

TABLE OF CONTENTS

8.0 IMPACT ASSESSMENT8-1

8.1 OVERVIEW8-1

8.1.1 Methods for Calculating Incidental Take.....8-2

8.1.1.1 Development Effects (Covered Activity Zone 1).....8-2

8.1.1.2 Development Effects (Covered Activity Zone 2).....8-3

8.1.1.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).....8-3

8.1.1.4 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).....8-3

8.1.1.5 Activities on Preserves and Reserves.....8-3

8.1.2 Incidental Take Analysis.....8-3

8.1.2.1 Development Effects (Covered Activity Zone 1).....8-4

8.1.2.2 Development Effects (Covered Activity Zone 2).....8-4

8.1.2.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).....8-5

8.1.2.4 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).....8-6

8.1.2.5 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).....8-7

8.2 VALLEY FLOOR GRASSLAND AND VERNAL POOL NATURAL COMMUNITY IMPACT ASSESSMENT8-7

8.2.1 Methods for Calculating Incidental Take.....8-7

8.2.1.1 Development Effects (Covered Activity Zone 1).....8-8

8.2.1.2 Development Effects (Covered Activity Zone 2).....8-9

8.2.1.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).....8-9

8.2.1.4 Operations and Maintenance Activity Effects (Covered Activity Zones 1 and 2).....8-10

8.2.2 Development Effects (Covered Activity Zone 1)8-10

8.2.2.1 Direct Effects8-10

8.2.2.2 Indirect Effects.....8-13

8.2.3 Development Effects (Covered Activity Zone 2)8-15

8.2.3.1 Direct Effects8-15

8.2.3.2 Indirect Effects.....8-15

8.2.4 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).....8-15

8.2.4.1 Direct Effects8-15

8.2.4.2 Indirect Effects.....8-15

8.2.5 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).....8-16

8.2.5.1 Direct Effects8-16

8.2.5.2 Indirect Effects.....8-16

8.2.6 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).....8-16

8.2.6.1 Direct Effects8-16

8.2.6.2 Indirect Effects.....8-17



8.2.7 Requested Take Summary 8-17

8.2.8 Conservation Summary 8-17

8.2.9 Effects on Covered Species 8-18

 8.2.9.1 Contra Costa Goldfields..... 8-18

 8.2.9.2 Alkali Milk-Vetch..... 8-22

 8.2.9.3 Bogg’s Lake Hedge-Hyssop 8-23

 8.2.9.4 Colusa Grass 8-24

 8.2.9.5 Ferris’s Milk-Vetch 8-26

 8.2.9.6 Legenere 8-27

 8.2.9.7 San Joaquin Valley Orcutt Grass 8-28

 8.2.9.8 Solano Grass 8-29

 8.2.9.9 Vernal Pool Smallscale..... 8-31

 8.2.9.10 Delta Green Ground Beetle..... 8-33

 8.2.9.11 Conservancy Fairy Shrimp 8-35

 8.2.9.12 Vernal Pool Fairy Shrimp 8-37

 8.2.9.13 Vernal Pool Tadpole Shrimp 8-39

 8.2.9.14 California Tiger Salamander..... 8-41

8.3 CALIFORNIA RED-LEGGED FROG IMPACT ASSESSMENT 8-44

 8.3.1 Development Effects (Zones 1 and 2) 8-45

 8.3.1.1 Direct Effects 8-45

 8.3.1.2 Indirect Effects..... 8-46

 8.3.2 Irrigation and Reclamation District Construction and Annexation
Effects (Covered Activity Zones 1 and 2) 8-46

 8.3.2.1 Direct Effects 8-46

 8.3.2.2 Indirect Effects..... 8-46

 8.3.3 Operation and Maintenance Activity Effects (Covered Activity
Zones 1 and 2) 8-46

 8.3.3.1 Direct Effects 8-46

 8.3.3.2 Indirect Effects..... 8-47

 8.3.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2,
and 3) 8-47

 8.3.4.1 Direct Effects 8-47

 8.3.4.2 Indirect Effects..... 8-48

 8.3.5 Requested Take Summary 8-48

 8.3.6 Conservation Summary 8-48

8.4 CALLIPPE SILVERSPOT BUTTERFLY IMPACT ASSESSMENT 8-49

 8.4.1 Development Effects (Covered Activity Zones 1 and 2)..... 8-49

 8.4.1.1 Direct Effects 8-50

 8.4.1.2 Indirect Effects..... 8-50

 8.4.2 Irrigation and Reclamation District Construction and Annexation
Effects (Covered Activity Zones 1 and 2) 8-51

 8.4.2.1 Direct Effects 8-51

 8.4.2.2 Indirect Effects..... 8-51

 8.4.3 Operation and Maintenance Activity Effects (Covered Activity
Zones 1 and 2) 8-51

 8.4.3.1 Direct Effects 8-51

 8.4.3.2 Indirect Effects..... 8-51

 8.4.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2,
and 3) 8-52



8.4.4.1	Direct Effects	8-52
8.4.4.2	Indirect Effects	8-52
8.4.5	Requested Take Summary	8-52
8.4.6	Conservation Summary	8-52
8.5	RIPARIAN, STREAM, AND FRESHWATER MARSH NATURAL COMMUNITY IMPACT ASSESSMENT	8-53
8.5.1	Development Effects (Covered Activity Zones 1 and 2)	8-53
8.5.1.1	Direct Effects	8-53
8.5.1.2	Indirect Effects	8-53
8.5.2	Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)	8-53
8.5.2.1	Direct Effects	8-54
8.5.2.2	Indirect Effects	8-54
8.5.3	Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)	8-54
8.5.3.1	Direct Effects	8-54
8.5.3.2	Indirect Effects	8-54
8.5.4	Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)	8-54
8.5.4.1	Direct Effects	8-55
8.5.4.2	Indirect Effects	8-55
8.5.5	Requested Take Summary	8-55
8.5.6	Conservation Summary	8-56
8.5.7	Effects on Covered Species	8-57
8.5.7.1	Valley Elderberry Longhorn Beetle	8-58
8.5.7.2	Steelhead	8-61
8.5.7.3	Chinook Salmon	8-63
8.5.7.4	Tricolored Blackbird	8-65
8.6	GIANT GARTER SNAKE IMPACT ASSESSMENT	8-68
8.6.1	Development Effects (Covered Activity Zones 1 and 2)	8-68
8.6.1.1	Direct Effects	8-68
8.6.1.2	Indirect Effects	8-68
8.6.2	Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)	8-69
8.6.2.1	Direct Effects	8-69
8.6.2.2	Indirect Effects	8-69
8.6.3	Operations and Maintenance Activity Effects (Covered Activity Zones 1 and 2)	8-69
8.6.3.1	Direct Effects	8-70
8.6.3.2	Indirect Effects	8-70
8.6.4	Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)	8-70
8.6.4.1	Direct Effects	8-71
8.6.4.2	Indirect Effects	8-71
8.6.5	Requested Take Summary	8-71
8.6.6	Conservation Summary	8-71
8.7	COASTAL MARSH NATURAL COMMUNITY IMPACT ASSESSMENT	8-72
8.7.1	Development Effects (Covered Activity Zones 1 and 2)	8-72
8.7.1.1	Direct Effects	8-72



8.7.1.2 Indirect Effects..... 8-73

8.7.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2) 8-74

8.7.2.1 Direct Effects 8-74

8.7.2.2 Indirect Effects..... 8-74

8.7.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2) 8-74

8.7.3.1 Direct Effects 8-74

8.7.3.2 Indirect Effects..... 8-75

8.7.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3) 8-75

8.7.4.1 Direct Effects 8-75

8.7.4.2 Indirect Effects..... 8-75

8.7.5 Requested Take Summary 8-75

8.7.6 Conservation Summary 8-76

8.7.7 Effects on Covered Species 8-76

8.7.7.1 Suisun Thistle 8-76

8.7.7.2 Soft Bird's-Beak 8-77

8.7.7.3 Mason's Lilaeopsis 8-79

8.7.7.4 California Black Rail 8-82

8.7.7.5 California Clapper Rail 8-83

8.7.7.6 Salt Marsh Harvest Mouse..... 8-85

8.7.7.7 Delta Smelt 8-87

8.7.7.8 Sacramento Splittail..... 8-88

8.7.7.9 Longfin Smelt 8-90

8.7.7.10 Green Sturgeon 8-91

8.8 SWAINSON'S HAWK IMPACT ASSESSMENT 8-92

8.8.1 Development Effects (Covered Activity Zones 1 and 2)..... 8-92

8.8.1.1 Direct Effects 8-92

8.8.1.2 Indirect Effects..... 8-93

8.8.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2) 8-93

8.8.2.1 Direct Effects 8-93

8.8.2.2 Indirect Effects..... 8-94

8.8.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2) 8-94

8.8.3.1 Direct Effects 8-94

8.8.3.2 Indirect Effects..... 8-94

8.8.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3) 8-94

8.8.4.1 Direct Effects 8-94

8.8.4.2 Indirect Effects..... 8-95

8.8.5 Requested Take Summary 8-95

8.8.6 Conservation Summary 8-95

8.9 BURROWING OWL IMPACT ASSESSMENT 8-96

8.9.1 Development Effects (Covered Activity Zones 1 and 2)..... 8-96

8.9.1.1 Direct Effects 8-96

8.9.1.2 Indirect Effects..... 8-96



8.9.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).....8-97
 8.9.2.1 Direct Effects8-97
 8.9.2.2 Indirect Effects.....8-97
 8.9.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).....8-97
 8.9.3.1 Direct Effects8-97
 8.9.3.2 Indirect Effects.....8-98
 8.9.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).....8-98
 8.9.4.1 Direct Effects8-98
 8.9.4.2 Indirect Effects.....8-98
 8.9.5 Requested Take Summary.....8-98
 8.9.6 Conservation Summary.....8-98

TABLES

Table 8.1: Urban Development Land Conversions by City (Covered Activity Zone 1).....8-4
 Table 8.2: Land Conversion Impacts from Known Activities Outside Urban Growth Boundaries by City (Covered Activity Zone 2).....8-5
 Table 8.3: New Irrigation and Flood Control Facilities for Special Districts8-6
 Table 8.4: Direct Impacts to Vernal Pool Habitat in Medium Value Conservation Areas by Plan Participant.....8-12
 Table 8.5: Indirect Effects to Valley Floor Grassland and Vernal Pool Habitat by Plan Participant.....8-13
 Table 8.6: Indirect Effects to High Value Vernal Pool Conservation Areas from Development in Covered Activity Zone 1.....8-14
 Table 8.7: Indirect Effects to Medium Value Vernal Pool Conservation Areas from Development in Covered Activity Zone 1.....8-14
 Table 8.8: Anticipated Valley Floor Grassland and Vernal Pool Habitat Preservation8-18
 Table 8.9: Riparian, Stream, Freshwater Marsh and Other Aquatic Habitat Impacted by Development in Covered Activity Zones 1 and 2 (acres)8-55
 Table 8.10: Estimated Potential Giant Garter Snake Habitat in Covered Activity Zone 28-70
 Table 8.11: Conversion of Swainson’s Hawk Foraging Habitat in Covered Activity Zone 1 (acres).....8-92
 Table 8.12: Conversion of Swainson’s Hawk Foraging Habitat from City Activities Outside of UGBs (Covered Activity Zone 2) (acres).....8-93



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8.0 IMPACT ASSESSMENT

8.1 OVERVIEW

In this section, the direct and indirect effects of the Solano Habitat Conservation Plan (HCP) Covered Activities (proposed actions) are assessed for each Natural Community and Covered Species. Direct effects are the immediate effects of the proposed project on the species or its habitat and include the effects of interrelated actions and interdependent actions. Interrelated actions are those actions that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the proposed action (50 Code of Federal Regulations [CFR] 402.02). Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur (50 CFR 402.02).

From the analysis of direct and indirect effects, a maximum amount of take anticipated from the Covered Activities is identified. Generally, incidental take is expressed as the extent of habitat likely to be destroyed or disturbed but may also be the number or percentage of an occurrence that may be taken. The Federal Endangered Species Act (FESA) defines “take” as “*harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.*” Federal regulation 50 CFR 17.3 defines the term “harass” as an intentional or negligent act that creates the likelihood of injuring wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns such as breeding, feeding, or sheltering (50 CFR 17.3). Furthermore, Federal regulation 50 CFR 17.3 defines “harm” as an act that either kills or injures a listed species. By definition, “harm” includes habitat modification or degradation that actually kills or injures a listed species by significantly impairing essential behavior patterns such as breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 217.12).

The California Endangered Species Act (CESA) (Fish and Game Code Section 2050 et seq.), administered by the California Department of Fish and Game (CDFG), is analogous and parallel to the FESA in many respects. Take under the CESA is defined as “*hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.*” The State definition, however, differs in two respects from the Federal definition. First, the State definition includes State-listed threatened and endangered plants as well as wildlife. Second, the State definition does not include the terms “harm” and “harass”, thereby limiting take under CESA to deliberate actions intended to purposefully possess listed wildlife and plants.

For the purposes of the Solano HCP, the analysis of take for each Covered Species uses the Federal definition and includes an assessment of the proposed actions potential to “harm” and “harass” the species.

Impacts to Covered Species from Covered Activities are addressed on a Natural Community basis and, for most species, are described as the amount of habitat lost rather than the number of individuals removed from a population (USFWS 1996). Each Covered Species is addressed either in the applicable Natural Community or as an individual species as presented in Chapter 4.0 and Appendix B.



Impacts for each Natural Community and Covered Species are discussed for each category of Covered Activities (see Section 2.5). The Covered Activity categories are described in more detail in Section 2.5 and include:

- Urban development (applicable primarily in Covered Activity Zone 1, with a small amount anticipated in Covered Activity Zone 2 [see Figure 1-4]);
- Construction of new irrigation and flood control facilities to support inclusions, expansions, and annexations for the irrigation, reclamation and special districts' service areas (applicable primarily in Covered Activity Zone 2, but may also occur in Covered Activity Zone 1);
- Operations and maintenance activities at Plan Participant facilities (see Appendix A) (applicable in Covered Activity Zones 1 and 2); and
- Activities on preserves and reserves (applicable in Covered Activity Zones 1, 2, and 3)

Covered Activity Zone 1 occurs within the urban growth boundaries (UGBs) of the Cities of Fairfield, Suisun City, Vacaville, Vallejo, Rio Vista, and Dixon (Figure 1-4). Covered Activity Zone 2 includes a 0.5-mile (mi) buffer area around the city UGBs and the service and annexation areas of the Solano County Water Agency (SCWA), Solano Irrigation District (SID), Maine Prairie Water District (MPWD), Dixon Resource Conservation District (Dixon RCD), and Reclamation District No. 2068 (RD 2068). Covered Activity Zone 3 includes the remainder of Solano County. In addition to the assessment of adverse effects to each Natural Community and Covered Species by each category of Covered Activity, a summary of requested take/effects and an assessment of the contribution to recovery are provided for each species.

