and Significant Natural Areas. Potential mitigation strategies for reducing impacts to rare natural communities and significant natural areas resulting from construction of storage facilities would include:

- Avoiding rare natural communities and significant natural areas altogether
- Restoring or enhancing disturbed rare natural communities or significant natural areas at other locations before or at the time that construction impacts are incurred
- Restoring rare natural communities or significant natural areas back into impacted locations once storage facility construction activities are completed

Benefit 4.6: Increase in Habitats for Special-Status Species. Implementation of the ERP, the Water Quality Program, and the Water Use Efficiency Program would expand or improve aquatic, riparian, and grassland habitats. In addition, aquatic and riparian habitats would be increased due to new surface storage. These habitat improvements would benefit the majority of the special-status species due to their dependence on such habitats for forage, shelter, and reproduction.

Benefit 4.7: Expansion of Rare Natural Communities and Significant Natural Areas. The increase in quantity, quality, and connectivity of aquatic, riparian, and grassland habitats through implementation of the ERP would provide for similar increases in most of the San Joaquin River Region's rare natural communities and significant natural areas. These increases would take place since most of the rare natural communities and significant natural areas are dependent upon or occur exclusively in aquatic, riparian, or grassland habitats. In addition, the eradication of many nonnative invasive plants would return some areas to more favorable conditions where rare natural communities and significant natural areas could expand due to reduced encroachment by the nonnative species. Therefore, this impact is considered beneficial.

Alternative 1 - Summary of Significant Unavoidable Impacts

Impacts to Habitat Area and Associated Wildlife.

Impact 4.6: Permanent Fragmentation of Riparian Habitats. Under Alternative 1, existing riparian habitat corridors could be permanently fragmented as a result of inundation of off-stream storage reservoirs, potentially blocking the movement and interchange of populations of some wildlife species from upper to lower watershed locations. This impact cannot be mitigated. Therefore, this impact is considered a significant unavoidable impact.

Impacts to Special-Status Species and Communities. Assuming that the aforementioned mitigation strategies are implemented, no significant unavoidable impacts to special-status species and communities are identified under Alternative 1.

Alternative 2 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Under Alternative 2, the types of impacts on habitat area and associated wildlife associated with implementation of the ERP and construction of storage facilities would be the same as under Alternative 1; however, the magnitude associated with construction and operation of storage facilities would differ. Mitigation strategies for offsetting the Alternative 2 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 4.1: Temporary Loss or Disturbance of Wetland and Riparian Communities. This impact would be the same as under Alternative 1. Therefore, this impact is considered significant.

Impact 4.2: Permanent Loss of Wetland and Riparian Communities. Vegetation and wildlife resources that would be affected by this impact would be the same as under Alternative 1. The area of wetland and riparian habitat that would potentially be impacted by construction of storage facilities, however, would potentially be greater than under Alternative 1 because some Alternative 2 variations include 1.5 million acre-feet of additional surface storage. Therefore, this impact is considered significant.

Impact 4.3: Decrease in Important Deer Use Areas. Implementation of Alternative 2 would have the same impacts on deer use areas as under Alternative 1. The area of important deer habitats that would be potentially affected, however, would be potentially greater than under Alternative 1 because some Alternative 2 variations include 1.5 million acre-feet of additional surface storage. Therefore, this impact is considered significant.

Impact 4.4: Decrease in Important Wildlife Habitats. Implementation of Alternative 2 would have the same potential impacts on important wildlife habitats as under Alternative 1. The area of important wildlife habitats that would potentially be affected, however, would potentially be greater than under Alternative 1 because some Alternative 2 variations include 1.5 million acre-feet of additional surface storage. Therefore, this impact is considered significant.

Benefit 4.1: Increase in Open-Water Communities. Construction of storage facilities under Alternative 2 would provide the same benefits for wildlife as under Alternative 1. The amount of open-water habitat created under Alternative 2, however, would be greater than under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 4.2: Increase in Riparian Communities. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Under Alternative 2, the types of impacts on the quality and pattern of native habitats would be the same as under Alternative 1; the magnitude, however, would potentially be greater under Alternative 2 variations that include storage than under Alternative 1. Mitigation strategies for offsetting the

Alternative 2 impacts described below are the same as described for equivalent impacts under Alternative 1.

Impact 4.5: Temporary Fragmentation of Riparian Habitats. This impact would be the same as under Alternative 1. Therefore, this impact is considered significant.

Impact 4.6: Permanent Fragmentation of Riparian Habitats. Construction of surface storage facilities would have the same potential for fragmenting riparian habitats as under Alternative 1. The degree that riparian habitats would be fragmented by storage facilities under Alternative 2, however, would potentially be greater than under Alternative 1 because the impact area and number of storage sites would likely be greater under Alternative 2. Therefore, this impact is considered significant.

Impact 4.7: Reduction in Quality of Wetland and Riparian Communities. Construction of surface storage facilities would potentially impact wetland and riparian habitat quality as under Alternative 1. The area of potentially affected habitat under Alternative 2, however, would potentially be greater than under Alternative 1 because the number of storage sites would likely be greater under Alternative 2. Therefore, this impact is considered significant.

Benefit 4.3: Improved Riparian Habitat Quality. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 4.4: Improved Habitat Patterns. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Benefit 4.5: Improved Connectivity of Riparian Habitat. This benefit would be the same as under Alternative 1. Therefore, this impact is considered beneficial.

Impacts and Mitigation Strategies for Special-Status Species and Communities. Potential impacts and mitigation strategies for special-status species and communities under Alternative 2 would be similar to Alternative 1, except that the severity and scope of impacts could be greater due to the increased off-aqueduct surface storage and new tributary storage present under Alternative 2. Mitigation strategies would also be similar to Alternative 1.

Alternative 2 - Summary of Significant Unavoidable Impacts

Significant unavoidable impacts under Alternative 2 would be the same as under Alternative 1.

Alternative 3 - Summary of Significant Impacts and Mitigation Strategies

Impacts and Mitigation Strategies for Habitat Area and Associated Wildlife. Impacts and mitigation strategies for habitat area and associated wildlife under the range of variations would be the same as under Alternative 2, except that additional areas of native plant communities and agricultural lands would

be affected by construction of spur conveyance links from the Delta to areas east of the Delta. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction of spur conveyance facilities are unknown.

Impacts and Mitigation Strategies for Habitat Quality and Pattern. Impacts and mitigation strategies for habitat quality and pattern under Alternative 3 would be the same as under Alternative 1.

Impacts and Mitigation Strategies for Special-Status Species and Communities.
Impacts and mitigation strategies for special-status species and communities under Alternative 3 would be the same as under Alternative 2.

Alternative 3 - Summary of Significant Unavoidable Impacts

Significant unavoidable impacts under Alternative 3 would be the same as under Alternative 1.

5.5.2 Alternative 1 Impact Evaluation by Variation - San Joaquin River Region

Variation 1A - Plant Communities and Associated Wildlife

Under Variation 1A, the **ERP** would be implemented in the San Joaquin River Region as described in Phase 2 Alternative Descriptions.

The ERP primary objective for the San Joaquin River Region is to improve ecological processes and habitat conditions that are critical to sustaining and improving anadromous fish populations. Proposed program activities that affect terrestrial biological resources include restoration and protection of stream meander belts; restoration of floodplain processes, such as overbank flooding of floodplains and stream channel migration; and restoration, enhancement, or protection of riparian vegetation to provide SRA cover. Partial restoration of the ecological processes that sustain healthy riverine ecosystems on affected streams would result in a more natural pattern of stream channel migration, bank erosion, and overbank flooding that are important factors in maintaining healthy riparian and other associated floodplain habitats.

The ERP under Alternative 1 would result in the direct and indirect restoration, enhancement, or protection of up to an estimated 5,000 acres of riparian and associated floodplain habitats along the San Joaquin River and its major tributaries. Improvements in riparian habitat would primarily result in the loss of agricultural lands adjacent to streams and rivers. A relatively small area of native plant communities could be temporarily or permanently affected by riparian habitat improvements, depending on the type of improvement actions that are implemented.

Typical wildlife species associated with potentially affected plant communities of the San Joaquin River Region are presented in Attachment A.

Implementation of the ERP would potentially affect grassland and ruderal

communities located adjacent to stream channels. Types of actions that could affect these **natural terrestrial communities** include levee setbacks, modification of streamflows, and modification of livestock grazing practices along stream channels. Potential direct impacts on these habitats that could be associated with levee setbacks and modification of levee maintenance practices are the same as those described for the Delta Region. Setting back levees, reducing the adverse effects of grazing along channels, and changing timing and magnitude of streamflows would change local ground and surface water hydrology. In some locations, these changes would potentially be sufficient to result in the gradual conversion of annual grassland to riparian and wetland communities.

Implementation of the ERP under Alternative 1 would result in the restoration, enhancement, or protection of up to an estimated 5,000 acres of riparian habitat. Because the type of **riparian community** that would be restored is dependent on site-specific conditions, such as local hydrology and soils, the area of each type of riparian community that would be restored is not predictable. Restoration of riparian habitats would primarily be achieved through restoration of floodplain processes that would create the conditions necessary for the natural reestablishment of riparian vegetation. In some locations, existing riparian scrub, woodland, and forest could be affected by construction of levee setbacks.

Habitat values associated with increasing habitat area and improving habitat quality and pattern and as a result restoring riparian habitats are the same as those described for restoration of riparian habitats in the Delta Region.

Implementation of the ERP could increase the area of **open-water and wetlands** associated with stream courses and flood basins in the San Joaquin River Region. Actions that restore channel meander could result in the creation of oxbow lakes in future years as channels migrate across their floodplains.

Habitat values associated with increasing habitat area and improving habitat quality and pattern and as a result restoring open-water and wetland habitats are the same as those described for restoration of riparian habitats in the Delta Region.

Under Alternative 1 implementation of the ERP would restore up to an estimated 5,000 acres of riparian habitat. Restoration of riparian habitat, including setting back levees, could affect **agricultural lands** located immediately adjacent to the San Joaquin River and its tributaries. Some riparian habitat would be restored within existing stream meander belts and along levees that are not in agricultural production.

Habitat values associated with the loss of agricultural lands are similar to those described for the Delta Region. Approximately 128 species of wildlife associated with agricultural lands in the San Joaquin River Region would potentially be affected by implementation of the ERP (Table 5-16).