8.1.1 Methods for Calculating Incidental Take

Various methods were used to assess the direct and indirect effects of Covered Activities on the Natural Communities and Covered Species. The primary method for assessing direct effects was by overlaying data layers on proposed Covered Activities (Figures 2-3 through 2-9 in Chapter 2.0 and Appendix A) with data layers compiled for existing biological resources (i.e., Natural Community and Covered Species Conservation Areas shown on Figures 4-8, 4-10, 4-13, 4-14, 4-18, 4-20, 4-21, and 4-22 in Chapter 4.0) in the geographic information system (GIS) (ArcGIS v. 9.3).

8.1.1.1 Development Effects (Covered Activity Zone 1)

Impacts from development were first assessed by overlaying the cities' General Plan-designated planned developments (Figures 2-3 through 2-8) with the vegetation types mapped on Figure 3-6 and the appropriate Conservation Areas (Figures 4-8, 4-10, 4-13, 4-14, 4-18, 4-20, 4-21, and 4-22). In a few cases (i.e., vernal pools, riparian, and coastal marsh), the level of take estimated based solely on the cities' General Plan-designated planned development, without additional avoidance, minimization, and mitigation measures, would exceed what can be permitted under the Chapter 10 issuance criteria (USFWS 1996). Therefore, impacts were scaled down by applying the avoidance, minimization, and mitigation measures outlined in Chapter 6.0 to develop allowable levels of take for the Natural Community and Covered Species.



8.1.1.2 Development Effects (Covered Activity Zone 2)

Development effects from activities outside of the UGB (Covered Activity Zone 2) were assessed differently than Covered Activity Zone 1 impacts because detailed plans of all potential activities do not currently exist. For the few known Covered Activities that fall in this category (see Section 2.5.1.2), direct and indirect impacts were assessed for these activities by overlaying the footprint of the proposed development onto the vegetation types mapped on Figure 3-6 and the appropriate Conservation Areas (Figures 4-8, 4-10, 4-13, 4-14, 4-18, 4-20, 4-21, and 4-22). To estimate impacts from currently unknown projects that may occur under this Covered Activity category, a total take limit (based on habitat acres in the 0.5 mi buffer area around the UGBs) was set for this Covered Activity category.

8.1.1.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Assessing direct and indirect effects from activities in this Covered Activity category was difficult because there are a lot of unknowns. In most cases the irrigation and reclamation districts do not have detailed plans for new facilities; they just know they need new facilities or improvements to existing facilities. Based on this projected need, each non-urban Plan Participant was allotted a certain number of acres/linear miles of new facilities in their current districts and annexation areas. The total impact to each vegetation type that is associated with Natural Communities was estimated by assessing the location of the Plan Participants' boundaries and annexation areas in relation to existing facilities and surrounding vegetation types.

8.1.1.4 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

Methods for calculating direct effects to Natural Communities and Covered Species to determine which facilities and activities occur in this community involved overlaying the data on the flood control facility maps presented in Appendix A (Figures A-3 through A-15) with the vegetation types presented on Figure 3-6 and with the appropriate Conservation Areas (Figures 4-8, 4-10, 4-13, 4-14, 4-18, 4-20, 4-21, and 4-22). Once the linear feet of the facilities in each Natural Community were determined, they were compared with the data (i.e., total length of the facilities, estimated impacts, and frequency of the activities over the term of the HCP) from the routine operation and maintenance activity tables presented in Appendix A (Tables A.3 through A.15).

8.1.1.5 Activities on Preserves and Reserves

The restoration, enhancement, management, and monitoring activities discussed in Chapters 5.0, 6.0, and 7.0 were reviewed to assess any potential direct and indirect effects to Natural Communities and Covered Species. Most of these activities may have some temporary direct and indirect effects, but for the most part, the activities result in long-term benefits.

8.1.2 Incidental Take Analysis

This section provides a brief summary of the results of the incidental take analysis for the Solano HCP.



8.1.2.1 Development Effects (Covered Activity Zone 1)

Covered Activity Zone 1 encompasses all of the land within the UGBs of Dixon, Fairfield (excluding Travis Air Force Base [AFB]), Rio Vista, Suisun City, Vacaville, and Vallejo, approximately 87,000 acres (ac). Projected development in Covered Activity Zone 1 would result in the conversion of 6,620 ac of valley floor grassland and vernal pool habitat, 3,505 ac of habitat in the Inner Coast Range, and 5,970 ac of Irrigated Agriculture. Table 8.1 identifies the extent of land conversion associated with urban development in each city. Impacts occurring in the Inner Coast Range are delineated by Covered Species, primarily California tiger salamander, California red-legged frog, callippe silverspot butterfly, Swainson’s hawk, and burrowing owl. Impacts to the Riparian, Stream, and Freshwater Marsh Natural Community and the Coastal Marsh Natural Community would be comparatively small at 84.5 ac and 25 ac, respectively. The total land conversion in all the UGBs is estimated at 16,227 ac. Of this, 3,430 ac are vacant lots that have minimal habitat value except that they may contain Swainson’s hawk and burrowing owl foraging habitat or isolated wetlands.

Table 8.1: Urban Development Land Conversions by City (Covered Activity Zone 1)

Habitat Type/Conservation Area	Land Conversion (acres ¹)						
	Dixon	Fairfield	Rio Vista	Suisun City	Vacaville	Vallejo	Total
Valley Floor and Vernal Pool Grassland Habitat – Uplands	1	2,360	1,380	460	2,010	250	6,461
Vernal Pool Habitat – Wetlands	13	70	13	13	38	12	159
California tiger salamander potential habitat in the Inner Coast Range	0	5	0	0	200	0	205
California red-legged frog and callippe silverspot butterfly habitat in the California Red-Legged Frog Conservation Area	0	420	0	0	0	530	950
Callippe silverspot butterfly habitat outside of the California Red-Legged Frog Conservation Area, but in the Callippe Silverspot Butterfly Conservation Area	0	110	0	0	0	0	110
Swainson’s hawk and burrowing owl habitat in the Inner Coast Range	0	1170	0	0	390	680	2,240
Irrigated Agriculture	1,930	430	50	0	3,550	10	5,970
Riparian, Stream, and Freshwater Marsh	0	2	0.5	1.5	18	0.5	22.5
Other habitat associated with the Riparian, Stream, and Freshwater Marsh Natural Community	0.5	11	3	8	30	32	84.5
Coastal Marsh Habitat	0	2	3	5	0	15	25
Total Land Conversion	1,944.5	4,580	1,449.5	487.5	6,236	1529.5	16,227

¹ Numbers are rounded to the nearest 10 acres.

8.1.2.2 Development Effects (Covered Activity Zone 2)

In addition to development impacts in Covered Activity Zone 1, a small amount of impacts from development are expected in Covered Activity Zone 2 in areas immediately adjacent to the UGBs



(within 0.5 mi or less) of the participating six cities. These activities include construction of detention basins, water lines, and water storage tanks to service urban development areas and widening of existing roads. Table 8.2 provides the take limits in each Natural Community and Covered Species Conservation Area for each participating city for Covered Activities associated with urban development occurring outside of the cities’ UGBs. The total take in this zone due to Covered Activities is 1,278.8 ac.

Table 8.2: Land Conversion Impacts from Known Activities Outside Urban Growth Boundaries by City (Covered Activity Zone 2)

Habitat Type/Conservation Area	Land Conversion (acres)						Total
	Dixon	Fairfield	Rio Vista	Suisun City	Vacaville	Vallejo	
Valley Floor and Vernal Pool Grassland Habitat – Uplands	0	150	100	25	50	20	345
Vernal Pool Habitat – Wetlands	1	10	2	5	3	1	22
California tiger salamander potential habitat in the Inner Coast Range	0	10	0	0	20	0	30
California red-legged frog and callippe silverspot butterfly habitat in the California Red-Legged Frog Conservation Area	0	40	0	0	0	60	100
Callippe silverspot butterfly habitat outside of the California Red-Legged Frog Conservation Area, but in the Callippe Silverspot Butterfly Conservation Area	0	10	0	0	0	0	10
Swainson’s hawk and burrowing owl habitat in the Inner Coast Range	0	100	0	0	100	0	200
Irrigated Agriculture	200	45	5	0	300	2	552
Riparian, Stream, and Freshwater Marsh	0	1	1	1	4	1	8
Other habitat associated with the Riparian, Stream, and Freshwater Marsh Natural Community	0.1	1	0.5	1	2	3	7.6
Coastal Marsh Habitat	0	0.2	1	1	0	2	4.2
Total Land Conversion	201.1	367.2	109.5	33	479	89	1278.8

8.1.2.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

The construction of new irrigation and flood control facilities to support irrigation and reclamation district expansions and annexations may result in the conversion of up to 595 ac of habitat. This will primarily occur in Covered Activity Zone 2, but may also include some areas in Covered Activity Zone 1. The habitat type most affected by the construction of new irrigation and flood control facilities will be irrigated agriculture (Table 8.3). The second habitat type anticipated to be most directly affected by this Covered Activity category is open water habitat. Open water habitat may be disproportionately affected because new/improved irrigation ditches will likely follow existing irrigation ditches. The open water habitat that will be affected will be limited to existing



Table 8.3: New Irrigation and Flood Control Facilities for Special Districts

Vegetation/Habitat Type	District					
	SCWA	SID	Dixon RCD	MPWD	RD 2068	Total
Irrigated Agriculture	60	280	145	30	20	535
Grassland – Upland	1	1	0	0	0	2
Grassland – Valley Floor	1	1	1	1	1	5
Grassland – Vernal Pool System	1	1	1	1	1	5
Levee	5	4	2	1	2	14
Marsh	1	0	0	0	0	1
Open Water	5	10	5	5	5	30
Riparian	2	1	0	0	0	3
Total	76	298	154	38	29	595

Dixon RCD = Dixon Resource Conservation District
 MPWD = Maine Prairie Water District
 RD 2068 = Reclamation District No. 2068
 SCWA = Solano County Water Agency
 SID = Solano Irrigation District

irrigation ditches and will have little direct effect on Covered Species. Most of the existing irrigation ditches have little to no riparian habitat, so very little of that habitat type is expected to be directly affected. None of the irrigation or reclamation districts will annex lands that are not currently irrigated; however, there are remnants of grassland areas scattered throughout their districts. There is a small chance that the construction of new irrigation and flood control facilities may have direct effects to this habitat type. For example, a new facility may be constructed adjacent to a parcel that currently contains valley floor grassland; however, the facility is intended to deliver water to adjacent parcels that are in irrigated agriculture. Table 8.3 lists the anticipated levels of take of each vegetation type during the life of the HCP associated with the construction of new irrigation and flood control facilities.

8.1.2.4 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

Operation and maintenance activities are associated with the operation and maintenance of Plan Participant facilities (see Appendix A). Facilities in this category include non-Federal transportation and flood control projects, irrigation ditches (both supply and drainage), drainage ditches and appurtenant facilities, and water treatment facilities.

Routine maintenance activities are required to protect the integrity of existing infrastructure (e.g., roads, fences and gates, water control structures [pipes, conduits, and culverts], pump stations, afterbays, ditches, and distribution systems) and to ensure that facilities operate efficiently and safely. Routine activities include: removal of sediment, vegetation, and debris; repair and replacement of utilities; backfilling of gullies and holes caused by soil erosion; trimming of overgrown or overhanging vegetation on maintenance roads, or embankments; and mowing for fire control. Detailed descriptions of existing facilities and operation and maintenance activities are provided in Appendix A.

The primary impacts for most Covered Species would be potential mortality; loss of cover; loss of nest sites, dens, and burrows; and loss of foraging habitat that would result from the removal of vegetation and accumulated sediment during routine canal maintenance, repair of banks, grading



for roads, and weed and rodent abatement/control activities. The primary approach for Covered Species conservation for this category of Covered Activities is to avoid or minimize adverse effects by employing applicable Best Management Practices (BMPs) as detailed in Chapter 6. Where adverse impacts cannot be avoided, these activities are treated as new development and subject to applicable mitigation measures for affected Covered Species.

8.1.2.5 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

Covered Activities in preserves and reserves are primarily related to implementation of HCP conservation strategies such as the establishment and management of reserves and preserves, habitat restoration and creation, scientific collection/monitoring, relocation of Covered Species, and associated activities (see Sections 2.4 and 2.5).

Approximately 27,000 ac of reserves, preserves, and other cooperative habitat restoration/construction areas (e.g., commercial and institutional mitigation banks) are expected to be developed or to participate in the Solano HCP. Covered Activities (e.g., habitat restoration and construction, scientific collection and monitoring) may also occur on existing reserves and preserves. Potential impacts to Covered Species vary greatly by habitat and location; however, reserve design and management standards (Section 10.5) require management and restoration plans authorized under the Solano HCP to include measures to minimize and avoid adverse impacts to Covered Species. Any potential adverse impacts to Covered Species are expected to be short-term and will be mitigated by long-term gains in populations that would result from an increase in the quantity and quality of habitat through implementation of management measures to promote Covered Species habitat requirements.

8.2 VALLEY FLOOR GRASSLAND AND VERNAL POOL NATURAL COMMUNITY IMPACT ASSESSMENT

Valley floor grasslands are dominated by two typically intermixed associations: vernal pool system grasslands and grasslands associated with low hills such as the Montezuma Hills and Potrero Hills and upper terraces along the Valley Floor/Inner Coast Range foothills (see Section 3.3.2 for details). Vernal pool ecosystems in Solano County consist of seasonally inundated pool basins and swales embedded in a matrix of undulating grasslands. This section assesses impacts to the Valley Floor Grassland and Vernal Pool Natural Community and associated Covered Species. Overall impacts to the Natural Community are addressed first followed by a section for each associated Covered Species.

8.2.1 Methods for Calculating Incidental Take

Various methods were used to assess the direct and indirect impacts of Covered Activities on the Valley Floor Grassland and Vernal Pool Natural Community. The primary method for assessing direct effects was by first overlaying data on proposed activities (Figures 2-3 through 2-9 in Chapter 2.0 and Appendix A) with data compiled for existing biological resources (i.e., Natural Community and Covered Species Conservation Areas as shown on Figures 4-8, 4-10, 4-13, 4-14, 4-18, 4-20, 4-21, and 4-22 in Chapter 4.0). The following sections detail the methods used for calculating impacts for each Covered Activity category.



8.2.1.1 Development Effects (Covered Activity Zone 1)

Direct and indirect impacts were assessed for the both the upland and wetland components of the Valley Floor Grassland and Vernal Pool Natural Community.

Direct Impacts – Uplands. Impacts from development were first assessed by overlaying the cities' General Plan-designated planned development (Figures 2-3 through 2-8) with the Valley Floor and Grassland and Vernal Pool Natural Community (Figure 3-5) and the Vernal Pool Conservation Areas (Figure 4-8). The vegetation category Urban-Vacant lands was included in the impact analysis because it has the potential to contain habitat for Covered Species (See Section 3.3.2.6). For the most part, the estimated impact acreage, which is based solely on the cities' General Plan-designated planned development without additional avoidance, minimization, and mitigation measures, exceeds what can be permitted under the Chapter 10.0 issuance criteria (USFWS 1996). Therefore, these impacts were scaled down by applying the avoidance, minimization, and mitigation measures outlined in Chapter 6.0 to establish allowable levels of take for the Natural Community and Covered Species. The only areas where avoidance is assumed to occur within the cities' UGBs, based on Avoidance and Minimization Measure VPG 1, is in the High Value Vernal Pool Conservation Areas (Figure 4-8). Most of these areas are Contra Costa Goldfield Known Core Population Areas (Figure 4-5). The site design criteria outlined in Section 6.3.2.1 in combination with existing city plans for specific areas and other published Environmental Impact Reports (EIRs) for specific projects were used to analyze impacts in High Value Vernal Pool Conservation Areas.

Indirect Impacts – Uplands. Indirect impacts to the upland component of the Valley Floor Grassland and Vernal Pool Natural Community were estimated by buffering the cities' General Plan-designated planned development, minus the areas in the High Value Vernal Pool Conservation Areas (these were assessed separately), by 250 ft to assess indirect impacts to upland habitat in High and Medium Value Conservation Areas per the requirements in Mitigation Measure VPG 1.

Direct Impacts – Wetlands. A draft wetland delineation encompassing Covered Activity Zone 1 and a 0.5 mi buffer area was conducted for the purpose of applying for a Letter of Permission (LOP) from the United States Army Corps of Engineers (Corps) in order to integrate the Solano HCP with the Section 404 regulatory process (LSA 2011). The result of the draft wetland delineation is a geodatabase of all wetlands in Covered Activity Zone 1 and a 0.5 mi buffer area. LSA used a combination of remote-sensing and direct field analysis records to estimate the extent of Federal Clean Water Act (CWA) jurisdictional waters in the study area. Direct field analysis records consisted of both verified and unverified delineations. Where no on-site mapping was available, LSA Associates, Inc. used GIS-compatible aerial photography to map potentially jurisdictional features. This wetland geodatabase was used to estimate direct and indirect impacts to the wetland component of the Valley Floor Grassland and Vernal Pool Natural Community.

Direct impacts to wetlands were first assessed using methodology similar to estimating impacts to the uplands by overlaying the cities' General Plan-designated planned development (Figures 2-3 through 2-8) with the wetlands layer. However, the entire wetland was considered impacted if it overlapped with any planned development. Again, levels of take needed to be scaled down by applying the avoidance, minimization, and mitigation measures outlined in Chapter 6.0. The main



areas where avoidance is assumed within the cities' UGBs are the Contra Costa Goldfield Known Core Population Areas (Figure 4-5). In these areas, the site design criteria outlined in Section 6.3.2.1 in combination with existing city plans for specific areas, published EIRs for specific projects, and the known distribution of Contra Costa goldfields were used to analyze impacts in High Value Vernal Pool Conservation Areas. The impacted wetland areas estimated in this analysis was subtracted from the estimated upland impact area to estimate a final total anticipated development area.

Indirect Impacts – Wetlands. Indirect impacts to vernal pool wetlands were estimated by buffering the cities' General Plan-designated planned development, less the areas in the High Value Vernal Pool Conservation Areas (these areas were assessed separately), by 250 ft to assess indirect impacts to wetland habitat in High and Medium Value Conservation Areas and buffered by 100 ft to assess indirect impacts to wetland habitat in Low Value Conservation Areas per the requirements in Mitigation Measure VPG 1. If any part of a wetland was within either 250 feet (ft) or 100 ft of planned development, the entire wetland was considered impacted.

8.2.1.2 Development Effects (Covered Activity Zone 2)

Development effects from activities outside of the UGB (Covered Activity Zone 2) had to be assessed slightly differently because detailed plans of all potential activities do not exist. There are a few known activities that fall in this Covered Activities category (see Section 2.5.1.2). For these known development-related activities, the footprint of the proposed development was overlaid onto the Grassland–Valley Floor and Grassland–Vernal Pool System vegetation types (Figure 3-5) to estimate impacts to uplands and then overlaid onto the wetland layer from the draft Covered Activity Zone 1 wetland delineation (LSA 2011). The wetland area was subtracted from the area estimated from the Grassland–Valley Floor and Grassland–Vernal Pool System vegetation calculation to estimate the upland impacts. Since similar calculations could not be done for unknown projects that may occur under this Covered Activity category, a total take limit (based on habitat acreage) was set for this Covered Activity category.

8.2.1.3 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Assessing impacts from activities in this Covered Activity category is difficult because there are a lot of unknowns. For example, in most cases the irrigation and reclamation districts have identified a need for new facilities or improvements to existing facilities; however, the districts do not have detailed plans for new facilities. Based on their projected need, each non-city-related Plan Participant was allotted a certain number of acres/linear miles of new facilities in their current districts and annexation areas. It was assumed that the majority of the impacts will be to irrigated agriculture and existing irrigation ditches and other infrastructure. A small portion of the total impact area was then allotted to impacts to the Valley Floor Grassland and Vernal Pool Natural Community. For Covered Activities in Zone 2 (Figure 1-4), maximum avoidance of vernal pools and other seasonal wetlands is required in all locations (see Section 10.5.4 and Avoidance and Minimization Measure VPG 1).



8.2.1.4 Operations and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

Methods for calculating direct effects to the Valley Floor Grassland and Vernal Pool Natural Community to determine which facilities and activities occur in this community involved overlaying the data on the flood control facility maps presented in Appendix A (Figures A-5, A-10a, A-10b, A-15) with the Grassland–Valley Floor and Grassland–Vernal Pool System vegetation types presented on Figure 3-6. Once the linear feet of the facilities in this community were determined, they were compared with the data (i.e., total length of the facilities, estimated impacts, and frequency of the activities over the term of the HCP) from the routine operation and maintenance activity tables presented in Appendix A (Tables A.5, A.10, A.14, and A.15). Only operation and maintenance activities for underground facilities that occur below valley floor grassland and vernal pool habitat (i.e., underground sewer and water lines, etc.) were used in determining the direct effects to this community. These facilities are expected to result in ground disturbance should they need to be repaired, resulting in impacts to the grassland communities and the covered species that may occur there.

8.2.2 Development Effects (Covered Activity Zone 1)

Conversion or take of habitat in the Valley Floor Grassland and Vernal Pool Natural Community for development-related activities is set at a maximum of 4,825 ac. The extent of loss of actual wetland, vernal pool, and swale communities will be no more than 180 ac over the term of the HCP.

8.2.2.1 Direct Effects

Direct impacts to upland habitat in the Valley Floor Grassland and Vernal Pool Natural Community will occur in Fairfield (2,360 ac), Rio Vista (1,380 ac), Suisun City (460 ac), Vacaville (2,010 ac), Vallejo (250 ac), and Dixon (1 ac). Direct impacts to wetland habitat in the Valley Floor Grassland and Vernal Pool Natural Community will occur in Dixon (13 ac), Fairfield (70 ac), Rio Vista (12 ac), Suisun City (13 ac), Vacaville (38 ac), and Vallejo (12 ac). These impacts will occur in high value (611 ac of upland and 29 ac¹ of wetland), medium value (2,870 ac of upland and 76 ac of wetland), and low value (2,980 ac of upland and 32 ac of wetland) conservation areas and isolated wetlands in agricultural areas (21 ac of wetlands). The bulk of the direct impacts will occur in medium and low value conservation areas.

High Value Conservation Areas. Approximately 640 ac of high value vernal pool habitat (611 ac of upland and 29 ac of wetland) will be directly impacted by development in Covered Activity Zone 1 under the HCP. The high value vernal pool habitat that will be directly impacted by development in Covered Activity Zone 1 will occur in the Cities of Fairfield and Suisun City. The following is a breakdown of these anticipated impacts by subarea (Figure 4-8):

- **Subarea 1A – Jepson Prairie:** The majority of Subarea 1A falls outside of Covered Activity Zone 1. The small portion that does fall in Covered Activity Zone 1 is located in the northeastern corner of the Fairfield Train Station Specific Plan Area (AECOM 2011) adjacent to Subarea 1C. Approximately 76 ac of upland habitat and 2 ac of wetland habitat are

¹ Impacts to wetland were rounded to the nearest acre.



anticipated to be directly impacted by development in Subarea 1A. The portion of Subarea 1A that is proposed for development is highly disturbed vernal pool grassland (Figure 4-5).

- Subarea 1B – McCoy Creek Basin Contra Costa Goldfield Core Population Area:** Subarea 1B, McCoy Creek Basin, covers approximately 615 ac within the UGB of Fairfield, of which 46 ac comprise the McCoy Basin and a Bureau of Reclamation facility associated with operation of the Putah South Canal. Under the design performance criteria, development in this subarea is expected to be approximately 175 ac (150 ac of upland and 14 to 15 ac of wetland). The expected preserve area would be between 380 ac and 440 ac.
- Subarea 1C – Upper Union Creek Contra Costa Goldfield Core Population Area:** Subarea 1C, the Upper Union Creek Contra Costa Goldfield Core Population Area, covers approximately 1,380 ac. Maximum conversion in this subarea for urban uses would be approximately 235 ac (230 ac of upland and 3 to 5 ac of wetland) as specified in the Fairfield Train Station Specific Plan EIR (AECOM 2011). The expected preserve area would be between 700 ac and 760 ac. Additional provisions are included in Avoidance and Minimization Measures VPG 2 and VPG 6 to maintain a minimum 1,320 ft wide habitat corridor linking Jepson Prairie, Upper Union Creek, Vanden, and McCoy Creek Basin Conservation Areas and a minimum 500 ft corridor between preserve areas.
- Subarea 1D – Vanden Contra Costa Goldfield Core Population Area:** Subarea 1D, the Vanden Contra Costa Goldfield Core Population Area, covers approximately 100 ac. The most prominent aquatic habitat is a large, approximately 9 ac playa pool. Due to the relatively small size of the Subarea (only 100 ac) and broad extent of wetlands, avoidance and minimization criteria would likely limit conversion/loss of habitat to 10 to 15 ac, leaving roughly 85 to 90 ac of preserved habitat in the subarea. This preserved habitat would abut the larger 700 to 760 ac Upper Union Creek Preserve.
- Subarea 1E – Walters/Air Base Parkway Contra Costa Goldfield Core Population Area:** Subarea 1E, the Walters/Air Base Parkway Contra Costa Goldfield Core Population Area, covers approximately 175 ac. The majority of this site (approximately 130 ac) consists of privately-owned land zoned for development under the City of Fairfield General Plan (City of Fairfield 2002, 2003). This subarea abuts the Travis Aero Club. The Travis Aero Club lies within the boundary of Travis AFB and consists of approximately 55 ac of restored vernal pool habitat, including restored populations of Contra Costa goldfields. Subarea 1E also includes a small preserve (approximately 8 ac) adjacent to the Jehovah's Witness Church at Walters Road that contains one pool with a population of goldfields. The majority of Subarea 1E is a proposed mitigation bank; therefore, little to no development will occur in this subarea
- Subarea 1F – Potrero Hills/Lower Union Creek/Denverton Creek Contra Costa Goldfield Core Population Area:** Subarea 1F, the Potrero Hills/Lower Union Creek/Denverton Creek Contra Costa Goldfield Core Population Area, consists of approximately 5,300 ac. Of the 5,300 ac, approximately 3,000 ac occur in Covered Activity Zone 1 (2,000 ac in Suisun City and 1,000 ac in Fairfield). However, only 400 ac are planned for development, of which only 65 to 70 ac (60 to 65 ac of upland and 5 ac of wetland) will likely be developed. Of the remaining area, approximately 380 ac are already preserved, and at least 350 ac will be preserved under the Solano HCP Conservation Strategy.
- Subarea 1G – Ledgewood Creek Contra Costa Goldfield Core Population Area:** Subarea 1G, the Ledgewood Creek Contra Costa Goldfield Core Population Area, encompasses approximately 470 ac, of which approximately 300 ac are classified as valley floor grassland and associated wetland habitats, such as vernal pools and swales. The remaining area



represents transition habitat between grassland and coastal marsh. Of the 300 ac of valley floor grassland and associated wetland habitats, approximately 185 ac are located within Suisun City's UGB. However, under a current development project (Raney Planning and Management, Inc. 2006), conversion would be limited to 87 ac (approximately 82 ac of upland and 5 ac of wetland) primarily west of Pennsylvania Avenue. Proposed development would involve preservation, restoration, and management of approximately 255 ac of suitable grassland and associated vernal pool habitats on two adjacent parcels, the Tooby and Barnfield parcels (Raney Planning and Management, Inc. 2006). The remainder of the two parcels contain tidal marsh habitat and provide an extremely rare tidal marsh to vernal pool/grassland transition.