The impacts of implementing the **Water Quality Program** would be the same as under Variation 1A for the Delta Region. Specific actions that could affect plant

communities and associated wildlife in the CALFED problem and solution areas are not identified for the CALFED **Water Use Efficiency Program**; therefore, the potential impacts of the program cannot be determined. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 1A.

Variation 1A - Special-Status Species and Communities

The San Joaquin River Region is dominated by agricultural land (of which pasture and orchards/vineyards are most abundant), foothill hardwood trees, grassland, and mixed coniferous forest. Proposed habitat restoration under the **ERP** would contain several components. Some agricultural land would be fallowed or permanently converted to riparian and wetland communities. This habitat alteration would benefit many of the special-status species listed in Table 5-19 because the majority of these species inhabit freshwater emergent wetlands, lakes, rivers on the valley floor, and riparian areas. Pasture lands, some of which would be lost as a result of conversion to wetland or shallow-water habitats, provide foraging areas for the Swainson's hawk. However, since the primary limiting factor for this species is nesting/roosting trees, there would be a net overall beneficial impact to this species. Other habitat restoration components would include enhancement of riparian communities along the San Joaquin River, restoration of riparian habitat on major tributaries of the San Joaquin River, and restoration of spawning grovels within waterways. These activities would have positive impacts on most if not all special-status species in the San Joaquin River Region.

Nineteen rare natural communities and 77 significant natural areas including vernal pools (Section IV of Affected Environment Technical Report) occur or have the potential to occur in the San Joaquin River Region. Many of these communities occur along the San Joaquin River or other major regional rivers and tributaries and include various riparian forests, scrublands, grasslands, marshes, and other wetland habitats. These communities support most of the special-status wildlife species, and would be positively impacted by the ERP in the long term by the expansion and direct restoration of suitable native habitat through the previously mentioned activities.

The **Water Quality Program** would improve water quality throughout the San Joaquin River Region by reducing mercury loadings, pesticide levels, urban contaminants, and oxygen depletion through improved management of discharges. These improvements in water quality under Variation 1A would benefit most of the 49 special-status species either directly, by improving the health of individuals of the species, or indirectly, by improving the quality of their habitat. Similarly, these water quality improvements could positively impact many of the 19 rare natural communities and 77 significant natural areas (Section IV of Affected Environment Technical Report) of the San Joaquin River Region.

The **Water Use Efficiency Program** includes plans whose goals are to reduce existing use and future demands on the

Table 5-19
Special-Status Species - Storage Facilities in the San Joaquin River Region

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Animals																				
Agelaius tricolor tricolored blackbird	SC	--	--																	
Ambystoma californiense California tiger salamander	C	CSC	--			X		X			X		X		X	X	X	X	X	X
Ammospermophilus nelsoni San Joaquin antelope squirrel	C	T	--					X			X		X		X	X	X	X	X	X
Aquila chrysaetos golden eagle	--	CSC	--																	
Athene cunicularia burrowing owl	--	--	--					X			X		X		X	X	X	X	X	X
Branchinecta lynchi vernal pool fairy shrimp	T	--	--					X			X		X		X	X	X	X	X	X
Buteo swainsoni Swainson's hawk	--	T	--					X			X		X		X	X	X	X	X	X
Carpenteria californica tree-anemone	PT	T	--					X			X		X		X	X	X	X	X	X
Clemmys marmorata western pond turtle	--	--	--			X		X			X		X		X	X	X	X	X	X
Coccyzus americanus occidentalis western yellow-billed cuckoo	--	E	--																	
Dipodomys heermanni dixoni Merced kangaroo rat	--	--	--					X			X		X		X	X	X	X	X	X
Dipodomys nitratoides exilis Fresno kangaroo rat	E	E	--					X CH			X CH		X CH		X CH	X CH	X CH	X CH	X CH	X CH

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Table 5-19 (continued)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Dipodomys nitratoides nitratoides Tipton kangaroo rat	E	E	--					X			X		X		X	X	X	X	X	X
Eumops perotis californicus California mastiff bat	SC	--	--																	
Falco mexicanus prairie falcon	--	CSC	--					X			X		X		X	X	X	X	X	X
Gambelia silus blunt-nosed leopard lizard	E	E	--					X			X		X		X	X	X	X	X	X
Grus canadensis tabida greater sandhill crane	--	T	--					(+)			(+)		(+)		(+)	(+)	(+)	(+)	(+)	(+)
Gymnogyps californianus California condor						CH		CH			CH		CH		CH	CH	CH	CH	CH	CH
Lampetra hubbsi Kern brook lamprey	SC	--	--			X		X			X		X		X	X	X	X	X	X
Lepidurus packardi vernal pool tadpole shrimp	E	--	--					X			X		X		X	X	X	X	X	X
Lytta hoppingi Hoppings blister beetle	SC	--	--					X			X		X		X	X	X	X	X	X
Lytta molesta Molestan blister beetle	SC	--	--					X			X		X		X	X	X	X	X	X
Masticophis flagellum ruddocki San Joaquin whipsnake	SC	--	--					X			X		X		X	X	X	X	X	X
Perognathus inornatus inornatus San Joaquin pocket mouse	--	--	--					X			X		X		X	X	X	X	X	X
Plegadis chihi white-faced ibis	SC	--	--			X		X			X		X		X	X	X	X	X	X
Riparia riparia bank swallow	--	T	--					X			X		X		X	X	X	X	X	X
Scaphiopus hammondii western spadefoot	SC	--	--					X			X		X		X	X	X	X	X	X
Thamnophis gigas giant garter snake	T	T	--			X		X			X		X		X	X	X	X	X	X

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Table 5-19 (continued)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	Fed. List	CA List	CNPS	A	B	C	A	B	C	D	E	A	B	C	D	E	F	G	H	I
Vulpes macrotis mutica San Joaquin kit fox	E	T	--					X			X		X		X	X	X	X	X	X
Linderiella occidentalis California linderiella	--	--	--					X			X		X		X	X	X	X	X	X
Plants																				
Atriplex cordulata heartscale	SC	--	1B					X			X		X		X	X	X	X	X	X
Atriplex depressa brittlescale	--	--	1B					X			X		X		X	X	X	X	X	X
Atriplex minuscula lesser saltscale	--	--	1B					X			X		X		X	X	X	X	X	X
Atriplex vallicola lost hills crownscale	SC	--	1B					X			X		X		X	X	X	X	X	X
Castilleja campestris ssp succulenta succulent owl's-clover	PT	E	1B					X			X		X		X	X	X	X	X	X
Caulanthus californicus California jewelflower	E	E	1B					X			X		X		X	X	X	X	X	X
Cordylanthus palmatus palmate-bracted bird's-beak	E	E	1B					X			X		X		X	X	X	X	X	X
Delphinium recurvatum recurved larkspur	SC	--	1B					X			X		X		X	X	X	X	X	X
Downingia pusilla dwarf downingia	--	--	2					X			X		X		X	X	X	X	X	X
Eriastrum hooveri Hoover's eriastrum	T	--	4					X			X		X		X	X	X	X	X	X
Gratiola heterosepala Boggs Lake hedge-hyssop	--	E	1B			X		X			X		X		X	X	X	X	X	X
Lasthenia glabrata ssp coulteri Coulter's goldfields	SC	--	1B					X			X		X		X	X	X	X	X	X

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Table 5-19 (continued)

Species	Status			Alt. 1			Alt. 2					Alt. 3								
Common Name	**Fed. List**	**CA List**	**CNPS**	**A**	**B**	**C**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Layia munzii Munz's tidy-tips	--	--	1B					X			X		X		X	X	X	X	X	X
Lembertia congdonii San Joaquin woollythreads	E	--	1B					X			X		X		X	X	X	X	X	X
Linanthus serrulatus Madera linanthus	--	--	1B					X			X		X		X	X	X	X	X	X
Orcuttia inaequalis San Joaquin Valley orcutt grass	PE	E	1B					X			X		X		X	X	X	X	X	X
Pseudobahia bahiifolia Hartweg's golden sunburst	PE	E	1B					X			X		X		X	X	X	X	X	X
Pseudobahia peirsonii San Joaquin adobe sunburst	PE	E	1B					X			X		X		X	X	X	X	X	X
Sagittaria sanfordii Sanford's arrowhead	SC	--	1B			X		X			X		X		X	X	X	X	X	X
Total Special-Status Species:						7		44			44		44		44	44	44	44	44	44
Vernal Pool Special-Status Species Habitat (acres)[a]	NA	NA	NA	0	0	0	0	53.509	0	0	53.509	0	53.509	0	53.509	53.509	53.509	53.509	53.509	53.509

Notes:

[a] Vernal pool special-status species landscape includes the watershed areas that support several of the species indicated in this table. The database used for estimating acres affected is Holland (1997), a more accurate database than the NDDB database used for evaluating the presence of individual species.

Source: California Natural Diversity Data Base (NDDB 1997)

Symbols:

X = indicates a known occurrence of a species within a storage footprint

(+) = indicates a presumed occurrence of a species within a storage footprint based on the likely presence of suitable habitat

CH = Critical Habitat

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Table 5-19 (concluded)

Status Abbreviations:

Federal (NDDB 1997)	State (NDDB 1997)	CNPS (Skinner and Pavlik 1994)
E = endangered	E = endangered	1A = presumed extinct
T = threatened	T = threatened	1B = species that are rare, threatened, or endangered throughout their range
PE = proposed endangered	R = rare	2 = species that are rare, threatened, or endangered in California but more common elsewhere
PT = proposed threatened	CSC = species of concern	4 = species has a limited distribution in California
C = candidate		
SC = species of concern		

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state's limited water supply. However, some elements of the program are voluntary and some are already in use or planned as part of other programs, so the benefits that can be attributed to CALFED actions are limited. Therefore, to the extent that the Water Use Efficiency Program reduces existing water use and future demand, more water can be left in San Joaquin River Region channels, which could have positive or no impacts to special-status species as well as to rare natural communities and significant natural areas.

No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 1A.

Variation 1B - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1B would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 1B.

Variation 1B - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1B would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 1B.

Variation 1C - Plant Communities and Associated Wildlife

Changes in the area or quality of plant communities affected by **Storage Facilities** would potentially also affect wildlife populations associated with those plant communities. Typical wildlife species associated with plant communities of the San Joaquin River Region are presented in Attachment A. Table 5-20 describes the relative impact of construction of storage facilities on habitats compared to other variations.

Construction of off-aqueduct storage could result in temporary or permanent loss or disturbance of wetland, riparian, annual grassland, and valley foothill hardwood communities and agricultural lands as a result of inundation and construction of roads and other infrastructure assuming storage facilities are constructed in foothill habitats along the western side of the San Joaquin Valley. Table 5-16 summarizes the numbers of wildlife species typically associated with each of the habitat types that could be affected by construction of storage facilities. The actual area and habitat types that would be affected by construction of off-aqueduct storage facilities, however, would depend on the siting, design, and operations of facilities. Construction of storage reservoirs could fragment important habitats and disrupt wildlife movement patterns. The potential effects of fragmenting riparian habitats would be similar to those described for the Delta Region. If off-aqueduct reservoirs are located in watersheds that support riparian vegetation, reservoirs could also result in the loss or degradation of riparian habitat downstream of reservoirs as a

Table 5-20
Comparison of Levels of Benefit and Impact of Storage Facilities Among Alternatives 1, 2, and 3 Variations on Habitat Types in the San Joaquin River Region

Alternative Variation	Potentially Created Open Water	Potentially Affected Nonagricultural Habitat	Potentially Affected Agricultural Habitat
1C	+	-	-
2B	+++	---	---
2D	++	--	--
2E	+++	---	---
3B	+++	---	---
3D	+++	---	---
3E	+++	---	---
3F	+++	---	---
3G	+++	---	---
3H	+++	---	---
3I	+++	---	---

Note: "+" indicates increase in habitat acres and "-" indicates a decrease in habitat acres. The larger number of symbols represents a greater degree of change in habitat acres.

result of interrupting sediment supply to the stream channel and altering stream hydrology. Some habitat types that could be lost or degraded as a result of storage facilities, such as valley oak woodland, could have declined locally or regionally sufficiently from historic conditions that additional losses could substantially affect associated wildlife populations. The wildlife value of habitats surrounding reservoirs for some species could also be degraded if public access and levels of recreation substantially increase. Local deer populations could be adversely affected if storage reservoirs, attendant facilities, and associated recreational uses result in loss or degradation of CDFG-designated critical deer winter range and fawning habitats, and other important deer use areas. Construction of off-aqueduct storage would result in creation of open-water habitats during periods water is stored.

If groundwater storage is achieved by percolating water through water-spreading grounds, construction of water-spreading grounds and associated facilities could result in the temporary or permanent loss of annual grassland and agricultural habitat types, assuming they are constructed in low land areas of the San Joaquin Valley. The actual area and habitat types that would be affected by construction and operation of groundwater recharge facilities, however, would depend on the siting, design, and operations of facilities. Shallow open-water habitat would be created during periods surface water is retained on spreading grounds. Mudflats and bare ground would be created as surface water is drawn down. To maintain percolation efficiency, however, spreading grounds would likely be maintained to be devoid of vegetation. Consequently, these created habitats would likely provide low forage and cover values for associated wildlife.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1C would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 1C.

Variation 1C - Special-Status Species and Communities

Variation 1C water **Storage Facilities** would include up to 500,000 acre-feet of groundwater storage in the San Joaquin Valley. Although direct construction impacts for groundwater storage facilities are generally less than for surface storage facilities, rare natural communities and significant natural areas could be impacted. In addition, up to seven special-status aquatic animal and plant species could be impacted (Table 5-19) depending upon the manner in which diversions for groundwater storage are conducted and what effects these diversions have on the water quality itself. Type and extent of specific impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage facilities would depend on the locations and operation of the storage facilities, which have yet to be determined.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 1C would be the same as under Variation 1A. No new **Conveyance Facilities** would be

planned for the San Joaquin River Region under Variation 1C.

5.5.3 Alternative 2 Impact Evaluation by Variation - San Joaquin River Region

Variation 2A - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2A would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2A.

Variation 2A - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2A would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2A.

Variation 2B - Plant Communities and Associated Wildlife

The impacts associated with construction of groundwater **Storage Facilities** under Variation 2B would be the same as under Variation 1C. Impacts of construction of 2 million acre-feet of off-aqueduct storage and associated facilities would be similar to those described for construction of 1 million acre-feet of off-aqueduct storage under Variation 1C, except that the habitat area impacted and the area of open-water created with storage of an additional 1 million acre-feet under Variation 2B would potentially be greater. Table 5-20 describes the relative impact of construction of storage facilities on habitats compared to other variations. Table 5-16 summarizes the numbers of wildlife species typically associated with each of the habitat types that could be affected by construction of storage facilities.

Under Variation 2B 500,000 acre-feet of new surface storage would be developed by either enlarging existing storage reservoirs or developing new off-stream storage. The analysis of new storage facilities is based on the potential impacts that would be associated with the enlargement of an existing reservoir and a hypothetical off-stream storage location in the foothills surrounding the San Joaquin Valley. Consequently, this analysis is only representative of the types of impacts that could occur with implementation of Variation 2B. The habitat types and area that would actually be affected by increasing storage would depend on the siting and design of storage facilities.

Enlargement of existing reservoirs and construction of new off-stream storage could result in temporary or permanent loss or disturbance of wetland, riparian, annual grassland, valley foothill hardwood, and montane hardwood communities and agricultural lands as a result of inundation and construction of roads and other infrastructure. For example, enlargement of Millerton Lake could affect up to 2,000 acres of annual grassland and blue oak woodland and construction of the previously proposed Montgomery Reservoir Project could affect up to 8,100 acres of annual

grassland. As a result of inundation, enlargement or construction of additional reservoirs would create open-water habitat. If off-stream reservoirs are located in watersheds that support riparian vegetation, reservoirs could also result in the loss or degradation of riparian habitat downstream of reservoirs as a result of interrupting sediment supply to the stream channel and altering stream hydrology. Some habitat types that could be lost or degraded as a result of enlarging existing reservoirs or constructing additional storage facilities, such as valley oak woodland, could have declined locally or regionally sufficiently from historic conditions that additional losses could substantially affect associated wildlife populations. Construction of off-site reservoirs could fragment important habitats and disrupt wildlife movement patterns. The potential effects of fragmenting riparian habitats would be similar to those described for the Delta Region. The wildlife value of habitats surrounding reservoirs for some species could also be degraded if public access and levels of recreation substantially increase. Local deer populations could be adversely affected if storage reservoirs, attendant facilities, and associated recreational uses result in loss or degradation of CDFG-designated critical deer winter range and fawning habitats, and other important deer use areas.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2B would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2B.

Variation 2B - Special-Status Species and Communities

Variation 2B **Storage Facilities** would include up to 500,000 acre-feet of storage on San Joaquin River Region tributaries (either by enlarging existing storage or by creating new off-stream storage), and up to 500,000 acre-feet of groundwater storage in the San Joaquin Valley. Although the potential for loss of habitat and impacts to special-status species due to surface storage cannot be precisely determined until a decision is made as to where the expanded and/or new surface storage facilities would be located, impacts to 44 special-status species are possible (Table 5-19).

Although direct construction impacts for groundwater storage facilities are generally less than that for surface storage facilities, rare natural communities and significant natural areas could be impacted. In addition to those species potentially affected by surface water storage, up to three other special-status aquatic animal and plant species could be impacted by groundwater storage (depending upon the manner in which diversions are conducted and what effects these diversions have on the water quality itself). Type and extent of specific impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage facilities would depend on the locations and operation of the storage facilities, which have yet to be determined.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2B would be the same as under Variation 1A.

No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2B.

Variation 2C - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2C would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2C.

Variation 2C - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2C would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2C.

Variation 2D - Plant Communities and Associated Wildlife

Impacts of construction of 2 million acre-feet of off-aqueduct **Storage Facilities** and associated facilities would be similar to those described for construction of 1 million acre-feet of off-aqueduct storage under Variation 1A, except that the habitat area impacted and the area of open-water created with storage of an additional 1 million acre-feet under Variation 2D would potentially be greater. Table 5-20 describes the relative impact of construction of storage facilities on habitats compared to other variations.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2D would be the same as under Variation 1A. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2D.

Variation 2D - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2D would be the same as under Variation 1A. Variation 2D **Storage Facilities** would be similar to Variation 2B. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2D.

Variation 2E - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2E would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 2B. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 2E.

Variation 2E - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 2E would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 2B. No new

Conveyance Facilities would be planned for the San Joaquin River Region under Variation 2E.

5.5.4 Alternative 3 Impact Evaluation by Variation - San Joaquin River Region

Variation 3A - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3A would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 3A.

Variation 3A - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3A would be the same as under Variation 1A. No new **Storage** or **Conveyance Facilities** would be planned for the San Joaquin River Region under Variation 3A.

Variation 3B - Plant Communities and Associated Wildlife

Under Variation 3B **Conveyance Facilities,** spur conveyance links from the Delta to east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3B would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 2B.

Variation 3B - Special-Status Species and Communities

Variation 3B **Storage Facilities** would include up to 500,000 acre-feet of storage on San Joaquin River Region tributaries (either by enlarging existing storage or by creating new off-stream storage), and up to 500,000 acre-feet of groundwater storage in the San Joaquin Valley. Although the potential for loss of habitat and impacts to special-status species due to surface storage cannot be precisely determined until a decision is made as to where the expanded and/or new surface storage facilities would be located, impacts to 44 special-status species are possible (Table 5-19).

Although direct construction impacts for groundwater storage facilities are generally less than for surface storage facilities, rare natural communities and significant natural areas could be impacted. In addition to those species potentially affected by surface storage facilities, up to three other special-status aquatic animal and plant species could be impacted by groundwater storage (depending upon the manner in which diversions are conducted and what effects these diversions have on the water quality itself). Type and extent of specific impacts to special-status species, rare natural communities, and significant natural areas from construction and operation of groundwater storage

facilities would depend on the locations and operation of the storage facilities, which have yet to be determined.

Under Variation 3B **Conveyance Facilities,** spur conveyance links from the Delta to east of the Delta would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3B would be the same as under Variation 1A.

Variation 3C - Plant Communities and Associated Wildlife

Under Variation 3C **Conveyance Facilities,** spur conveyance links, would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction of spur conveyance facilities are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3C would be the same as under Variation 1A. No new **Storage Facilities** would be planned for the San Joaquin River Region under Variation 3C.

Variation 3C - Special-Status Species and Communities

Under Variation 3C **Conveyance Facilities,** spur conveyance links, would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction of spur conveyance facilities are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3C would be the same as under Variation 3A. No new **Storage Facilities** would be planned for the San Joaquin River Region under Variation 3C.

Variation 3D - Plant Communities and Associated Wildlife

Under Variation 3D **Conveyance Facilities,** spur conveyance links would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3D would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 3B.