Medium Value Conservation Areas. Approximately 2,946.5 ac of medium value vernal pool habitat (approximately 2,870 ac of upland and 76.5 ac of wetland) will be directly impacted by development in Covered Activity Zone 1 under the HCP. Medium value habitat planned for development occurs in the Cities of Fairfield (Subareas 2B, 2C, 2G, 2H, and 2J), Rio Vista (Subarea 2I), Suisun City (Subareas 2E and 2F), Vacaville (Subareas 2C, 2D, 2K, and 2N), and Vallejo (Subarea 2M). Table 8.4 provides a breakdown of anticipated acres of impact to both upland and wetland in each medium value subarea by Plan Participant.

Table 8.4: Direct Impacts to Vernal Pool Habitat in Medium Value Conservation Areas by Plan Participant

Plan Participant	Vernal Pool Conservation Subarea	Direct Impacts		Total Direct Impacts
		Upland	Wetland	
Dixon	2A	1	0	1
Fairfield	2B	21	1	22
	2C	638	20	658
	2G	76	6.5	82.5
	2H	108	11	119
	2J	72	0.5	72.5
Rio Vista	2I	1,284	12	1,296
Suisun City	2E	58	1	59
	2F	28	0	28
Vacaville	2C	42	0.5	42.5
	2D	456	18	474
	2K	20	0	20
	2N	20	1	21
Vallejo	2M	46	5	51
Total		2,870	76.5	2,946.5

Low Value Conservation Areas. Approximately 3,013 ac of low value vernal pool habitat (2,980 ac of upland and 33 ac of wetland) will be directly impacted by development in Covered Activity Zone 1 under the HCP. Low value vernal pool habitat planned for development occurs in the Cities of Fairfield (974 ac of upland and 9 ac of wetland), Suisun City (226 ac of upland and 3 ac of wetland), Vacaville (1,477 ac of upland and 13 ac of wetland), Vallejo (208 ac of upland and 7 ac of wetland), and Rio Vista (95 ac of upland and 1 ac of wetland).



Vernal Pool Wetlands in Agricultural Areas. There are several isolated wetlands in areas mapped as agriculture that fall outside of a Vernal Pool Conservation Area. In these areas, the upland component would be considered impacts to agriculture and would mitigate according to the Swainson’s hawk and burrowing owl mitigation requirements; however, there would still be impacts to the wetland component according to the valley floor grassland and vernal mitigation measure for wetland mitigation (Mitigation Measure VPG 1). Based on the HCP wetland mapping effort, there is an estimated total of 21 ac of wetlands in planned development areas in the Cities of Fairfield (2.5 ac), Vacaville (5.5 ac), and Dixon (13 ac).

8.2.2.2 Indirect Effects

Approximately 1,010 ac of upland habitat and 252 ac of wetland habitat in the Valley Floor Grassland and Vernal Pool Natural Community will be indirectly affected by development. Mitigation Measure VPG 1 requires mitigation for indirect impacts within 250 ft of development for wetlands and uplands in high and medium value conservation areas, and 100 ft of development for wetlands in low value conservation areas. Indirect impacts from urban development were assessed relative to these distances. Table 8.5 provides a breakdown of the indirect effects to uplands and wetlands by the Plan Participant using these values. Indirect effects may include the introduction of invasive species, loss of pollinators due to destruction or degradation of their habitat, alterations to grazing regimes, changes in overland flow, and changes in hydrology.

Table 8.5: Indirect Effects to Valley Floor Grassland and Vernal Pool Habitat by Plan Participant

Plan Participant	Upland Impacts (acres)	Wetland Impacts (acres)
Dixon	0	0
Fairfield	529	97
Rio Vista	189	32
Suisun City	79	100
Vacaville	99	21
Vallejo	114	2
Total	1010	252

High Value Conservation Areas. There will be the most indirect impacts to wetland habitat in high value conservation areas because these are the main areas where avoidance will occur under the Conservation Strategy in Covered Activity Zone 1; therefore, there will be development adjacent to preserved areas (Avoidance and Minimization Measure VPG 1). Using the methods described in Section 8.2.1.1, indirect impacts to habitat in high value conservation areas were calculated and are summarized in Table 8.6. Acreages may vary once specific site plans are developed, and indirect impacts may increase in order to maximize avoidance of direct effects.

Medium Value Conservation Areas. Most of the medium value vernal pool conservation areas in Covered Activity Zone 1 that are zoned for development will likely be developed under the HCP (i.e., maximum avoidance of wetlands is not necessary under Avoidance and Minimization Measure VPG 1). The majority of the indirect effects to Valley Floor Grassland and Vernal Pool habitat in medium value conservation areas will occur in areas outside of the UGBs (Table 8.7).



Table 8.6: Indirect Effects to High Value Vernal Pool Conservation Areas from Development in Covered Activity Zone 1

Plan Participant	Subareas	Upland Impacts (acres)	Wetland Impacts (acres)
Fairfield	1B	25	16
	1C	192	26
	1D	12	11
	1E	5	21
	1H	2	2
Suisun City	1F	34	34
	1G	20	65
Total		290	175

Table 8.7: Indirect Effects to Medium Value Vernal Pool Conservation Areas from Development in Covered Activity Zone 1

Plan Participant	Subarea	Upland Impacts (acres)	Wetland Impacts (acres)
Fairfield	2B	3	1
	2C	218	5
	2G	7	0.5
	2H	46	4
	2J	19	0.1
Rio Vista	2I	189	32
Suisun City	2E	25	1
Vacaville	2C	11	0
	2D	22	15
	2K	8	0
	2N	58	6
Vallejo	2M	114	2.5
Total		720	67.1

Low Value Conservation Areas. Indirect impacts to low value conservation areas were only assessed for the wetlands component in 100 ft of development. Approximately 8 ac of wetlands in low value conservation areas will be indirectly impacted by development in the City of Fairfield. No other cities have indirect effects to vernal pool wetland habitat in low value conservation areas.

Vernal Pool Wetlands in Agricultural Areas. Indirect impacts to vernal pool wetlands in agricultural areas were only assessed for the wetlands component within 100 ft of development. Approximately 2 ac of vernal pool wetlands in agricultural areas will be indirectly impacted by development in the City of Fairfield. No other cities have indirect effects to vernal pool wetland habitat in agricultural areas.



8.2.3 Development Effects (Covered Activity Zone 2)

8.2.3.1 Direct Effects

Direct effects to the Valley Floor Grassland and Vernal Pool Natural Community will also result from projects initiated by the cities outside the UGBs in Covered Activity Zone 2. Such Covered Activities will result in approximately 345 ac of direct effects (i.e., development) to Valley Floor Grassland and Vernal Pool habitat. The direct effects to the Valley Floor Grassland and Vernal Pool Natural Community outside of the UGBs will occur in the Cities of Fairfield (150 ac), Rio Vista (100 ac), Suisun City (25 ac), Vacaville (50 ac), and Vallejo (20 ac). No direct effects to the Valley Floor Grassland and Vernal Pool Natural Community outside of the UGBs will occur in Dixon. Specific facilities that will directly affect this community consist of planned road widening (1.6 ac), proposed storm water treatment plants (15.2 ac), and proposed water lines (0.5 ac) (see Figures 2-3 through 2-8).

8.2.3.2 Indirect Effects

Indirect effects to Valley Floor Grassland and Vernal Pool habitat as a result of development activities in Covered Activity Zone 2 were calculated based on data available at the time of the HCP preparation. California tiger salamander and other Covered Species may be impacted by the indirect effects of increased runoff from roads and the increased traffic volume on roads that are widened. Avoidance and Minimization Measure VPG 5, Design Measures for New Roads, would minimize these indirect effects.

8.2.4 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Construction of new irrigation and flood control facilities will primarily affect existing irrigated agriculture and irrigation ditches. However, there are parcels containing valley floor grassland and vernal pool grassland habitats in the service area boundaries and annexation areas. None of the irrigation or reclamation districts will annex lands that are not currently irrigated; however, there are remnants of grassland areas scattered throughout the districts. There is a small chance that the construction of new irrigation and flood control facilities may have direct effects to this habitat type.

8.2.4.1 Direct Effects

The maximum total direct effects to valley floor grassland habitat and vernal pool grassland habitat are 5 ac and 5 ac, respectively, due to construction and annexation activities in the irrigation and reclamation districts in Covered Activity Zones 1 and 2. Vernal pool wetlands will be avoided to the maximum extent practicable (see Section 10.4.1).

8.2.4.2 Indirect Effects

The maximum total indirect effects to valley floor grassland habitat and vernal pool grassland habitat are 17 ac and 8 ac, respectively, due to construction and annexation activities in the irrigation and reclamation districts in Covered Activity Zones 1 and 2. The main indirect effect is the introduction and spread of invasive species as a result of frequent disturbance from the grading of access roads.



8.2.5 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

8.2.5.1 Direct Effects

Operation and maintenance activities associated with facilities may affect a small amount of grassland and vernal pool habitat in the Valley Floor Grassland and Vernal Pool Natural Community. The estimated direct effect of these activities on Valley Floor Grassland and Vernal Pool habitat for the life of the Plan is 3 ac (2 ac of valley floor grassland habitat and 1 ac of vernal pool grassland habitat; see Figure 3-6). Specific activities that will likely impact Valley Floor Grassland and Vernal Pool habitat are the repair and replacement of sewage force mains, underground sewer lines, underground irrigation supply lines, storm drain lines, and water lines. These are all underground facilities that, in some areas, have the potential to have valley floor grassland and vernal pool grassland at the soil surface. If these facilities need to be repaired or replaced, small temporary impacts to these habitats could occur. If vernal pool wetlands are temporarily impacted, they will be restored following the requirements in Avoidance and Minimization Measure VPG 5.

Most of the irrigation ditches occur in irrigated agriculture; however, there are a few areas where these facilities intersect Valley Floor Grassland and Vernal Pool habitat. In these areas, maintenance activities such as blading and grading of access roads may temporarily impact a small amount of vernal pool habitat. In addition, during the removal of sediment from ditches, the sediment is placed on the canal bank. These spoil piles may accidentally extend into grassland habitat if the habitat is adjacent to the ditch; however, these impacts would be very small and infrequent.

8.2.5.2 Indirect Effects

Operation and maintenance activities associated with various facilities may indirectly affect habitat in the Valley Floor Grassland and Vernal Pool Natural Community. The main indirect effect to habitat is the introduction of nonnative plant species caused by routine operation and maintenance activities. Activities such as fire breaks, road grading, and excavating waterlines and sewage lines under existing vegetation could disturb habitat and encourage the spread of nonnative plant species. If spoil piles are placed next to vernal pools, they could alter the topography, which could in turn potentially alter the hydrology of the pools. The indirect effects of operation and maintenance activities on Valley Floor Grassland and Vernal Pool habitat will be very small.

8.2.6 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

8.2.6.1 Direct Effects

Covered Activities in the preserves and reserves relate primarily to implementation of the HCP reserve system, including adaptive management and monitoring, habitat enhancement, and habitat restoration and creation on designated reserves/preserves, mitigation sites/banks, open space lands, and adjacent lands. For vernal pools, the biggest impact from Covered Activities on reserves involves the restoration and creation of vernal pool and swale habitats. Based on the anticipated direct wetland impact of approximately 158 ac, an anticipated 200 ac of additional wetland habitat will be created and/or restored in preserves and reserves. Restoration and enhancement of wetlands in the preserves/reserves could result in the temporary disturbance of an area two to three times the size of the restored wetland acreage (i.e., 400 to 600 ac). This temporary disturbance will generally be limited to previously disturbed areas and not high value native habitats (see Section 10.5.5).



Restoration activities will likely occur over a period of several years and at different sites. Since 1995, approximately 100 ac of vernal pools and swale wetlands have been constructed at the existing, approved Elsie Gridley Mitigation Bank and the North Suisun Mitigation Bank. The rate of wetland construction will likely be driven by market demand and could take 10 to 15 years to complete. Any short-term losses of habitat or species that may be killed or injured during grading operations will be offset by long-term gains in restored/enhanced habitat function and value.

8.2.6.2 Indirect Effects

Restoration and creation of preserves and reserves could indirectly affect the Valley Floor Grassland and Vernal Pool Natural Community by introducing nonnative plant species.

8.2.7 Requested Take Summary

The extent of loss of wetland, vernal pool, and swale communities will be a maximum of 158 ac over the term of the HCP. Although loss of wetland habitat is typically considered the primary metric for assessing effects to most vernal pool-associated species, vernal pool-dependent species also require surrounding upland habitat during various times of the year. Uplands are also critical for providing habitat for invertebrate pollinators and for maintaining water quality and pool hydrology (see Appendix B). The requested long-term take of upland Valley Floor Grassland and Vernal Pool habitat is a maximum of 6,461 ac for Covered Activity Zone 1 urban development (see Table 8.1). No more than 395 ac of upland Valley Floor Grassland and Vernal Pool habitat and 22 ac of vernal pool wetlands can be directly affected as a result of development activities in Covered Activity Zone 2 (Table 8.2). Up to 65 ac of valley floor grassland and 5 ac of vernal pool grassland habitat can be directly affected as a result of the construction of new irrigation and flood control facilities in Covered Activity Zone 2 (Table 8.3). Operations and maintenance activities associated with facilities may affect a maximum of 3 ac of Valley Floor Grassland and Vernal Pool habitat for the life of the Plan (2 ac of valley floor grassland habitat and 1 ac of vernal pool grassland habitat; see Figure 3-6). An additional 400 to 600 ac of Valley Floor Grassland and Vernal Pool habitat could be temporarily impacted by habitat restoration and enhancement activities.

8.2.8 Conservation Summary

As compensatory mitigation for impacts to 6,620 ac of Valley Floor Grassland and Vernal Pool habitat, between 13,000 and 15,000 ac of high value Valley Floor Grassland and Vernal Pool habitat will be preserved as part of the Solano HCP preserve system (see Objective VPG 1.1). If activities associated with development or the construction of new irrigation and flood control facilities directly affects Valley Floor Grassland and Vernal Pool habitat then it will be mitigated for according to the ratios in Mitigation Measure VPG 1. High value habitat is located in the Vernal Pool High Value Conservation Areas (Figure 4-8) or in priority areas for future protection identified in Figure 4-26. In addition, approximately 200 ac of vernal pool and swale habitats will be restored in the preserved areas. Table 8.8 summarizes the extent to which each High Value Vernal Pool Conservation Area will be preserved and the benefits of its preservation on the conservation of the Valley Floor Grassland and Vernal Pool Natural Community and associated Covered Species.