Variation 3D - Special-Status Species and Communities

Under Variation 3D **Conveyance Facilities,** spur conveyance links would be constructed. The number, siting, and design of these facilities have not been developed; therefore, impacts associated with construction are unknown.

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variation 3D would be the same as under Variation 1A,

and **Storage Facilities** would be the same as under Variation 3B.

Variations 3E-3I - Plant Communities and Associated Wildlife

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3E-3I would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 3B. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variations 3E-3I.

Variations 3E-3I - Special-Status Species and Communities

The impacts of implementing the **ERP, Water Quality Program**, and **Water Use Efficiency Program** under Variations 3E-3I would be the same as under Variation 1A, and **Storage Facilities** would be the same as under Variation 3B. No new **Conveyance Facilities** would be planned for the San Joaquin River Region under Variations 3E-3I.

5.6 Environmental Impacts in the SWP and CVP Service Areas

Implementation of the CALFED Alternatives would have only minor direct impacts on wetland, riparian, and upland communities near streams, reservoirs, and estuaries in SWP and CVP service areas outside of the Central Valley. Although the volume and quality of water exported could increase, the destination of the water would be the same as under the No Action Alternative. Small changes could occur in the quantity and quality of natural terrestrial communities bordering receiving waters but are not quantifiable at a programmatic level of detail.

Implementation of the CALFED Alternatives could be growth inducing in areas where the volume and quality of water would be increased. In these areas residential and/or commercial growth could remove terrestrial habitat, displace resident species, and/or reduce the quality of surrounding habitat. These impacts are not quantifiable at a programmatic level of detail. If increased growth occurs, the resulting impacts would need to be addressed by the local planning agencies with zoning and permitting authority.

6.0 REFERENCES

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ATTACHMENT A
HABITAT GUILD AND SPECIES SUMMARY

HABITAT GUILD AND SPECIES SUMMARY

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Deep Water					
Birds					
Western grebe	Sp,F,W	F,R	F,R	B,F,R	B,F,R
Clark's grebe	Sp, F,W	F,R	F,R	B,F,R	B,F,R
American white pelican	Sp,F,W	F,R	F,R	F,R	F,R
Double-crested cormorant	Resident	F,R	F,R	F,R	F,R
Canvasback	F,W	F,R	F,R	F,R	F,R
Redhead	Resident	F,R	F,R	F,R	F,R
Ring-necked duck	F,W	F,R	F,R	F,R	F,R
Greater scaup	F,W	F,R	F,R		
Lesser scaup	F,W	F,R	F,R	F,R	F,R
Black scoter	F,W	F,R			
Surf scoter	F,W	F,R			
White-winged scoter	F,W	F,R			
Common goldeneye	F,W	F,R	F,R	F,R	F,R
Barrow's goldeneye	F,W	F,R	F,R	F,R	?
Bufflehead	F,W	F,R	F,R	F,R	F,R
Hooded merganser	F,W	F,R	F,R	F,R	F,R
Common merganser	Sp,F,W	?	F,R	F,R	F,R
Red-breasted merganser	F,W	F,R			
Ruddy duck	Resident	F,R	F,R	F,R	F,R
Wilson's phalarope	Sp,F	F,R	F,R	F,R	F,R
Red-necked phalarope	Sp,F	F,R	F,R	F,R	F,R
Bonaparte's gull	F,W	F,R	F,R	F,R	F,R
Mew gull	F,W	F,R	F,R		
Ring-billed gull	Sp,F,W	F,R	F,R	F,R	F,R
California gull	Sp,F,W	F,R	F,R	F,R	F,R
Herring gull	Sp,F,W	F,R	F,R	F,R	F,R
Thayer's gull	Sp,F,W	F,R	F,R	F,R	F,R
Western gull	Sp,F,W	F,R			
Caspian tern	Sp,Su	F	F	F	F
Elegant tern	Su,F	F			
Forster's tern	Sp,Su	F,R	F,R	F,R	F,R
Mammals					
River otter	Resident		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Shallow Water					
Birds					
Black-crowned night-heron	Resident	F,R	F,R	F,R	F,R
Great blue heron	Resident	F,R	F,R	F,R	F,R
Great egret	Resident	F,R	F,R	F,R	F,R
Cattle egret	F,W	F,R	F,R		F,R
White-faced ibis	Resident	F,R	F,R	F,R	F,R
Sandhill crane			F,R		F,R
Tundra swan	F,W	F,R	F,R	F,R	F,R
Greater white-fronted goose	F,W	F,R	F,R	F,R	F,R
Snow goose	F,W	F,R	F,R	F,R	F,R
Ross' goose	F,W	F,R	F,R	F,R	F,R
Canada goose	Sp,F,W	F,R	F,R	F,R	F,R
Green-winged teal	F,W	F,R	F,R	F,R	F,R
Mallard	Resident	F,R	F,R	F,R	F,R
Northern pintail	F,W	F,R	F,R	F,R	F,R
Cinnamon teal	Sp,F,W	F,R	F,R	F,R	F,R
Northern shoveler	F,W	F,R	F,R	F,R	F,R
Gadwall	Sp,F,W	F,R	F,R	F,R	F,R
American wigeon	F,W	F,R	F,R	F,R	F,R
American peregrine falcon	F,W	F	F	F	F
Black-necked stilt	Resident	F,R	F,R	F,R	F,R
American avocet	Resident	F,R	F,R	F,R	F,R
Greater yellowlegs	Sp,W,F	F,R	F,R	F,R	F,R
Lesser yellowlegs	F,W	F,R	F,R	F,R	F,R
Willet	F,W	F,R	F,R	F,R	F,R
Whimbrel	Sp,F	F,R	F,R	F,R	F,R
Long-billed curlew	Sp,F,W	F,R	F,R	F,R	F,R
Long-billed dowitcher	Sp,F,W	F,R	F,R	F,R	F,R
Ring-billed gull	Sp,F,W	F,R	F,R	F,R	F,R
California gull	Sp,F,W	F,R	F,R	F,R	F,R
Herring gull	Sp,F,W	F,R	F,R	F,R	F,R
Least tern	Sp,Su	F			
Mudflats					
Birds					
American peregrine falcon	F,W	F	F	F	F
Black-bellied plover	Sp,F	F,R	F,R	F,R	F,R
Snowy plover	Resident	B,F,R	B,F,R		B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Semipalmated plover	Sp,F	F,R	F,R	F,R	F,R
Killdeer	Resident	B,F,R	B,F,R	B,F,R	B,F,R
Black-necked stilt	Resident	B,F,R	B,F,R	B,F,R	B,F,R
American avocet	Resident	B,F,R	B,F,R	B,F,R	B,F,R
Greater yellowlegs	Sp,W,F	F,R	F,R	F,R	F,R
Lesser yellowlegs	F,W	F,R	F,R	F,R	F,R
Willet	F,W	F,R	F,R	F,R	F,R
Spotted sandpiper	F,W	F,R	F,R	F,R	F,R
Whimbrel	Sp,F	F,R	F,R	F,R	F,R
Long-billed curlew	Sp,F,W	F,R	F,R	F,R	F,R
Marbled godwit	Sp,F,W	F,R	F,R		
Ruddy turnstone	Sp,F,W	F,R	F,R		
Red knot	F,W	F,R			
Sanderling	F,W	F,R			
Western sandpiper	Sp,F	F,R	F,R	F,R	F,R
Least sandpiper	Sp,F,W	F,R	F,R	F,R	F,R
Dunlin	Sp,F,W	F,R	F,R	F,R	F,R
Short-billed dowitcher	Sp,F,W	F,R	F,R		
Long-billed dowitcher	Sp,F,W	F,R	F,R	F,R	F,R
Ring-billed gull	Sp,F,W	R	R	R	R
California gull	Sp,F,W	R	R	R	R
Herring gull	Sp,F,W	R	R	R	R
Caspian tern	Sp,Su	R	R	R	R
Forster's tern	Sp,Su	R	R	R	R
Least tern	Sp,Su	R			
Black tern	Sp,Su	R	R	R	R
Fresh Emergent Wetland					
Birds					
Pied-billed grebe	Resident		B,F,R	B,F,R	B,F,R
Eared grebe	Resident		B,F,R	B,F,R	B,F,R
American bittern	Resident		B,F,R	B,F,R	B,F,R
Cattle egret	Sp,F,W		F,R	F,R	B,F,R
Black-crowned night-heron	Resident		F,R	F,R	F,R
Snowy egret	Resident		B,F,R	B,F,R	B,F,R
White-faced ibis	Resident		F,R	B,F,R	B,F,R
Tundra swan	F,W		F,R	F,R	F,R
Greater white-fronted goose	F,W		F,R	F,R	F,R
Snow goose	F,W		F,R	F,R	F,R
Ross' goose	F,W		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Canada goose	F,W		B,F,R	F,R	F,R
Green-winged teal	F,W		F,R	F,R	F,R
Mallard	Resident		B,F,R	B,F,R	B,F,R
Northern pintail	F,W		F,R	F,R	F,R
Cinnamon teal	Sp,F,W		B,F,R	B,F,R	B,F,R
Gadwall	Sp,F,W		B,F,R	B,F,R	B,F,R
Redhead	Resident		B,F,R	B,F,R	B,F,R
Ring-necked duck	F,W		F,R	F,R	F,R
Lesser scaup	F,W		F,R	F,R	F,R
Greater scaup	F,W		F,R	F,R	
Bufflehead	F,W		F,R	F,R	F,R
Hooded merganser	F,W		F,R	F,R	F,R
Common merganser	F,W		F,R	F,R	F,R
Ruddy duck	Resident		B,F,R	B,F,R	B,F,R
Black rail	Resident		B,F,R	B,F,R	
Virginia rail	Resident		B,F,R	B,F,R	B,F,R
Common moorhen	Resident		B,F,R	B,F,R	B,F,R
American coot	Resident		B,F,R	B,F,R	B,F,R
Sandhill crane	F,W		F,R	F,R	F,R
Common snipe	Sp,F,W		F,R	F,R	F,R
Black tern	Sp,Su			B,F,R	B,F,R
Short-eared owl	Resident		B,F,R	B,F,R	B,F,R
Marsh wren	Resident		B,F,R	B,F,R	B,F,R
Common yellowthroat	Resident		B,F,R	B,F,R	B,F,R
Red-winged blackbird	Resident		B,F,R	B,F,R	B,F,R
Tricolored blackbird	Resident		B,F,R	B,F,R	B,F,R
Yellow-headed blackbird	Sp,Su		B,F,R	B,F,R	B,F,R
Mammals					
Beaver	Resident		B,F,R	B,F,R	B,F,R
Muskrat	Resident		B,F,R	B,F,R	B,F,R
Coyote	Resident		B,F,R	B,F,R	B,F,R
Red fox	Resident		B,F,R	B,F,R	B,F,R
Gray fox	Resident		B,F,R	B,F,R	B,F,R
River otter	Resident		B,F,R	B,F,R	B,F,R
Reptiles					
Western aquatic garter snake	Resident		B,F,R	B,F,R	B,F,R
Common garter snake	Resident		B,F,R	B,F,R	B,F,R
W. terrestrial garter snake	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Amphibians					
Pacific treefrog	Resident		B,F,R	B,F,R	B,F,R
Saline Emergent Wetland					
Birds					
Eared grebe	Resident	B,F,R	B,F,R		
Black-crowned night-heron	Resident	F,R	F,R		
Snowy egret	Resident	F,R	B,F,R		
Mallard	Resident	B,F,R	B,F,R		
Northern pintail	F,W	F,R	F,R		
Cinnamon teal	Sp,F,W	B,F,R	B,F,R		
Gadwall	Sp,F,W	B,F,R	B,F,R		
Redhead	Resident	B,F,R	B,F,R		
Lesser scaup	F,W	F,R	F,R		
Greater scaup	F,W	F,R	F,R		
Bufflehead	F,W	F,R	F,R		
Ruddy duck	Resident	B,F,R	B,F,R		
Black rail	Resident	B,F,R	B,F,R		
Clapper rail	Resident	B,F,R	B,F,R		
Virginia rail	F,W	F,R	F,R		
Sora	F,W	F,R	F,R		
American coot	F,W	B,F,R	B,F,R		
Willet	F,W	F,R	F,R		
Whimbrel	F,W	F,R	F,R		
Common snipe	Sp,F,W	F,R	F,R		
Marsh wren	Resident	B,F,R	B,F,R		
Common yellowthroat	Resident	B,F,R	B,F,R		
Red-winged blackbird	Resident	B,F,R	B,F,R		
Tricolored blackbird	F,W	F,R	F,R		
Mammals					
Red fox	Resident		B,F,R		
Salt marsh harvest mouse	Resident		B,F,R		
Deer mouse	Resident		B,F,R		
Valley Foothill Riparian					
Birds					
Great blue heron	Resident		B,R	B,R	B,R
Great egret	Resident		B,R	B,R	B,R
Wood duck	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Turkey vulture	Resident		R	R	R
White-tailed kite	Resident		B,F,R	B,F,R	B,F,R
Bald eagle	F,W		R	R	R
Sharp-shinned hawk	Sp,F,W		F,R	F,R	F,R
Cooper's hawk	Sp,F,W		B,F,R	B,F,R	B,F,R
Red-shouldered hawk	Resident		B,F,R	B,F,R	B,F,R
Swainson's hawk	Sp,Su,F		B,R	B,R	B,R
Red-tailed hawk	Resident		B,R	B,R	B,R
American kestrel	Resident		B,F,R	B,F,R	B,F,R
Merlin	F,W		F,R	F,R	F,R
Ring-necked pheasant	Resident		R	R	R
California quail	Resident		B,F,R	B,F,R	B,F,R
Wild Turkey	Resident		B,F,R	B,F,R	B,F,R
Spotted sandpiper	F,W		B,F,R	B,F,R	B,F,R
Band-tailed pigeon	Resident		F,R	F,R	F,R
Mourning dove	Resident		B,F,R	B,F,R	B,F,R
Yellow-billed cuckoo	Sp,Su			B,F,R	
Barn owl	Resident		B,F,R	B,F,R	B,F,R
Western screech owl	Resident		B,F,R	B,F,R	B,F,R
Great horned owl	Resident		B,F,R	B,F,R	B,F,R
Long-eared owl	Resident		B,F,R	B,F,R	B,F,R
Black-chinned hummingbird	Sp,Su		B,F,R	B,F,R	B,F,R
Anna's hummingbird	Resident		B,F,R	B,F,R	B,F,R
Rufous hummingbird	Sp,F		F,R	F,R	F,R
Belted kingfisher	Resident		B,F,R	B,F,R	B,F,R
Red-breasted sapsucker	F,W		F,R	F,R	F,R
Nuttall's woodpecker	Resident		B,F,R	B,F,R	B,F,R
Downy woodpecker	Resident		B,F,R	B,F,R	B,F,R
Hairy woodpecker	F,W		F,R	F,R	F,R
Northern flicker	Resident		B,F,R	B,F,R	B,F,R
Western wood-pewee	Sp,Su		F,R	F,R	F,R
Willow flycatcher	F		F,R	F,R	F,R
Pacific slope flycatcher	Sp,Su		B,F,R	B,F,R	B,F,R
Black phoebe	Resident		B,F,R	B,F,R	B,F,R
Ash-throated flycatcher	Sp,Su		B,F,R	B,F,R	B,F,R
Purple martin	Sp,Su		B,F,R	B,F,R	B,F,R
Tree swallow	Resident		B,F,R	B,F,R	B,F,R
Violet-green swallow	Sp,Su		B,F,R	B,F,R	B,F,R
No. rough-winged swallow	Sp,Su		B,F,R	B,F,R	B,F,R
Bank swallow	Sp,Su		B,F,R	B,F,R	B,F,R
Cliff swallow	Sp,Su		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Barn swallow	Sp,Su		B,F,R	B,F,R	B,F,R
Scrub jay	Resident		B,F,R	B,F,R	B,F,R
Yellow-billed magpie	Resident		B,F,R	B,F,R	B,F,R
American crow	Resident		B,F,R	B,F,R	B,F,R
Plain titmouse	Resident		B,F,R	B,F,R	B,F,R
Bushtit	Resident		B,F,R	B,F,R	B,F,R
White-breasted nuthatch	Resident		B,F,R	B,F,R	B,F,R
Brown creeper	F,W		B,F,R	B,F,R	B,F,R
Bewick's wren	Resident		B,F,R	B,F,R	B,F,R
House wren	Sp,Su,F		B,F,R	B,F,R	B,F,R
Golden-crowned kinglet	F,W		F,R	F,R	F,R
Ruby-crowned kinglet	F,W		F,R	F,R	F,R
Blue-gray gnatcatcher	F,W			F,R	F,R
Western bluebird	Resident		B,F,R	B,F,R	B,F,R
Swainson's thrush	Sp,F		F,R	F,R	F,R
Hermit thrush	Sp,F,W		F,R	F,R	F,R
American robin	Resident		B,F,R	B,F,R	B,F,R
Wrentit	Resident		B,F,R	B,F,R	B,F,R
Northern mockingbird	Resident		B,F,R	B,F,R	B,F,R
Cedar waxwing	Sp,F,W		F,R	F,R	F,R
European starling	Resident		B,F,R	B,F,R	B,F,R
Hutton's vireo	Resident		B,F,R	B,F,R	B,F,R
Warbling vireo	Sp,F		F,R	F,R	F,R
Orange-crowned warbler	Sp,F,W,		B,F,R	B,F,R	B,F,R
Nashville warbler	Sp,F		F,R	F,R	F,R
Yellow warbler	Sp,F		F,R	F,R	F,R
Yellow-rumped warbler	Sp,F,W		F,R	F,R	F,R
Black-throated gray warbler	Sp,F		F,R	F,R	F,R
Common yellowthroat	Resident		B,F,R	B,F,R	B,F,R
Yellow-breasted chat	Sp,Su		B,F,R	B,F,R	B,F,R
Western tanager	Sp,F		F,R	F,R	F,R
Black-headed grosbeak	Sp,Su,F		B,F,R	B,F,R	B,F,R
Blue grosbeak	Sp,Su		B,F,R	B,F,R	B,F,R
Spotted towhee	Resident		B,F,R	B,F,R	B,F,R
California towhee	Resident		B,F,R	B,F,R	B,F,R
Chipping sparrow	Sp,F,W		F,R	F,R	F,R
Lark sparrow	Resident		B,F,R	B,F,R	B,F,R
Fox sparrow	F,W		F,R	F,R	F,R
Song sparrow	Resident		B,F,R	B,F,R	B,F,R
Lincoln's sparrow	F,W		F,R	F,R	F,R
Golden-crowned sparrow	F,W		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
White-crowned sparrow	F,W		F,R	F,R	F,R
Dark-eyed junco	F,W		F,R	F,R	F,R
Red-winged blackbird	Resident		B,F,R	B,F,R	B,F,R
Brown-headed cowbird	Resident		B,F,R	B,F,R	B,F,R
Northern oriole	Sp,Su		B,F,R	B,F,R	B,F,R
House finch	Resident		B,F,R	B,F,R	B,F,R
Purple finch	F,W		F,R	F,R	F,R
Pine siskin	F,W		F,R	F,R	F,R
Lawrence's goldfinch	Resident		B,F,R	B,F,R	B,F,R
Lesser goldfinch	Resident		B,F,R	B,F,R	B,F,R
American goldfinch	Resident		B,F,R	B,F,R	B,F,R
Mammals					
Virginia opossum	Resident		B,F,R	B,F,R	B,F,R
Ornate shrew	Resident		B,F,R	B,F,R	B,F,R
Broad-footed mole	Resident		B,F,R	B,F,R	B,F,R
Yuma myotis	Resident		B,F,R	B,F,R	B,F,R
California myotis	Resident		B,F,R	B,F,R	B,F,R
Western pipistrelle	Resident		B,F,R	B,F,R	B,F,R
Big brown bat	Resident		B,F,R	B,F,R	B,F,R
Red bat	Resident		B,F,R	B,F,R	B,F,R
Hoary bat	Resident		B,F,R	B,F,R	B,F,R
Townsend's big-eared bat	Resident		B,F,R	B,F,R	B,F,R
Pallid bat	Resident		B,F,R	B,F,R	B,F,R
Brazillian free-tailed bat	Resident		B,F,R	B,F,R	B,F,R
Brush rabbit	Resident		B,F,R	B,F,R	B,F,R
Desert cottontail	Resident		B,F,R	B,F,R	B,F,R
Black-tailed hare	Resident		B,F,R	B,F,R	B,F,R
California ground squirrel	Resident		B,F,R	B,F,R	B,F,R
Western gray squirrel	Resident		B,F,R	B,F,R	B,F,R
Botta's pocket gopher	Resident		B,F,R	B,F,R	B,F,R
Beaver	Resident		B,F,R	B,F,R	B,F,R
Western harvest mouse	Resident		B,F,R	B,F,R	B,F,R
Deer mouse	Resident		B,F,R	B,F,R	B,F,R
Dusky-footed woodrat	Resident		B,F,R	B,F,R	B,F,R
California vole	Resident		B,F,R	B,F,R	B,F,R
Muskrat	Resident		B,F,R	B,F,R	B,F,R
Black rat	Resident		B,F,R	B,F,R	B,F,R
Norway rat	Resident		B,F,R	B,F,R	B,F,R
House mouse	Resident		B,F,R	B,F,R	B,F,R
Porcupine	Resident		B,F,R	B,F,R	