Table 8.8: Anticipated Valley Floor Grassland and Vernal Pool Habitat Preservation

Subarea (Figure 4-9)	Anticipated Preservation (acres)	Vernal Pool Conservation Criteria (Section 4.3.2.3)
Subarea 1A – Jepson Prairie, or other potential vernal pool preserve or reserve areas outlined in Figure 4-26	11,140–13,220	High Value Conservation Criteria 1, 2, 3, 4, 5, 6, and 7
Subarea 1B – McCoy Creek Basin Contra Costa Goldfield Core Population Area	380–400	High Value Conservation Criteria 3, 4, and 7
Subarea 1C – Upper Union Creek Contra Costa Goldfield Core Population Area	700–760	High Value Conservation Criteria 1, 3, 4, 5 and 7
Subarea 1D – Vanden Contra Costa Goldfield Core Population Area	60	High Value Conservation Criteria 3, 4, and 7
Subarea 1E – Walters/Air Base Parkway Contra Costa Goldfield Core Population Area	170	High Value Conservation Criteria 3, 4, and 7
Subarea 1F – Potrero Hills/Lower Union Creek/Denverton Creek Contra Costa Goldfield Core Population Area	350 minimum	High Value Conservation Criteria 1, 2, 3, 4, 5, 6, and 7
Subarea 1G – LedgeWood Creek Contra Costa Goldfield Core Population Area	120	High Value Conservation Criteria 2, 3, 4, 6, and 7

8.2.9 Effects on Covered Species

For the majority of Covered Species associated with the Valley Floor Grassland and Vernal Pool Natural Community, the maximum level of take is estimated to be the same as that described in the Natural Community discussion. This section does not repeat these maximum take levels for each species. Instead, the section for each species briefly summarizes the estimated take and conservation of known occurrences/populations. The two exceptions are Contra Costa goldfields and California tiger salamander. The direct effects to these species are different because the known and potential range of the species (Figures 4-5 and 4-6) are slightly different than the Vernal Pool Conservation Areas (Figure 4-8). For Contra Costa goldfields, the known core population areas and the potential habitat and watershed areas are limited to vernal pool habitat in and around Fairfield and Suisun City (Figure 4-5). For California tiger salamander, the known and potential range includes some upland grassland and oak savanna habitat in the Inner Coast Range Natural Community and excludes areas west of Interstate 80 (I-80) (Figure 4-6).

8.2.9.1 Contra Costa Goldfields

Contra Costa goldfields occur in a variety of seasonal wetlands, but are primarily associated with vernal pools ranging from small pools and swales to large pools. There are five Contra Costa Goldfield Core Population Areas in the Plan Area: McCoy Creek Basin, the southwestern portion of Upper Union Creek, Vanden, Walters/Air Base Parkway, just north of the Potrero Hills and south of State Route 12 (SR-12) in Potrero Hills/Lower Union Creek/Denverton Creek, and LedgeWood Creek (Figure 4-5). In addition, 12 other occurrences, primarily in the Potrero Hills/Lower Union Creek/Denverton Creek Core Population Area, consist of a few isolated occupied pools. The Upper Union Creek Core Population Area and the Potrero Hills/Lower Union Creek/Denverton Creek Core Population Area contain the largest extent of contiguous potential habitat outside of the planned development areas of Fairfield and Suisun City, but are relatively unoccupied (LSA 2010a).



1. **Development Effects (Covered Activity Zones 1 and 2).** Almost all of the Contra Costa Goldfield Core Population Areas occur within the UGBs of Fairfield or Suisun City. The following details the anticipated levels of take of occupied habitat from development activities.
 - a. **Direct Effects.** Under the Solano HCP Conservation Strategy, development in Contra Costa Goldfield Core Population Areas (1B, 1C, 1D, 1E, 1F, 1G, and 1H) must meet specific performance standards designed to preserve viable populations/reserves in each Core Population Area while still allowing some development to occur. Avoidance and Minimization Measures VPG 1, VPG 2, VPG 3, and VPG 4 would reduce development in these Core Population Areas to 542 ac of upland habitat and 30 ac of wetland habitat (i.e., the primary habitat for Contra Costa goldfields). Small, isolated, and currently unknown populations could also be lost as a result of development in adjacent Medium Value Conservation Areas (Subareas 2B, 2C, 2E, 2G, and 2H) that encompass an additional 943 ac of potential upland habitat and 40 ac of potential wetland habitat in Covered Activity Zone 1. In addition, approximately 2 ac of vernal pool habitat in Subarea 2C will be directly affected by development activities outside of the Fairfield and Vacaville UGBs. The following provides a summary of anticipated impacts to occupied habitat in each Core Population Area:
 - 1) **Subarea 1B – McCoy Creek Basin Contra Costa Goldfield Core Population Area.** Direct impacts to occupied habitat will occur in Subarea 1B as a result of development activities. The exact amount of occupied habitat impacted is not known. However, if Subarea 1B contains more than 30 ac of occupied habitat, then the maximum anticipated wetland fill in Subarea 1B (15 ac) would equal the amount of occupied habitat that could be directly impacted in accordance with Avoidance and Minimization Measure VPG 2.
 - 2) **Subarea 1C – Upper Union Creek Contra Costa Goldfield Core Population Area.** Actual loss of plants will not occur in this area because most of the occupied habitat areas have already been preserved. Based on Mitigation Measure VPG 3, new populations will likely be established in the 700 to 760 ac of preserved land in this Core Population Area. Additional provisions are included in Mitigation Measure VPG 1 to maintain a minimum 1,320 ft wide habitat corridor linking Jepson Prairie, McCoy Creek Basin, Upper Union Creek, and Vanden Conservation Areas.
 - 3) **Subarea 1D – Vanden Contra Costa Goldfield Core Population Area.** The prominent aquatic habitat in this Core Population Area is a large, approximately 9 ac playa pool. The majority of the occupied Contra Costa goldfield habitat encompasses the playa pool and the land southeast and adjacent to the existing Noonan Ranch Conservation Bank. Development will likely occur in the northwestern portion of Subarea 1D, avoiding the majority of the occupied Contra Costa goldfield habitat.
 - 4) **Subarea 1E – Walters/Air Base Parkway Contra Costa Goldfield Core Population Area.** The majority of Subarea 1E is a proposed mitigation bank; therefore, little to no development will occur in this Core Population Area, nor would there be direct effects to occupied habitat. The main concern in Subarea 1E is indirect effects because it is surrounded by development.
 - 5) **Subarea 1F – Potrero Hills/Lower Union Creek/Denverton Creek Contra Costa Goldfield Core Population Area.** This area contains only isolated occupied pools. Planned development would likely impact two occupied pools in this Core Population Area. This Core Population Area represents one of the largest contiguous blocks of



potential Contra Costa goldfield habitat in Solano County. Additional habitat will likely be acquired to meet mitigation needs and will likely be the target of restoration activities required under Mitigation Measure VPG 3.

- 6) **Subarea 1G - Ledgewood Creek Contra Costa Goldfield Core Population Area.** Under a current development project (Gentry-Suisun Draft EIR 2006), conversion would be limited to 87 ac located primarily west of Pennsylvania Avenue. Based on surveys conducted by Vollmar Consulting, this development project would impact one known subpopulation occupying a depression approximately 0.02 ac in size and supporting between of 20 to 200 plants (Vollmar Consulting 1998, 2003). Proposed development would involve preservation, restoration, and management of approximately 255 ac of suitable grassland and associated vernal pool habitats on the adjacent Tooby and Barnfield parcels (Raney Planning and Management, Inc. 2006). The remainder of the two parcels contain tidal marsh habitat and provide an extremely rare tidal marsh to vernal pool/grassland transition. These two preservation parcels support a number of identified Contra Costa goldfield populations.
 - 7) **Subarea 1H – Cordelia Contra Costa Goldfield Core Population Area.** Subarea 1H is outside of the UGBs. No direct impacts to occupied habitat are anticipated from development activities.
 - b. **Indirect Effects.** There will be Contra Costa goldfield habitat preserves in Covered Activity Zone 1 because of requirements for avoidance of High Value Conservation Areas (Avoidance and Minimization Measure VPG 1). There will be indirect effects to these preserved high value goldfield areas from surrounding development projects. A total of 290 ac of upland habitat and 175 ac of wetland habitat will be indirectly affected by development in Core Population Areas.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** It is unlikely that the construction of new irrigation and reclamation district facilities will directly or indirectly affect occupied Contra Costa goldfield habitat. All of the known Core Population Areas fall outside of the Dixon RCD potential drainage service expansion area (Figure 2-2) and the Dixon Regional Watershed Joint Powers Authority (DRW JPA) locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A). There is a small amount of overlap between Subareas 1H and 2H and the SID potential annexation areas (Figure 2-9). There is also overlap between the SID existing service area (Figure 2-9) and Subareas 1B, 2C, and 2G. If new facilities are constructed in Contra Costa goldfield habitat areas, all of the avoidance, minimization, and mitigation measures in Chapter 6.0 would apply.
 3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Approximately 6 mi of Plan Participant facilities occur in Contra Costa Goldfield Core Population Areas and 6.5 mi of Plan Participant facilities occur in potential habitat areas. Primary features include SID irrigation ditches (including approximately 1.5 mi of underground irrigation supply pipelines, most of which are in potential habitat areas) and 3 mi of Fairfield-Suisun Sewer District (FSSD) underground sanitary sewer lines. Impacts to Contra Costa goldfield habitat could occur if underground facilities require repair or replacement. All activities would be subject to the measures in Chapter 6.0, which will minimize direct and indirect effects to this species. The direct effect of these activities is the temporary conversion of 1 ac of vernal pool habitat for the life of the Plan.



4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Implementation of management and restoration activities on preserves could result in impacts to Contra Costa goldfields. Restoration activities, including grading to create additional vernal pools, seed collection, soil salvage, and monitoring, could result in temporary impacts to Contra Costa goldfields. Presumably, the restoration activity would mitigate any temporary effects to Contra Costa goldfields. Grazing and/or weed eradication could temporarily reduce the numbers of Contra Costa goldfields; however, management of these lands should emphasize actions that increase the size of the goldfield population. An unknown number of plants could be affected by preserve management and restoration activities. However, no conversion of habitat is anticipated, and any effects to Contra Costa goldfields would likely be short-term and would be mitigated by long-term gains in the population. Restoration actions are anticipated to result in a net increase in Contra Costa goldfield populations.
5. **Effect Summary.** The requested conversion of vernal pool habitats in Contra Costa Goldfield Core Population Areas (High Value Vernal Pool Conservation Subareas 1B, 1C, 1D, 1E, 1F, 1G and 1H) comprises 535 ac of upland habitat and 27 ac of wetland habitat for development activities in Covered Activity Zone 1. Indirect effects would impact 290 ac of upland habitat and 175 ac of wetland habitat. Small, isolated, and currently unknown populations could also be lost as a result of development in adjacent Medium Value Conservation Areas (Subareas 2B, 2C, 2E, 2F, 2G, and 2H), encompassing an additional 975 ac of upland habitat and 41 ac of wetland habitat in Covered Activity Zones 1 and 2. No more than 1 ac of occupied habitat may be impacted by operation and maintenance activities, particularly if underground facilities require repair or replacement. The probability of these impacts actually occurring is very small. For reserve management activities, an unknown number of plants would be affected by management activities associated with establishing and managing habitat reserves. No more than 10 percent of any population/stand per year would be harvested for seed for restoration activities.
6. **Conservation Summary.** Contra Costa goldfields is one of the species considered in the United States Fish and Wildlife Service (USFWS; 2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 90 percent of species occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands) depending on location. Core Population Areas 1B, 1C, 1D, 1E, and 1F fall into the 95 percent preservation category, and Core Population Areas 1G and 1H are located in the 85 percent preservation category. The conservation objectives, site design standards, and mitigation requirements described in Chapters 5.0 and 6.0 would conserve each subpopulation, representing the entire genetic range of the species in Solano County. In addition, the Plan will preserve between 65 and 100 percent of the habitat (with an average of 90 percent), and achieve the key conservation actions under the Alternative Recovery Criteria for Regional Conservation Plans.

The Solano HCP would establish between 1,780 and 1,860 ac of reserve land in the range of this species. Reserves would contain the larger “at risk” populations in the McCoy Creek Basin, Vanden, Ledgewood Creek, and Walters/Air Base Parkway Core Population Areas. The HCP would also require that corridors be established and maintained to connect populations of Contra Costa goldfields in accordance with Avoidance and Minimization Measures VPG 3 and VPG 6. These corridors would help to maintain the biological values of vernal pools and enhance the survival of Contra Costa goldfields. Connectivity would be maintained between vernal pool complexes in the Jepson Prairie region (Vernal Pool Conservation Subarea 1A) and the Upper Union Creek (Subarea 1C) and Lower Union Creek/Potrero Hills/Denverton Creek watersheds (Subarea 1F). Connectivity would also be established between the watersheds of



the Vanden Core Population Area (Subarea 1D) and the Upper Union Creek Core Population Area (Subarea 1C).

Mitigation Measure VPG 3 requires reestablishment and a minimum net increase in any extant populations of Contra Costa goldfields that are impacted by development by establishing new, self-reproducing populations. Based on studies by Collinge (2003), the restoration/establishment of self-reproducing populations of Contra Costa goldfields into restored or constructed vernal pools is practicable. Therefore, implementation of the Solano HCP would result in a net increase in the numbers of plants and protected habitat for Contra Costa goldfields.

8.2.9.2 Alkali Milk-Vetch

Alkali milk-vetch occurs in alluvial and seasonally wet grassland and alkali or sub-saline vernal pools that are marginal to the San Francisco Estuary. Although not known to occur in freshwater or salt marshes, alkali milk-vetch is present in some diked baylands (CSCC 2003) and alkali pool areas. Alkali milk-vetch is widely distributed throughout the vernal pool grasslands in Solano County, in the areas bordering Suisun Bay and extending east through Suisun City and Fairfield to Jepson Prairie.