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Coyote	Resident		B,F,R	B,F,R	B,F,R
Red fox	Resident		B,F,R	B,F,R	B,F,R
Ringtail	Resident		B,F,R	B,F,R	B,F,R
Raccoon	Resident		B,F,R	B,F,R	B,F,R
Long-tailed weasel	Resident		B,F,R	B,F,R	B,F,R
Mink	Resident		B,F,R	B,F,R	B,F,R
Western spotted skunk	Resident		B,F,R	B,F,R	B,F,R
Striped skunk	Resident		B,F,R	B,F,R	B,F,R
River otter	Resident		B,F,R	B,F,R	B,F,R
Bobcat	Resident		B,F,R	B,F,R	B,F,R
Tule elk				B,F,R	
Mule deer	Resident		B,F,R	B,F,R	B,F,R
Reptiles					
Western pond turtle	Resident		B,F,R	B,F,R	B,F,R
Western fence lizard	Resident		B,F,R	B,F,R	B,F,R
Coast horned lizard	Resident		B,F,R	B,F,R	B,F,R
Gilbert's skink	Resident		B,F,R	B,F,R	B,F,R
Western whiptail	Resident		B,F,R	B,F,R	B,F,R
Southern alligator lizard	Resident		B,F,R	B,F,R	B,F,R
Ringneck snake	Resident		B,F,R	B,F,R	
Racer	Resident		B,F,R	B,F,R	
Gopher snake	Resident		B,F,R	B,F,R	B,F,R
Common kingsnake	Resident		B,F,R	B,F,R	B,F,R
Common garter snake	Resident		B,F,R	B,F,R	B,F,R
W. terrestrial garter snake	Resident		B,F,R	B,F,R	B,F,R
Western aquatic garter snake	Resident		B,F,R	B,F,R	B,F,R
Western rattlesnake	Resident		B,F,R	B,F,R	B,F,R
Amphibians					
California slender salamander	Resident		B,F,R	B,F,R	B,F,R
Western toad	Resident		B,F,R	B,F,R	B,F,R
Pacific treefrog	Resident		B,F,R	B,F,R	B,F,R
Foothill yellow-legged frog	Resident			B,F,R	B,F,R
Bullfrog	Resident		B,F,R	B,F,R	B,F,R
Grassland					
Birds					
White-tailed	Resident		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Northern harrier	Resident		B,F,R	B,F,R	B,F,R
Red-tailed hawk	Resident		B,F,R	B,F,R	B,F,R
Swainson's hawk	Sp,Su,F		F,R	F,R	F,R
Ferruginous hawk	F,W		F,R	F,R	F,R
Rough-legged hawk	F,W		F,R	F,R	F,R
Golden eagle	Resident		F,R	F,R	F,R
American kestrel	Resident		F,R	F,R	F,R
Prairie falcon	F,W		F,R	F,R	F,R
Ring-necked pheasant	Resident		B,F,R	B,F,R	B,F,R
Sandhill crane	F,W		F,R	F,R	F,R
Morning dove	Resident		F,R	F,R	F,R
Barn owl	Resident		F,R	F,R	F,R
Burrowing owl	Resident		B,F,R	B,F,R	B,F,R
Short-eared owl	Resident		B,F,R	B,F,R	B,F,R
Say's phoebe	Sp,F,W		B,F,R	B,F,R	B,F,R
Western kingbird	Sp,Su,F		F,R	F,R	F,R
Horned lark	Resident		B,F,R	B,F,R	B,F,R
Loggerhead shrike	Resident		F,R	F,R	F,R
Savanah sparrow	F,W		F,R	F,R	F,R
Golden-crowned sparrow	F,W		F,R	F,R	F,R
White-crowned sparrow	F,W		F,R	F,R	F,R
Dark-eyed junco	F,W		F,R	F,R	F,R
Red-winged blackbird	Resident		F,R	F,R	F,R
Western meadowlark	Resident		B,F,R	B,F,R	B,F,R
Brewer's blackbird	Resident		F,R	F,R	F,R
Brown-headed cowbird	Resident		F,R	F,R	F,R
House finch	Resident		F,R	F,R	F,R
Lesser goldfinch	Resident		F,R	F,R	F,R
American goldfinch	Resident		F,R	F,R	F,R
Lawrence's goldfinch	Resident		F,R	F,R	F,R
House sparrow	Resident		F,R	F,R	F,R
Amphibians					
Tiger salamander	Resident		F,R	F,R	F,R
Western spadefoot	Resident		F,R	F,R	F,R
Western toad	Resident		F,R	F,R	F,R
Pacific treefrog	Resident		F,R	F,R	F,R
Red-legged frog	Resident		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Reptiles					
Western pond turtle	Resident		F,R	F,R	F,R
Western fence lizard	Resident		B,F,R	B,F,R	B,F,R
Coast horned lizard	Resident		B,F,R	B,F,R	B,F,R
Western whiptail	Resident		B,F,R	B,F,R	B,F,R
Southern aligator lizard	Resident		B,F,R	B,F,R	B,F,R
Racer	Resident		B,F,R	B,F,R	B,F,R
Coachwip	Resident		B,F,R	B,F,R	B,F,R
Gopher snake	Resident		B,F,R	B,F,R	B,F,R
Common kingsnake	Resident		B,F,R	B,F,R	B,F,R
Long-nosed snake	Resident		B,F,R	B,F,R	B,F,R
Common garter snake	Resident		B,F,R	B,F,R	B,F,R
W. terrestrial gartern snake	Resident		B,F,R	B,F,R	
Western rattlesnake	Resident		B,F,R	B,F,R	B,F,R
Mammals					
Ornate shrew	Resident		B,F,R	B,F,R	B,F,R
Broad-footed mole	Resident		B,F,R	B,F,R	B,F,R
Yuma myotis	Resident		F,R	F,R	F,R
California myotis	Resident		B,F,R	B,F,R	B,F,R
Western pipistrelle	Resident		F,R	F,R	F,R
Big brown bat	Resident		B,F,R	B,F,R	B,F,R
Red bat	Resident		B,F,R	B,F,R	B,F,R
Hoary bat	Resident		B,F,R	B,F,R	B,F,R
Townsends big-eared bat	Resident		F,R	F,R	F,R
Pallid bat	Resident		B,F,R	B,F,R	B,F,R
Brazilian free-tailed bat	Resident		F,R	F,R	F,R
Desert cottontail	Resident		B,F,R	B,F,R	B,F,R
Black-tailed hare	Resident		B,F,R	B,F,R	B,F,R
California gound squirrel	Resident		B,F,R	B,F,R	B,F,R
Botta's pocket gopher	Resident		B,F,R	B,F,R	B,F,R
San Joaquin pocket mouse	Resident		B,F,R	B,F,R	B,F,R
Heerman's kangaroo rat	Resident		B,F,R		B,F,R
California kangaroo rat	Resident			B,F,R	
Western harvest mouse	Resident		B,F,R	B,F,R	B,F,R
Deer mouse	Resident		B,F,R	B,F,R	B,F,R
California vole	Resident		B,F,R	B,F,R	B,F,R
House mouse	Resident		B,F,R	B,F,R	B,F,R
Kit fox	Resident		B,F,R		B,F,R
Coyote	Resident		B,F,R	B,F,R	B,F,R
Gray fox	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Racoon	Resident		B,F,R	B,F,R	B,F,R
Badger	Resident		B,F,R	B,F,R	B,F,R
Striped skunk	Resident		B,F,R	B,F,R	B,F,R
Bobcat	Resident		B,F,R	B,F,R	B,F,R
Mule deer	Resident		B,F,R	B,F,R	B,F,R
Tule Elk				B,F,R	
Wild pig	Resident		B,F,R	B,F,R	B,F,R
Alkali Sink					
Birds					
Killdeer	Resident				B,F,R
Snowy plover	Sp,Su?			B,F,R	
Greater roadrunner	Resident				B,F,R
Burrowing owl	Resident				B,F,R
Lesser nighthawk	Sp,Su,F				B,F,R
Horned lark	Resident				B,F,R
Golden-crowned sparrow	F,W				F,R
White-crowned sparrow	F,W				F,R
Dark-eyed junco	F,W				F,R
Western meadowlark	Resident				B,F,R
Brewer's blackbird	Resident				B,F,R
Red-winged blackbird	Resident?				B,F,R
House finch	Resident				B,F,R
Savanah sparrow	F,W				F,R
Lessergoldfinch	Resident				B,F,R
Lawrence's goldfinch	Resident				B,F,R
American goldfinch	F,W				F,R
Amphibians and Reptiles					
Blunt-nosed leapord lizard					B,F,R
Western fence lizard					B,F,R
Side-blotched lizard					B,F,R
Coast horned lizard					B,F,R
Western whiptail					B,F,R
Coachwhip					B,F,R
Long-nosed snake					B,F,R
Common garter snake				B,F,R	
Southwestern black-headed snake					B,F,R
Western rattlesnake					B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Mammals					
Yuma myotis	Resident		F,R	F,R	F,R
California myotis	Resident		B,F,R	B,F,R	B,F,R
Western pipistrelle	Resident		F,R	F,R	F,R
Big brown bat	Resident		B,F,R	B,F,R	B,F,R
Red bat	Resident		B,F,R	B,F,R	B,F,R
Hoary bat	Resident		B,F,R	B,F,R	B,F,R
Townsends big-eared bat	Resident		F,R	F,R	F,R
Pallid bat	Resident		B,F,R	B,F,R	B,F,R
Brazilian free-tailed bat	Resident		F,R	F,R	F,R
Desert cottontail	Resident		B,F,R	B,F,R	B,F,R
Black-tailed hare	Resident		B,F,R	B,F,R	B,F,R
California gound squirrel	Resident		B,F,R	B,F,R	B,F,R
San Joaquin pocket mouse	Resident		B,F,R	B,F,R	B,F,R
San Joaquin kangaroo rat	Resident				B,F,R
Western harvest mouse	Resident		B,F,R	B,F,R	B,F,R
Deer mouse	Resident		B,F,R	B,F,R	B,F,R
House mouse	Resident		B,F,R	B,F,R	B,F,R
Kit fox	Resident		B,F,R		B,F,R
Coyote	Resident		B,F,R	B,F,R	B,F,R
Gray fox	Resident		B,F,R	B,F,R	B,F,R
Badger	Resident		B,F,R	B,F,R	B,F,R
Agriculture (Wetland)					
Birds					
Pied-billed grebe	Resident		B,F,R	B,F,R	B,F,R
Great egret	Resident		F,R	F,R	F,R
Great blue heron	Resident		F,R	F,R	F,R
Black-cronwed night-heron	Resident		F,R	F,R	F,R
American bittern	Resident		B,F,R	B,F,R	B,F,R
Snowy egret	Resident		F,R	F,R	F,R
White-faced ibis	Resident		F,R	F,R	F,R
Tundra swan	F,W		F,R	F,R	F,R
Canada goose	F,W		F,R	F,R	F,R
Ross' goose	F,W		F,R	F,R	F,R
Snow goose	F,W		F,R	F,R	F,R
White-fronted goose	F,W		F,R	F,R	F,R
Green-winged teal	F,W		F,R	F,R	F,R
Mallard	Resident		B,F,R	B,F,R	B,F,R
Northern pintail	F,W		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Northern shoveler	F,W		F,R	F,R	F,R
Cinnamon teal	Resident		B,F,R	B,F,R	B,F,R
Gadwall	Resident		B,F,R	B,F,R	B,F,R
American widgeon	F,W		F,R	F,R	F,R
Turkey vulture	Resident		F,R	F,R	F,R
Northern harrier	Resident		F,R	F,R	F,R
White-tialed kite	Resident		F,R	F,R	F,R
Swainson's hawk	Sp,Su,F		F,R	F,R	F,R
Ring-necked pheasant	Resident		B,F,R	B,F,R	B,F,R
Sandhill crane	F,W		F,R	F,R	F,R
Killdeer	Resident		B,F,R	B,F,R	B,F,R
Mountain plover	F,W		F,R	F,R	F,R
Black-necked stilt	Resident		B,F,R	B,F,R	B,F,R
American avocet	Resident		B,F,R	B,F,R	B,F,R
Greater yellowlegs	F,W		F,R	F,R	F,R
Common snipe	Resident		B,F,R	B,F,R	B,F,R
Long-billed dowitcher	Sp,F,W		F,R	F,R	F,R
Dunlin	Sp,F,W		F,R	F,R	F,R
Least sandpiper	Sp,F,W		F,R	F,R	F,R
Western sandpiper	Sp,F,W		F,R	F,R	F,R
Ring-billed gull	Sp,F,W		F,R	F,R	F,R
Herring gull	Sp,F,W		F,R	F,R	F,R
California gull	Sp,F,W		F,R	F,R	F,R
Say's phoebe	Sp,F,W		B,F,R	B,F,R	B,F,R
Tree swallow	Resident		B,F,R	B,F,R	B,F,R
Cliff swallow	Sp,Su,F		F,R	F,R	F,R
Violet green swallow	Sp,Su,F		B,F,R	B,F,R	B,F,R
N. rough-winged swallow	Sp,Su,F		F,R	F,R	F,R
Bank swallow	Sp,Su,F		F,R	F,R	F,R
Barn swallow	Sp,Su,F		F,R	F,R	F,R
Northern mockingbird	Resident		B,F,R	B,F,R	B,F,R
American pipit	F,W		F,R	F,R	F,R
European starling	Resident		B,F,R	B,F,R	B,F,R
Lark sparrow	Resident		B,F,R	B,F,R	B,F,R
Song sparrow	Resident		B,F,R	B,F,R	B,F,R
Savanah sparrow	Sp,F,W		F,R	F,R	F,R
Lincoln's sparrow	F,W		F,R	F,R	F,R
Red-winged blackbird	Resident		B,F,R	B,F,R	B,F,R
Western meadowlark	Resident		B,F,R	B,F,R	B,F,R
?Yellow-headed blackbird	Resident		F,R	F,R	F,R
Brewer's blackbird	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Brown-headed cowbird	Resident		B,F,R	B,F,R	B,F,R
House finch	Resident		B,F,R	B,F,R	B,F,R
Amphibians					
Western toad	Resident		F,R	F,R	F,R
Pacific tree frog	Resident		F,R	F,R	F,R
Reptiles					
Gopher snake	Resident		B,F,R	B,F,R	B,F,R
Common kingsnake	Resident		B,F,R	B,F,R	B,F,R
Valley garter snake	Resident		B,F,R	B,F,R	B,F,R
Giant garter snake	Resident		B,F,R	B,F,R	B,F,R
Coast garter snake	Resident		B,F,R		
Mammals					
Virginia oppossum	Resident		F,R	F,R	F,R
Muskrat	Resident		B,F,R	B,F,R	B,F,R
Norway rat	Resident		B,F,R	B,F,R	B,F,R
Black rat	Resident		B,F,R	B,F,R	B,F,R
Raccoon	Resident		B,F,R	B,F,R	B,F,R
Red fox	Resident		F,R	F,R	F,R
Coyote	Resident		F,R	F,R	F,R
Beaver	Resident		B,F,R	B,F,R	B,F,R
Agriculture (Upland)					
Birds					
Great egret	Resident		F,R	F,R	F,R
Snowy egret	Resident		F,R	F,R	F,R
Canada goose	F,W		F,R	F,R	F,R
Ross' goose	F,W		F,R	F,R	F,R
Snow goose	F,W		F,R	F,R	F,R
White-fronted goose	F,W		F,R	F,R	F,R
Mallard	Resident		B,F,R	B,F,R	B,F,R
Northern shoveler	F,W		F,R	F,R	F,R
Gadwall	Resident		B,F,R	B,F,R	B,F,R
Turkey vulture	Resident		F,R	F,R	F,R
Swainson's hawk	Sp,Su,F		F,R	F,R	F,R
Red-tailed hawk	Resident		F,R	F,R	F,R
Ferruginous hawk	F,W		F,R	F,R	F,R
Rough-legged hawk	F,W		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Northern harrier	Resident		B,F,R	B,F,R	B,F,R
White-tailed kite	Resident		B,F,R	B,F,R	B,F,R
Golden eagle	Resident		F,R	F,R	F,R
American kestrel	Resident		F,R	F,R	F,R
Prairie falcon	F,W		F,R	F,R	F,R
Ring-necked pheasant	Resident		B,F,R	B,F,R	B,F,R
California quail	Resident		B,F,R	B,F,R	B,F,R
Sandhill crane	F,W		F,R	F,R	F,R
Killdeer	Resident		B,F,R	B,F,R	B,F,R
Mountain plover	F,W		F,R	F,R	F,R
Ring-billed gull	Sp,F,W		F,R	F,R	F,R
California gull	Sp,F,W		F,R	F,R	F,R
Rock dove	Resident		F,R	F,R	F,R
Mourning dove	Resident		B,F,R	B,F,R	B,F,R
Short-eared owl	Resident		F,R	F,R	F,R
Barn owl	Resident		F,R	F,R	F,R
Burrowing owl	Resident		F,R	F,R	F,R
Lewis' woodpecker	Resident		B,F,R	B,F,R	B,F,R
Nutall's woodpecker	Resident		B,F,R	B,F,R	B,F,R
Acorn woodpecker	Resident		B,F,R	B,F,R	B,F,R
Downy woodpecker	Resident		B,F,R	B,F,R	B,F,R
Red-breasted sapsucker	Resident		B,F,R	B,F,R	B,F,R
Northern flicker	Resident		B,F,R	B,F,R	B,F,R
Say's phoebe	Resident		B,F,R	B,F,R	B,F,R
Western kingbird	Sp,Su,F		B,F,R	B,F,R	B,F,R
Horned lark	Resident		B,F,R	B,F,R	B,F,R
Tree swallow	Resident		B,F,R	B,F,R	B,F,R
Cliff swallow	Sp,Su,F		F,R	F,R	F,R
Violet green swallow	Sp,Su,F		B,F,R	B,F,R	B,F,R
N. rough-winged swallow	Sp,Su,F		F,R	F,R	F,R
Bank swallow	Sp,Su,F		F,R	F,R	F,R
Barn swallow	Sp,Su,F		F,R	F,R	F,R
Yellow-billed magpie	Resident		B,F,R	B,F,R	B,F,R
Northern mockingbird	Resident		B,F,R	B,F,R	B,F,R
American pipit	F,W		F,R	F,R	F,R
Loggerhead shrike	Resident		B,F,R	B,F,R	B,F,R
European starling	Resident		B,F,R	B,F,R	B,F,R
Lark sparrow	Resident		B,F,R	B,F,R	B,F,R
Savanah sparrow	Sp,F,W		F,R	F,R	F,R
Lincoln's sparrow	F,W		F,R	F,R	F,R
Golden-cronwed sparrow	F,W		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Dark-eyed junco	F,W		F,R	F,R	F,R
Red-winged blackbird	Resident		B,F,R	B,F,R	B,F,R
Western meadowlark	Resident		B,F,R	B,F,R	B,F,R
Brewer's blackbird	Resident		B,F,R	B,F,R	B,F,R
Brown-headed cowbird	Resident		B,F,R	B,F,R	B,F,R
House finch	Resident		B,F,R	B,F,R	B,F,R
Lesser goldfinch	Resident		B,F,R	B,F,R	B,F,R
Lawrence's goldfinch	Resident		B,F,R	B,F,R	B,F,R
American goldfinch	Resident		B,F,R	B,F,R	B,F,R
House sparrow	Resident		B,F,R	B,F,R	B,F,R
Amphibians					
Western toad	Resident		F,R	F,R	F,R
Pacific tree frog	Resident		F,R	F,R	F,R
Reptiles					
Western fence lizard	Resident		B,F,R	B,F,R	B,F,R
Coast horned lizard	Resident		B,F,R	B,F,R	B,F,R
Western skink	Resident		B,F,R	B,F,R	
Western whiptail	Resident		B,F,R	B,F,R	B,F,R
Racer	Resident		B,F,R	B,F,R	B,F,R
Coachwip	Resident		B,F,R	B,F,R	B,F,R
Gopher snake	Resident		B,F,R	B,F,R	B,F,R
Common kingsnake	Resident		B,F,R	B,F,R	B,F,R
Common garter snake	Resident		B,F,R	B,F,R	B,F,R
W. terrestrial garter snake	Resident		B,F,R	B,F,R	
Western rattlesnake	Resident		B,F,R	B,F,R	B,F,R
Mammals					
Virginia oppossum	Resident		B,F,R	B,F,R	B,F,R
Broad-footed mole	Resident		B,F,R	B,F,R	B,F,R
Yuma myotis	Resident		F,R	F,R	F,R
California myotis	Resident		B,F,R	B,F,R	B,F,R
Western pipistrelle	Resident		F,R	F,R	F,R
Big brown bat	Resident		B,F,R	B,F,R	B,F,R
Red bat	Resident		B,F,R	B,F,R	B,F,R
Hoary bat	Resident		B,F,R	B,F,R	B,F,R
Townsends big-eared bat	Resident		F,R	F,R	F,R
Pallid bat	Resident		B,F,R	B,F,R	B,F,R
Brazilian free-tailed bat	Resident		F,R	F,R	F,R
Black-tailed hare	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
California gound squirrel	Resident		B,F,R	B,F,R	B,F,R
Fox squirrel	Resident		B,F,R	B,F,R	B,F,R
Botta's pocket gopher	Resident		B,F,R	B,F,R	B,F,R
Beaver	Resident		B,F,R	B,F,R	B,F,R
Western harvest mouse	Resident		B,F,R	B,F,R	B,F,R
Deer mouse	Resident		B,F,R	B,F,R	B,F,R
California vole	Resident		B,F,R	B,F,R	B,F,R
House mouse	Resident		B,F,R	B,F,R	B,F,R
Black rat	Resident		B,F,R	B,F,R	B,F,R
Norway rat	Resident		B,F,R	B,F,R	B,F,R
Kit fox	Resident		B,F,R		B,F,R
Coyote	Resident		B,F,R	B,F,R	B,F,R
Gray fox	Resident		B,F,R	B,F,R	B,F,R
Racoon	Resident		B,F,R	B,F,R	B,F,R
Badger	Resident		B,F,R	B,F,R	B,F,R
Striped skunk	Resident		B,F,R	B,F,R	B,F,R
Bobcat	Resident		B,F,R	B,F,R	B,F,R
Mule deer	Resident		B,F,R	B,F,R	B,F,R
Valley Oak Woodland					
Birds					
White-tailed kite	Resident		B,F,R	B,F,R	B,F,R
Sharp-shinned hawk	F,W		F,R	F,R	F,R
Cooper's hawk	R		B,F,R	B,F,R	B,F,R
Red-shouldered hawk	Resident		B,F,R	B,F,R	B,F,R
Swainson's hawk	Sp,Su,F		B,F,R	B,F,R	B,F,R
Wild turkey	Resident		B,F,R	B,F,R	B,F,R
Califonria quail	Resident		B,F,R	B,F,R	B,F,R
Mourning dove	Resident		B,F,R	B,F,R	B,F,R
Western screech owl	Resident		B,F,R	B,F,R	B,F,R
Long-eared owl	Resident		B,F,R	B,F,R	B,F,R
Anna's hummingbird	Resident		B,F,R	B,F,R	B,F,R
Lewis' woodpecker	Resident		B,F,R	B,F,R	B,F,R
Acorn woodpecker	Resident		B,F,R	B,F,R	B,F,R
Nutall's woodpecker	Resident		B,F,R	B,F,R	B,F,R
Northern flicker	Resident		B,F,R	B,F,R	B,F,R
Ash-throated flycatcher	Sp,Su,F		B,F,R	B,F,R	B,F,R
Western kingbird	Sp,Su,F		B,F,R	B,F,R	B,F,R
Tree swallow	Resident		B,F,R	B,F,R	B,F,R
Violet-green swallow	Sp,Su,F		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Scrub jay	Resident		B,F,R	B,F,R	B,F,R
Yellow-billed magpie	Resident		B,F,R	B,F,R	B,F,R
American crow	Resident		B,F,R	B,F,R	B,F,R
Plain titmouse	Resident		B,F,R	B,F,R	B,F,R
Bushtit	Resident		B,F,R	B,F,R	B,F,R
?White-breasted nuthatch	F,W		F,R	F,R	F,R
Bewick's wren	Resident		B,F,R	B,F,R	B,F,R
House wren	Sp,Su,F		B,F,R	B,F,R	B,F,R
Western bluebird	Resident		B,F,R	B,F,R	B,F,R
American robin	Resident		B,F,R	B,F,R	B,F,R
Varied thrush	F,W		F,R	F,R	F,R
Hermit thruch	F,W		F,R	F,R	F,R
Northern mockingbird	Resident		B,F,R	B,F,R	B,F,R
European starling	Resident		B,F,R	B,F,R	B,F,R
Warbling vireo	Sp,Su,F		B,F,R	B,F,R	B,F,R
Orange-crowned warbler	Sp,Su,F		B,F,R	B,F,R	B,F,R
Yellow-rumped warbler	F,W		F,R	F,R	F,R
Black-headed grosbeak	Sp,Su,F		B,F,R	B,F,R	B,F,R
Blue grosbeak	Sp,Su,F		B,F,R	B,F,R	B,F,R
Spotted towhee	Resident		B,F,R	B,F,R	B,F,R
Lark sparrow	Resident		B,F,R	B,F,R	B,F,R
Golden-crowned sparrow	F,W		F,R	F,R	F,R
White-crowned sparrow	F,W		F,R	F,R	F,R
Dark-eyed junco	F,W		F,R	F,R	F,R
?Northern oriole	Sp,Su,F		B,F,R	B,F,R	B,F,R
House finch	Resident		B,F,R	B,F,R	B,F,R
?Lesser goldfinch	Resident		B,F,R	B,F,R	B,F,R
?American goldfinch	F,W		F,R	F,R	F,R
House sparrow	Resident		B,F,R	B,F,R	B,F,R
Amphibians					
Tiger salamander	Resident		F,R	F,R	F,R
California newt	Resident		F,R	F,R	F,R
Slender salamander	Resident		B,F,R	B,F,R	B,F,R
Western spadefoot	Resident		F,R	F,R	F,R
Western toad	Resident		F,R	F,R	F,R
Pacific treefrog	Resident		F,R	F,R	F,R
Red-legged frog	Resident		F,R	F,R	F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
Reptiles					
Western pond turtle	Resident		F,R	F,R	F,R
Western fence lizard	Resident		B,F,R	B,F,R	B,F,R
Coast horned lizard	Resident		B,F,R	B,F,R	B,F,R
Western skink	Resident		B,F,R	B,F,R	
Western whiptail	Resident		B,F,R	B,F,R	B,F,R
Southern aligator lizard	Resident		B,F,R	B,F,R	B,F,R
California legless lizard	Resident		B,F,R	B,F,R	B,F,R
Ringneck snake	Resident		B,F,R		
Sharp-tailed snake	Resident		B,F,R		
Racer	Resident		B,F,R	B,F,R	B,F,R
Coachwip	Resident		B,F,R	B,F,R	B,F,R
Gopher snake	Resident		B,F,R	B,F,R	B,F,R
Common kingsnake	Resident		B,F,R	B,F,R	B,F,R
Long-nosed snake	Resident		B,F,R	B,F,R	B,F,R
Common garter snake	Resident		B,F,R	B,F,R	B,F,R
W. terrestrial gartern snake	Resident		B,F,R	B,F,R	
Western rattlesnake	Resident		B,F,R	B,F,R	B,F,R
Mammals					
Virginia oppossum	Resident		B,F,R	B,F,R	B,F,R
Ornate shrew	Resident		B,F,R	B,F,R	B,F,R
Towbridges shrew	Resident		B,F,R		
Broad-footed mole	Resident		B,F,R	B,F,R	B,F,R
Yuma myotis	Resident		F,R	F,R	F,R
California myotis	Resident		B,F,R	B,F,R	B,F,R
Western pipistrelle	Resident		F,R	F,R	F,R
Big brown bat	Resident		B,F,R	B,F,R	B,F,R
Red bat	Resident		B,F,R	B,F,R	B,F,R
Hoary bat	Resident		B,F,R	B,F,R	B,F,R
Townsends big-eared bat	Resident		F,R	F,R	F,R
Pallid bat	Resident		B,F,R	B,F,R	B,F,R
Brazilian free-tailed bat	Resident		F,R	F,R	F,R
Desert cottontail	Resident		B,F,R	B,F,R	B,F,R
Black-tailed hare	Resident		B,F,R	B,F,R	B,F,R
California gound squirrel	Resident		B,F,R	B,F,R	B,F,R
Botta's pocket gopher	Resident		B,F,R	B,F,R	B,F,R
Heerman's kangaroo rat	Resident		B,F,R		B,F,R
Western harvest mouse	Resident		B,F,R	B,F,R	B,F,R
Deer mouse	Resident		B,F,R	B,F,R	B,F,R
Dusky-footed woodrat	Resident		B,F,R	B,F,R	B,F,R