1. **Development Effects (Covered Activity Zones 1 and 2).** Two known occurrences¹ of alkali milk-vetch are located in Covered Activity Zone 1 in the urban areas of Fairfield and Suisun City, both of which are in known Contra Costa goldfield populations (Subareas 1G and 1E). Although no extant records exist from Vacaville, Rio Vista, or Vallejo, habitat in these areas may contain this species.

Since most of the known alkali milk-vetch populations in Covered Activity Zone 1 are associated with Contra Costa Goldfields Core Population Areas, and many of these goldfield populations occur in High Value Vernal Pool Conservation Areas designated for protection under Avoidance and Minimization Measures VPG 1 and VPG 2 and Mitigation Measure VPG 1, a significant portion of the known occurrences of alkali milk-vetch would be preserved. No more than 82 ac of upland habitat and 5 ac of wetland habitat will be directly affected in Subarea 1G, and little to no direct effects will occur in Subarea 1E.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Three known occurrences of alkali milk-vetch are located in Covered Activity Zone 2 in the service areas of Dixon RCD and RD 2068. However, these occurrences fall outside of the Dixon RCD potential drainage service expansion area (Figure 2-2), the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A), and the SID potential annexation areas (Figure 2-9). Although no extant records exist in the service areas of the other irrigation or reclamation districts, small amounts of remnant vernal pool habitat may be present and could have the potential to support this species.

¹ One occurrence of vernal pool plants and crustaceans corresponds to an occupied area at least 0.25 mi away from the next occupied area or is separated by major barriers (roads, development etc.), which corresponds to the definition of occurrence for these species in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b). The term population is used interchangeably with *occurrence* per the Recovery Plan definition.



3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Of the 18 alkali milk-vetch occurrences, 3 are at least partially located in Covered Activity Zone 2 and 2 are located in Covered Activity Zone 1. One alkali milk-vetch occurrence in the Dixon RCD Service Area exists entirely on protected land owned by the Department of Defense and Yolo County (i.e., the Davis Communications Annex). Two occurrences exist on the eastern boundaries of the Dixon RCD and RD 2068 Service Areas. Operation and maintenance activities outside of channel work would be limit to designated rights-of-way and other designated sites where alkali milk-vetch is not likely to occur.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Most of the known occurrences of alkali milk-vetch are located in Covered Activity Zone 3, including existing preserves at Jepson Prairie, Wilcox Ranch, and Calhoun Cut, and the commercial mitigation banks established at Gridley Ranch, Muzzy Ranch, and Burke Ranch. Implementation of management and restoration activities on preserves could potentially affect known alkali milk-vetch occurrences.
5. **Conservation Summary.** Alkali milk-vetch is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 80 percent of alkali milk-vetch occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands), depending on location. Most of the known alkali milk-vetch occurrences would be preserved through existing or anticipated reserves and preserves, including the existing preserves at Jepson Prairie, Wilcox Ranch, Calhoun Cut, and Yolo County Grasslands Regional Park and the commercial mitigation banks established at Gridley Ranch, Muzzy Ranch, and Burke Ranch. Eight of the 19 known occurrences in the Plan Area fall within these existing and anticipated reserves and preserves. Protection of Contra Costa Goldfield Core Population Areas would protect two additional known occurrences in the Plan Area. The four remaining known occurrences fall within potential reserve and preserve areas identified in Chapter 4.0, Conservation Analysis, and therefore may become incorporated into the Solano HCP reserve system. Implementation of the HCP would protect approximately 66 to 72 percent of known occurrences and between 13,000 and 15,000 ac of valley floor grassland and vernal pool habitat. Furthermore, Objective VPG 2.4 is to preserve and/or establish eight occurrences of alkali milk-vetch in the Plan Area.

8.2.9.3 Bogg's Lake Hedge-Hyssop

Bogg's Lake hedge-hyssop grows in vernal pools and in marshy areas on the margins of reservoirs and lakes, as well as in man-made habitats such as borrow pits and cattle ponds. In Solano County, four occurrences¹ of Bogg's Lake hedge-hyssop have been reported on, around, and just north of the Jepson Prairie Preserve.

¹ One occurrence of vernal pool plants and crustaceans corresponds to an occupied area at least 0.25 mi away from the next occupied area or is separated by major barriers (roads, development etc.), which corresponds to the definition of occurrence for these species in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b). The term population is used interchangeably with *occurrence* per the Recovery Plan definition.



1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known Bogg's Lake hedge-hyssop occurrences are located in Covered Activity Zone 1 or 2; however, subsequent surveys may identify this species in Covered Activity Zone 1.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** No known occurrences are located in Covered Activity Zone 1 or 2. However, suitable habitat is present in Covered Activity Zone 1, and small amounts of remnant vernal pool habitat, which may be suitable for this species, are present in Covered Activity Zone 2.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Canals and other Plan Participant facilities traverse valley floor grassland and vernal pool habitat. There are no facilities in that area located adjacent to currently known Bogg's Lake hedge-hyssop occurrences.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** All four Bogg's Lake hedge-hyssop occurrences are located in Covered Activity Zone 3 in the High Value Vernal Pool Conservation Subarea 1A, the Jepson Prairie region.
5. **Effect Summary.** The maximum requested conversion of habitat from development-related activities in Covered Activity Zones 1 and 2 is the same as that described for the wetland component of the Natural Community as a whole. Requested effects for operations and maintenance activities are the temporary loss of no more than 10 percent of a stand of plants per year. For activities on preserves and reserves, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.
6. **Conservation Summary.** Boggs Lake hedge-hyssop is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 80 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands) in the Jepson Prairie Core Recovery Area. One of the known occurrences is located in existing or anticipated reserves and preserves, including existing preserves at Jepson Prairie and the commercial mitigation banks established at Gridley Ranch, Muzzy Ranch, and Burke Ranch. In Covered Activity Zone 1, the most likely habitat for this species would be preserved through the preservation of Contra Costa Goldfield Core Population Areas. Objective VPG 2.6 specifies the preservation and/or establishment of two occurrences of Bogg's Lake hedge-hyssop in the Plan Area, which would represent 50 percent of the known occurrences in Solano County.

8.2.9.4 Colusa Grass

Colusa grass grows in large or deep vernal pools or lakes and shallow playas, in adobe clay soils that can be saline/alkaline (see Appendix B). In Solano County, four populations of Colusa grass are known to occur: two in the northeastern portion of the Plan Area on the Yolo County Grasslands Regional Park, one in the Jepson Prairie Preserve, and one in the Muzzy Ranch Conservation Bank. Colusa grass is threatened primarily by conversion of habitat to agricultural uses, development, overgrazing, and nonnative plants.

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known Colusa grass occurrences are located in Covered Activity Zone 1. Under Avoidance and Minimization



Measure VPG 4, no conversion of occupied Colusa grass habitat would be allowed within 500 ft of a known occurrence. All avoided areas must have an approved management plan and provide a sufficient endowment for the long-term management of the species consistent with the Reserve Management Guidelines in Section 10.5. Based on these conservation actions, no conversion of habitat or loss of Colusa grass would occur.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** One known Colusa grass occurrence is located in Covered Activity Zone 2; however, it occurs in the Davis Communications Annex. If additional occurrences were discovered in Covered Activity Zone 2, avoidance and minimization measures in Chapter 6.0 would be implemented to preclude impacts to this species.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Because Colusa grass is endangered and its known locations are well documented, operations and maintenance activities are not expected to directly or indirectly affect Colusa grass.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** One known Colusa grass occurrence is located in Covered Activity Zone 2 in the Davis Communications Annex, and two occurrences (one in the Jepson Prairie Preserve and one on private land) are located in Covered Activity Zone 3. Implementation of management and restoration activities on preserves is unlikely to result in adverse effects to Colusa grass. The primary potential Covered Activity would be the establishment/planting of Colusa grass in suitable habitats on existing and newly established reserves and preserves to achieve Objective VPG 2.8 (the preservation and/or establishment of one occurrence).
5. **Effects Summary.** Colusa grass is considered an extremely rare or range-limited species, and conversion of occupied Colusa grass habitat will not be allowed in Covered Activity Zone 1 or 2 (Avoidance and Minimization Measure VPG 4). For activities on preserves and reserves, the harvest of seed from no more than 10 percent of a single population/stand no more than once every 5 years is requested to allow for transplanting to additional sites in other preserves (specific introduction plans would need to be developed and would be subject to approval by SCWA and the HCP Technical Review Committee prior to implementation).
6. **Conservation Summary.** Colusa grass is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 90 percent of known occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands), depending on location. Colusa grass is an extremely rare and range-limited species with only three known occurrences in the Plan Area, two of which fall within existing preserves (Jepson Prairie and Davis Communications Annex). The third occurrence lies within the priority areas for conservation of vernal pool species. Because of the limited population and distribution of Colusa grass, desirable recovery actions include protection of known populations and re-introduction of new colonies in suitable habitat areas. Implementation of the HCP would result in the establishment of between 13,000 and 15,000 ac of new preserves and areas protected from development primarily in high quality vernal pool habitat areas. These new preserves could potentially support currently unidentified populations of Colusa grass. Many of the commercial mitigation/conservation banks and preserves (Gridley Ranch, Muzzy Ranch, Burke Ranch, and possibly the North Suisun Bank) also contain suitable habitat for re-introduction of this species.



8.2.9.5 Ferris's Milk-Vetch

The Solano HCP considers Ferris's milk-vetch to be a range-limited species because it is only known from a few extant localities throughout its range; only two occurrences are known in the Plan Area. Ferris's milk-vetch grows in vernal mesic meadows and mildly alkaline flats in valley and foothill grassland, usually on dry, heavy clay or adobe soil at elevations ranging from 20 to 150 ft.

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known Ferris's milk-vetch occurrences are located in Covered Activity Zone 1, and the one known occurrence is located outside of the Covered Activity Zone 2 areas in which city-related development would occur.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** One of the known occurrences of Ferris's milk-vetch in the Plan Area is from an isolated vernal pool area surrounded by irrigated agriculture in Covered Activity Zone 2. The other occurrence is just outside the Plan Area in the Yolo Bypass Wildlife Area. These occurrences fall outside the Dixon RCD potential drainage service expansion area (Figure 2-2), the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A), and the SID potential annexation areas (Figure 2-9). They fall in or are adjacent to the existing service area boundaries of Dixon RCD and MPWD. Nevertheless, it is unlikely this species will be affected by this category of Covered Activities.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** The one known occurrence of Ferris's milk-vetch in Solano County is from an isolated vernal pool area surrounded by irrigated agriculture in Covered Activity Zone 2. This small patch of vernal pool habitat is adjacent to the Dixon Main Drain to the north. Maintenance of this drain may have indirect effects on this occurrence (e.g., facilitating the spread of invasive species). Vernal pool habitat adjacent to this facility will be marked by a qualified biologist and avoided prior to maintenance activities that may affect adjacent upland habitat per the requirements in Chapter 6.0.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** The one known occurrence of Ferris's milk-vetch in Solano County is from Covered Activity Zone 2, and no Ferris's milk-vetch occurrences are known in Covered Activity Zones 1 and 3, although suitable habitat is abundant in the latter. The occurrence in Covered Activity Zone 2 is located in a potential outlier reserve area. There may also be an occurrence in the Yolo Bypass Wildlife Area, which abuts the Plan Area to the east and south. If these two occurrences still exist, the Solano HCP is requesting take of no more than 10 percent of any population/stand per year for harvesting seed in order to achieve Objective VPG 2.3, which is to preserve and/or establish one occurrence of Ferris's milk vetch in the Plan Area.
5. **Effect Summary.** The maximum requested conversion of habitat is the same as that described for the wetland component of the Natural Community as a whole. Actual loss of occupied habitat is expected to be substantially less. Requested effect levels for operation and maintenance activities are the temporary loss of no more than 10 percent of a stand of plants per year. For activities on preserves and reserves, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.
6. **Conservation Summary.** Ferris's milk-vetch is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The



recovery strategy calls for the preservation/protection of 100 percent of known occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands), depending on location. Only one known occurrence is located in the Plan Area, and it falls within a potential vernal pool preservation area. In addition, implementation of the Solano HCP would result in the establishment of new preserves and areas that are protected from development that could support Ferris's milk-vetch. Furthermore, under Objective VPG 2.3, the Solano HCP will preserve and/or establish one occurrence of Ferris's milk-vetch in the Plan Area (specific introduction plans would need to be developed and would be subject to approval by SCWA and the HCP Technical Review Committee prior to implementation).

8.2.9.6 Legenere

Legenere grows in a variety of habitats, including vernal pools, vernal marshes, artificial ponds, and floodplains of intermittent streams, at elevations ranging from 9 to 3,350 ft (USFWS 2005b). There are 11 populations of legenere reported in Solano County, with most occurring on the Jepson Prairie Preserve and Calhoun Cut Ecological Reserve (existing protected lands).

1. **Development Effects (Covered Activity Zones 1 and 2).** There are two known legenere occurrences located in Covered Activity Zone 1. Both of these occurrences are located in potential conservation areas in northeast Fairfield; however, these areas will be set aside as mitigation for impacts to adjacent habitat.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** No known occurrences are located in Covered Activity Zone 2; however, small amounts of remnant vernal pool habitat that may potentially be suitable for this species are present in the zone. If the construction of new facilities affects suitable legenere habitat, implementation of measures addressed in Chapter 6.0 will mitigate these effects.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** No known occurrences are located in Covered Activity Zone 2. However, there is one occurrence located in the Elsie Gridley Mitigation Bank. The Alamo Creek Flood Control Channel maintained by SCWA bisects the bank. This is the one location where a known occurrence of legenere may be indirectly affected by operation and maintenance activities. In addition, small amounts of remnant vernal pool habitat, which may potentially be suitable for this species, are present in Covered Activity Zone 2.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** The other nine known legenere occurrences are located in Covered Activity Zone 3, and the two occurrences that are located in Covered Activity Zone 1 are located in areas that will likely be preserved. Restoration and creation activities on preserves and reserves could directly and indirectly affect legenere habitat. For activities on preserves and reserves, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.
5. **Effects Summary.** The maximum requested conversion of habitat is the same as that described for the wetland component of the Natural Community as a whole. Actual loss of occupied habitat is expected to be substantially less. Requested effect levels for operation and maintenance activities are the temporary loss of no more than 10 percent of a stand of plants per year. For activities on preserves and reserves, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.