Guilds and Species	Seasonal Occurrence	CALFED Region Bay	Delta	Sac	SJ
California vole	Resident		B,F,R	B,F,R	B,F,R
House mouse	Resident		B,F,R	B,F,R	B,F,R
Coyote	Resident		B,F,R	B,F,R	B,F,R
Gray fox	Resident		B,F,R	B,F,R	B,F,R
Ringtail	Resident		B,F,R	B,F,R	B,F,R
Racoon	Resident		B,F,R	B,F,R	B,F,R
Long-tailed veasel	Resident		B,F,R	B,F,R	B,F,R
Badger	Resident		B,F,R	B,F,R	B,F,R
Striped skunk	Resident		B,F,R	B,F,R	B,F,R
Bobcat	Resident		B,F,R	B,F,R	B,F,R
Mule deer	Resident		B,F,R	B,F,R	B,F,R
Wild pig	Resident		B,F,R	B,F,R	B,F,R

Seasonal Occurrence

Spring (Sp): March 21 to June 20
Summer (Su): June 21 to September 22
Fall (F): September 23 to December 21
Winter (W): December 22 to March 20
Occurs in all seasons: Resident

CALFED Region

San Francisco Bay (Bay)
Sacramento River and San Joaquin River Delta (Delta)
Sacramento River drainage (Sac)
San Joaquin River drainage (SJ)

Habitat Use

Breeding (B)
Foraging (F)
Resting (R)
Uncertain Status (?)

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