6. **Conservation Summary.** Legenere is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 80 percent of known occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). Only 4 of the 11 legenere occurrences exist outside of protected areas, and 2 of those occurrences occur in areas that are planned to be protected under the HCP Conservation Strategy. Restoration/construction of replacement wetland habitats will also provide additional opportunities for expanding/establishing new populations of this species.

8.2.9.7 San Joaquin Valley Orcutt Grass

The Solano HCP considers San Joaquin Valley Orcutt grass to be a range-limited species because it is only known from a few extant localities throughout its range. Only one record of this species (discovered in 2003) is known from Solano County. On the east side of the Central Valley, San Joaquin Valley Orcutt grass is threatened by habitat loss caused by urban and agricultural development, overgrazing, nonnative invasive plants, and small population size.

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known occurrences of San Joaquin Valley Orcutt grass are located in Covered Activity Zone 1 planned development areas. However, areas of suitable habitat planned for development shall be surveyed for this species according to the pre-application survey requirements described in Chapter 6.0. As a range-limited species, no adverse impacts to this species are authorized under the Solano HCP. Avoidance and Minimization Measure VPG 5 stipulates that applicants develop site-specific buffer zones that shall include the immediate watershed and a minimum 500 ft buffer surrounding the watershed. All avoided areas shall have approved management plans and a sufficient endowment for long-term management of the species consistent with the Reserve Management Guidelines in Section 10.5. Therefore, no adverse effects or loss of occupied habitat are authorized under the Solano HCP.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** None of the currently known occurrences of San Joaquin Valley Orcutt grass are located in Covered Activity Zone 2. If San Joaquin Valley Orcutt grass were to be discovered in Covered Activity Zone 2, protocols in Chapter 6.0 would be implemented to preclude impacts to this species.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** None of the currently known occurrences of San Joaquin Valley Orcutt grass are located in Covered Activity Zone 2, and the one occurrence located in Covered Activity Zone 1 in the Muzzy Ranch Conservation Bank is not adjacent to any facilities owned or maintained by the Plan Participants. If San Joaquin Valley Orcutt grass were to be discovered in Covered Activity Zone 2, protocols in Chapter 6.0 would be implemented to preclude impacts to this species.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** The sole occurrence of San Joaquin Valley Orcutt grass is located in the Vernal Pool High Value Conservation Areas at the Muzzy Ranch Conservation Bank. Implementation of management and restoration activities on preserves is unlikely to result in adverse effects to this species. The primary potential Covered Activity would be planting additional stands of San Joaquin Valley Orcutt grass in suitable habitats on existing and newly established reserves and preserves. Management plans and restoration plans are required to minimize management actions that could affect other Covered Species (see Section 10.5). Additionally, Objective VPG 2.9



specifies the preservation and/or establishment of one occurrence of San Joaquin Valley Orcutt grass in the Plan Area.

5. **Effects Summary.** Conversion of occupied habitat will not be allowed (Avoidance and Minimization Measure VPG 5) for Covered Activity Zone 1 or 2 activities because San Joaquin Valley Orcutt grass is considered an extremely rare or range-limited species. For activities on preserves and reserves, impacts from Covered Activities include the harvest of seed from no more than 10 percent of a single population/stand no more than once every 5 years to allow for transplanting to additional sites in other preserves (specific introduction plans would need to be developed and would be subject to USFWS approval prior to implementation).
6. **Conservation Summary.** San Joaquin Valley Orcutt grass is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 90 percent of known occurrences and 85 to 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands), depending on location. The Solano HCP considers San Joaquin Valley Orcutt grass to be a range-limited species because it is only known from a few extant localities throughout its range and one location in Solano County. As a result, desirable recovery objectives include identifying and protecting extant populations and establishing new populations. Implementation of the Solano HCP conservation program would result in the establishment of 13,000 to 15,000 ac of new vernal pool preserves and areas protected from development. These new preserves could potentially support San Joaquin Valley Orcutt grass if their boundaries overlap its distribution. These areas also provide opportunities for establishing new populations in suitable habitat. Approval of the Muzzy Ranch Conservation Bank would provide permanent protection and management for the one known location in Solano County. Collection of seed from established source(s) would provide additional opportunities for establishing new populations of this species.

8.2.9.8 Solano Grass

The Solano HCP considers Solano grass to be a range-limited species because it is only known from a few extant localities throughout its range. Solano grass is commonly found in drying, alkali-clay bottoms of large/deep vernal pools or lakes and shallow playas, and in adobe clay soils that can be saline/alkaline. Solano grass is primarily threatened by the invasion of nonnative plants (CDFG 2004a, CNPS 2011).

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known Solano grass occurrences are located in Covered Activity Zone 1. According to Chapter 6.0, surveys are required in suitable habitat and may locate this species in Covered Activity Zone 1. As a range-limited species, no adverse impacts to this species are authorized under the Solano HCP. Avoidance and Minimization Measure VPG 5 stipulates that applicants develop site-specific buffer zones that shall include the immediate watershed and a minimum 500 ft buffer surrounding the watershed. All avoided areas must have an approved management plan and a sufficient endowment for long-term management of the species consistent with the Reserve Management Guidelines in Section 10.5. Therefore, no adverse effects or loss of occupied habitat are authorized under the Solano HCP.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** One of the currently known Solano grass occurrences is located in



the Yolo County Grasslands Regional Park in Covered Activity Zone 2. Because Solano grass is considered an extremely rare or range-limited species, conversion of occupied habitat will not be allowed in Covered Activity Zone 1 or 2 (Avoidance and Minimization Measure VPG 5). Protocols in Chapter 6.0 shall be implemented to preclude impacts to this species. These protocols are designed to avoid impacts to vernal pools and species covered under the HCP, including Solano grass.

3. **Operations and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Because Solano grass is rare and its locations are well documented, no direct or indirect impacts to Solano grass will result from operation and maintenance activities.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** All of the currently known Solano grass occurrences are located in Covered Activity Zones 2 and 3 in Vernal Pool High Value Conservation Areas. One occurrence of Solano grass (which could possibly be extinct) in Covered Activity Zone 3 is currently located in a protected area on the Jepson Prairie Preserve, and the other one in Covered Activity Zone 3 is unprotected. The occurrence in Zone 2 is located on the Yolo County Grasslands Regional Park. Implementation of management and restoration activities on preserves is unlikely to result in adverse effects to this species. Reserve management standards (Section 10.5) require that management plans include measures to avoid adverse impacts to Covered Species such as Solano grass. The primary potential Covered Activity would be the establishment or planting of additional stands of Solano grass in suitable habitats on existing and newly established reserves and preserves. Objective VPG 2.10 specifies the establishment of one new occurrence of Solano grass on preserved lands in the Plan Area. Existing stands would have to be disturbed for seed collection in order to achieve Objective VPG 2.10.
5. **Effects Summary.** Solano grass is considered an extremely rare or range-limited species; therefore, conversion of occupied habitat will not be allowed under Avoidance and Minimization Measure VPG 4 in Covered Activity Zone 1 or 2. For activities on reserves and preserves, impacts from Covered Activities include the harvest of seed from no more than 10 percent of a single population/stand no more than once every 5 years to allow for transplanting to additional sites in other preserves (Prior to implementation, specific introduction plans would need to be developed that would be subject to USFWS approval.) Additional seed may also be available from the Crampton Herbarium at U.C. Davis.
6. **Conservation Summary.** The USFWS adopted a recovery plan for Solano grass concurrently with one for the Delta green ground beetle in 1985. Identified recovery actions include:
 - a. Use laws, regulations, and plans to protect Solano grass from collection.
 - b. Consider the usefulness of removal or retirement of Cook Lane through Olcott Lake, fee-title acquisition of in-holdings and/or easements with local lessees and landowners, fire management plans, maintaining natural water regimes, restricting herbicide use, and visitor-use plans for established preserves.
 - c. Enhance existing habitat and maximize productivity of Solano grass.
 - 1) Investigate the hydrology of Olcott Lake and the autecology of Solano grass. Examine the effects of abiotic factors on population fluctuations.
 - 2) Examine the effects of grazing and trampling. Erecting experimental grazing exclosures may reveal that exclusion of certain stock is necessary for recovery of the Solano grass.



- 3) Human use of Solano grass habitat may need to be limited.
- 4) Develop and implement management strategies.
- d. Establish additional populations of Solano grass in the Jepson Prairie region.
 - 1) Identify and secure transplantation sites using acquisition or conservation easements to control adverse development.
 - 2) Develop propagation and transplantation techniques, if needed.
 - 3) Rehabilitate transplantation sites, if needed.
 - 4) Introduce Solano grass into new sites.
- e. Increase public awareness of the Solano grass and its habitat.

A number of these actions address the population at Olcott Lake on the Jepson Prairie Preserve (at present, the preserve owner is not participating in the HCP). Other recovery actions such as establishment of new populations and increasing public awareness can be facilitated through HCP conservation activities.

Solano grass is also one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon, which represents a revision to the final recovery plan written for this species in 1985 (USFWS 1985). This recovery plan calls for the preservation/protection of 100 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). Implementation of the Solano HCP conservation program would result in the establishment of 13,000 to 15,000 ac of new vernal pool preserves and areas protected from development. These new preserves could potentially support Solano grass and provide opportunities for establishing new populations in suitable habitat. Potential reserves at Muzzy Ranch, Gridley Ranch, Burke Ranch, and possibly the North Suisun Bank provide secure, protected sites for establishing new populations. As described in the Recovery Plan, the discovery or establishment of two new populations that contain self-reproducing plants for 10 years is necessary to downlist Solano grass to a threatened status. Collection of seed from established source(s) would provide additional opportunities for establishing new populations of this species. HCP implementation and public outreach also helps increase public awareness of Solano grass and other special-status species in the region.

8.2.9.9 Vernal Pool Smallscale

Vernal pool smallscale grows in alkaline vernal pools where it is primarily associated with the bottoms of the basins rather than with the edges of the pools (USFWS 2005b). Three occurrences of this species are recorded for Solano County, and all are on or near the Jepson Prairie Preserve.

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known vernal pool smallscale occurrences are located in Covered Activity Zone 1. However, there is one occurrence in Vernal Pool Subarea 1G that is just outside of Covered Activity Zone 1. Additional occurrences may occur in suitable habitat in this subarea. This occurrence will likely be preserved as part of the mitigation for development in Subarea 1G. Since this species appears to be primarily associated with larger alkaline playa pools, potential conversion or loss of habitat will be substantially less than 159 ac for the total Natural Community.



2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** One occurrence is located in Covered Activity Zone 2, just outside the UGB of Fairfield. However, this occurrence falls outside the Dixon RCD potential drainage service expansion area (Figure 2-2), the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A), and the SID potential annexation areas (Figure 2-9). Although no extant records exist in the service areas of the other irrigation or reclamation districts, small amounts of remnant vernal pool habitat may be present and could have the potential to support this species. Maximum impacts to vernal pool grassland habitat from construction and annexation activities of the irrigation and reclamation districts in Covered Activity Zones 1 and 2 total 5 ac. Actual impacts to vernal pool wetlands will be much less because wetlands will be avoided to the maximum extent practicable (see Section 10.4.1). If the construction of new facilities affects suitable vernal pool smallscale habitat, implementation of measures addressed in Chapter 6.0 will mitigate these effects.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** One of the known occurrences of vernal pool smallscale is located in Covered Activity Zone 2 adjacent to one of the FSSD underground treated discharge pipes and other underground sanitary sewer pipes. The repair or replacement of these facilities could cause direct impacts to vernal pool smallscale habitat. If these activities are required during the life of the Plan, measures in Chapter 6.0 would be implemented to minimize impacts to this species. Indirect effects to vernal pool smallscale habitat caused by routine operations and maintenance activities include the introduction of nonnative plant species. Activities such as fire breaks, road grading, and the excavating of waterlines and sewage lines under existing vegetation could disturb habitat and encourage the spread of nonnative plant species.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Three known occurrences of this species are located in Covered Activity Zone 3. Implementation of management and restoration activities on preserves could result in impacts to vernal pool smallscale. These impacts could include modification of vernal pool habitat in the course of restoring vernal pools and associated habitats. Management plans and restoration plans are required to account for and minimize activities that may adversely affect vernal pool smallscale and other vernal pool plant and animal species. In addition, Objective VPG 2.5 specifies the preservation and/or establishment of one occurrence of vernal pool smallscale in the Plan Area.
5. **Effects Summary.** Covered Activities in or adjacent to vernal pools and adjacent grasslands could directly or indirectly impact an unknown number of vernal pool smallscale. Because vernal pool smallscale is primarily associated with larger playa pools and potentially smaller alkaline vernal pools, potential conversion is an unknown but reduced subset of the anticipated approximate 180 ac of wetland lost due to development-related Covered Activities. Impacts from the construction of new irrigation and reclamation district facilities and operation and maintenance activities will be the loss of no more than 10 percent of a stand of plants per occurrence for the life of the HCP. For activities on preserves and reserves, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.
6. **Conservation Summary.** Vernal pool smallscale is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The recovery strategy calls for the preservation/protection of 90 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). Of the 34 known occurrences, 19 (i.e., 56 percent) occur on protected lands in the range of this species. One of three known occurrences in the Plan Area is protected



on the Jepson Prairie Preserve. The remaining two known occurrences lie within the high priority area for preserve establishment. The Solano HCP conservation strategies commit to: (1) protecting one of these additional known populations or at least one new record (i.e., currently undiscovered); (2) establishing new populations to replace any newly discovered populations impacted by Covered Activities; and (3) establishing at least one new population in the HCP reserve system. Thus, at least three occurrences equal to 100 percent of currently known occurrences will be preserved under the HCP. Adaptive management and monitoring requirements will heighten awareness of the effects of and the need for reserve management actions for this species.

8.2.9.10 Delta Green Ground Beetle

Delta green ground beetle prefers grassland habitat that is interspersed with vernal pools or playa pools that typically hold water for long periods (USFWS 1999a). Presently, the beetle is only known to occur on less than 5,000 ac of the Jepson Prairie in Solano County (USFWS 1999a). Recently, the number of beetles appears to have declined, possibly due to the temporary removal of managed grazing (USFWS 1999a).

1. **Development Effects (Covered Activity Zones 1 and 2).** None of the currently known Delta green ground beetle occurrences are located in Covered Activity Zone 1 planned development areas. However, potential habitat is present in and around the larger vernal pools in western Suisun City. Potential Covered Activity Zone 1 conversion of the Valley Floor Grassland and Vernal Pool Natural Community in which this species could occur totals 6,620 ac. Loss of wetlands in this community is projected to be approximately 159 ac. Since this species appears to be primarily associated with larger playa pools with long hydroperiods, potential conversion or loss of habitat would be substantially less than the total 159 ac of wetlands given the limited occurrences of playa-type pools in planned urban development areas.

This species shares similar habitat (i.e., larger playa pools with long hydroperiods) as some of the no-take species (i.e., Colusa grass and Solano grass). As range-limited species, no adverse impacts will occur to Colusa grass and Solano grass under the Solano HCP. Furthermore, Avoidance and Minimization Measure VPG 5 stipulates that third-party applicants shall develop site-specific buffer zones that include the immediate watershed and a minimum 500 ft buffer surrounding the watershed. All avoided areas must have an approved management plan and a sufficient endowment for long-term management of the species consistent with the Reserve Management Guidelines in Section 10.5. These measures to preserve Colusa grass and Solano grass populations will also benefit the Delta green ground beetle.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** None of the known occurrences fall within Covered Activity Zone 2, nor do they fall within the Dixon RCD potential drainage service expansion area (Figure 2-2), the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A), or the SID potential annexation areas (Figure 2-9). Although no extant records exist in the service areas of the other irrigation or reclamation districts, small amounts of remnant vernal pool habitat may be present and could have the potential to support this species. If the construction of new facilities affects suitable Delta green ground beetle habitat, implementation of measures addressed in Chapter 6.0 will mitigate these effects.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** The Alamo Creek Flood Control Channel (SCWA) traverses designated critical habitat for the Delta green



ground beetle on the Elsie Gridley Mitigation Bank. Potentially suitable habitat also borders the Alamo Creek Flood Control Channel, the Ulatis Creek Flood Control Channel (SCWA), and an MPWD channel on the Elsie Gridley Mitigation Bank. Protocols in Chapter 6.0 for vernal pool and wetland protection would be implemented to preclude impacts to this species. No adverse effects to the Delta green ground beetle are expected since it is a range-limited species that occupies specialized playa pool habitat that will be protected under the Solano HCP.

4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Known occurrences and the majority of suspected habitat for the Delta green ground beetle are located in Vernal Pool High Value Conservation Subarea 1A. All occurrences are either completely or partially located in a protected area (Jepson Prairie Preserve, Wilcox Ranch, Muzzy Ranch, and Burke Ranch). Designated critical habitat is present in the Elsie Gridley Mitigation Bank, and suitable habitat and/or known occurrences are also present on all of the other proposed vernal pool mitigation bank/reserve sites (Muzzy Ranch, Burke Ranch, and North Suisun Mitigation Bank).

Implementation of management and restoration activities on preserves could result in take of an unknown number of Delta green ground beetle. These impacts could include:

- a. Grading/construction activities associated with implementation of vernal pool, swale, and seasonal wetland restoration/construction activities;
- b. Collection of seed and soil from existing onsite wetlands that will be used to revegetate/inoculate restored and constructed wetlands; and
- c. Proposed monitoring designed to document constructed wetland performance compliance and the effects of ongoing management activities on mitigation bank lands.

Such activities, particularly ground-disturbing activities such as restoration of vernal pool habitats, could result in the take of an unknown number of Delta green ground beetles. However, the potential level of take would be minimal given that most restoration will be limited to areas of previous ground disturbance (agricultural uses) and/or areas outside of existing vernal pool complexes. Potential impacts would be short term and offset by increased vernal pool/wetland habitat area. Additionally, Objective VPG 2.11 specifies the preservation of 2,500 ac of natural vernal pool grassland encompassing known occurrences of Delta green ground beetle in the Jepson Prairie region of the Plan Area.

5. **Requested Take Summary.** Because of the lack of adequate survey protocols, the presence of the Delta green ground beetle may go undetected in Covered Activity Zone 1 or 2. If the species is present in Covered Activity Zone 1, it would occur in higher quality habitat containing Contra Costa goldfield populations. In these areas, take/habitat conversion would be governed primarily by conservation strategies for Contra Costa goldfields and would be limited to between 700 and 800 ac. Additional take may also occur in the 3,590 ac of habitat outside of the Contra Costa Goldfield Core Population Areas affected by urban growth; however, presence in these areas is unlikely. For activities on reserves and preserves, an unknown number of Delta green ground beetles may be taken as a result of restoration, management, and monitoring plans approved by the USFWS through the mitigation bank review and approval process or as individual restoration plans certified under the Solano HCP (Section 10.5).
6. **Conservation Summary.** The USFWS adopted a recovery plan for the Delta green ground beetle in 1985 (USFWS 1985). The recovery plan identifies a recovery goal of establishing and securing three additional vigorous self-sustaining colonies on at least 5,000 ac of natural vernal



pool/grassland habitat. The Delta green ground beetle is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. This Recovery Plan calls for the preservation/protection of 100 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). The Solano HCP Conservation Program will significantly contribute to the 5,000 ac recovery standard for this species presented in the 1985 Recovery Plan and to the 95 percent protection of remaining habitat through the preservation of a minimum of 2,500 ac of natural vernal pool grassland that encompasses known occurrences of Delta green ground beetle in the Jepson Prairie region of the Plan Area. This preservation will likely occur on the Muzzy Ranch (1,287 ac), Gridley Ranch (1,100 ac) and Burke Ranch (1,290 ac) mitigation banks. This preservation would be in addition to the approximately 2,713 ac of Delta green ground beetle habitat already preserved on the Jepson Prairie Preserve (1,439 ac) and Wilcox Ranch (1,274 ac, The Nature Conservancy and City of Fairfield and Solano County with a Nature Conservancy conservation easement). Collectively, these areas would encompass 6,390 ac of protected and managed land. These preserves would also include all designated critical habitat for this species.

8.2.9.11 Conservancy Fairy Shrimp

The pools inhabited by the Conservancy fairy shrimp are typically large with neutral pH, very low conductivity, low total dissolved solids (TDS), and low alkalinity (Barclay and Knight 1984, Eng et al. 1990). In Solano County, Conservancy fairy shrimp are known primarily from the Jepson Prairie area and the vernal pools bordering the north edge of the Potrero Hills.

1. **Development Effects (Covered Activity Zones 1 and 2).** No occurrences of Conservancy fairy shrimp are contained in Covered Activity Zone 1 planned development areas. However, potential habitat is present in and around the larger vernal pools in western Suisun City and in northeastern Fairfield. In Covered Activity Zone 1, potential conversion of the Valley Floor Grassland and Vernal Pool Natural Community in which this species could occur totals 6,620 ac. The loss of wetlands in this community is projected to be approximately 159 ac. Since this species appears to be primarily associated with larger playa pools with long hydroperiods, potential conversion or loss of wetland habitat will be substantially less than the total 159 ac given the limited occurrence of playa-type pools in planned urban development areas.

This species shares similar habitat as some of the no-take species (i.e., Colusa grass and Solano grass). As a range-limited species, no adverse impacts will occur to Colusa grass and Solano grass under the Solano HCP. Furthermore, Avoidance and Minimization Measure VPG 5 stipulates that third-party applicants shall develop site-specific buffer zones that include the immediate watershed and a minimum 500 ft buffer surrounding the watershed. All avoided areas must have an approved management plan and a sufficient endowment for the long-term management of the species consistent with the Reserve Management Guidelines in Section 10.5. Measures to preserve Colusa grass and Solano grass populations will also benefit the Conservancy fairy shrimp.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** None of the known occurrences fall within the Dixon RCD potential drainage service expansion area (Figure 2-2), the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A), or the SID potential annexation areas (Figure 2-9). Although no extant records exist in the service areas of the other irrigation or



reclamation districts, small amounts of remnant vernal pool habitat may be present and could have the potential to support this species. Maximum impacts to vernal pool grassland habitat from construction and annexation activities of the irrigation and reclamation districts in Covered Activity Zones 1 and 2 total 5 ac. Actual impacts to vernal pool wetlands will be much less because wetlands will be avoided to the maximum extent practicable (see Section 10.4.1). If the construction of new facilities affects suitable Conservancy fairy shrimp habitat, implementation of measures addressed in Chapter 6.0 will mitigate these effects.

3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** None of the currently known occurrences of Conservancy fairy shrimp are located in Covered Activity Zone 2. Potentially suitable habitat for Conservancy fairy shrimp borders the Alamo Creek Flood Control Channel, the Ulatis Creek Flood Control Channel (SCWA), and an MPWD channel on Elsie Gridley Mitigation Bank. Protocols in Chapter 6.0 for vernal pool and wetland protection would be implemented to preclude impacts to this species.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Currently known occurrences of Conservancy fairy shrimp are located in Covered Activity Zone 3. At least 10 occurrences of Conservancy fairy shrimp are located in Covered Activity Zone 3 and in Vernal Pool High Value Conservation Areas, including documented occurrences on the Gridley Ranch and Muzzy Ranch mitigation banks. Although unlikely, ground-disturbing activities associated with restoration or weed abatement activities could result in impacts to this species. Management plans and restoration plans are required to account for other Covered Species and implement necessary management actions to avoid adverse effects. Management actions should include avoiding areas of existing populations and establishing populations in new areas. Additionally, Objective VPG 2.12 specifies the preservation and/or establishment of five populations of Conservancy fairy shrimp in the Plan Area. Incidental take of individuals could also occur during aquatic monitoring surveys at reserves and as part of compliance monitoring and seed/inoculum collection from existing vernal pools for vernal pool restoration.
5. **Requested Take Summary.** No Conservancy fairy shrimp are known to occur in Covered Activity Zone 1 planned development areas. If the species is present in planned development areas, it would occur in high quality habitat containing Contra Costa goldfields. In these areas, take/habitat conversion would be governed primarily by the conservation strategy for Contra Costa goldfields and would be limited to between 700 and 800 ac. Additional take may also occur in the 5,820 ac of habitat outside the Contra Costa Goldfield Core Population Areas affected by urban growth; however, presence in these areas is unlikely. For activities on preserves and reserves, an unknown number of Conservancy fairy shrimp may be taken as a result of restoration, management, and monitoring plans approved by USFWS through the mitigation bank review and approval process or as individual restoration plans certified under the Solano HCP (see Section 10.5).
6. **Conservation Summary.** The Conservancy fairy shrimp is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The Recovery Plan calls for preservation/protection of 100 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). The Solano HCP would contribute to these recovery goals by establishing new preserves and areas protected from development. Preserve areas that will potentially become part of the HCP reserve system include: Burke Ranch (1,290 ac), Muzzy Ranch (1,287 ac), and Gridley Ranch (1,100 ac). These preserve areas, in combination with existing reserves (Jepson Prairie, Wilcox Ranch, Calhoun Cut) will provide a large (approximately 7,600 ac) block of interconnected, high quality vernal pool habitat in the center of the known



distribution for this species in Solano County. In combination with the Potrero Hills Lane mitigation site, 13 of the 16 recorded locations (5 of the 7 occurrences) of this species in Solano County would be protected under conservation easements or fee title by conservation organizations. Additional lands may be added in the future in this area.

Restoration activities on other lands at the Muzzy Ranch Conservation Bank and Elsie Gridley Mitigation Bank sites include construction/restoration of additional vernal pools designed to be suitable for Conservancy fairy shrimp.

8.2.9.12 Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp occupies a variety of vernal pool habitats ranging from small, clear sandstone rock pools to large, turbid, alkaline, grassland valley floor pools (Eng et al. 1990, Helm 1998). Vernal pool fairy shrimp are sporadically distributed in vernal pool complexes (USFWS 1994a) such that adults may not inhabit some or many of the pools in a complex in any one year. Primary threats to the vernal pool fairy shrimp in Solano County are urban development, agricultural conversion, agricultural use, and water supply and flood control projects.

1. **Development Effects (Covered Activity Zones 1 and 2).** Vernal pool fairy shrimp are widely distributed in the vernal pools of Solano County, with records from Vacaville, Fairfield, Travis Air Force Base (AFB) Jepson Prairie, the pools along the north edge of the Potrero Hills, and in the Montezuma Hills (see Appendix B). There are 12 known occurrences located in Covered Activity Zone 1 and 2 known occurrences located in Travis AFB. Three of these occurrences fall within areas planned for development. This species has been recorded in several agricultural areas (primarily irrigated hay fields in Vacaville and Fairfield). At least three recorded locations in Fairfield occur in planned development areas. Remaining known occurrences are located in existing or potential mitigation banks and/or conservation lands. Potential conversion of habitat for this species is a subset of the 180 ac of wetlands proposed for fill as a result of development-related activities.

a. **Direct Effects.** In Covered Activity Zone 1, 6,620 ac are designated for development in the Valley Floor Grassland and Vernal Pool Natural Community. An estimated 270 to 400 ac of seasonal wetlands in this community provide suitable habitat for vernal pool fairy shrimp. As such, 453 ac in the high value conservation areas will be preserved as habitat and will not be subject to conversion to urban land uses. The remaining 159 ac will be developed for residences, businesses, roads, urban parks, and other urban uses. Direct impacts to vernal pool fairy shrimp habitat will occur in Dixon (13 ac), Fairfield (70 ac), Rio Vista (12 ac), Suisun City (13 ac), Vacaville (38.5 ac), and Vallejo (12 ac).

Direct effects to vernal pool fairy shrimp habitat will also result from projects initiated by cities outside their respective UGBs. These projects may include construction of detention basins, debris basins, wider roads, and walking trails. Such activities would result in additional direct effects to suitable vernal pool fairy shrimp habitat of up to approximately 22 ac. The direct effects to vernal pool fairy shrimp habitat outside of their respective UGBs will occur in the Cities of Dixon (1 ac), Fairfield (10 ac), Rio Vista (2 ac), Suisun City (5 ac), Vacaville (3 ac), and Vallejo (1 ac).

b. **Indirect Effects.** Vernal pool fairy shrimp habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. Indirect effects may include the isolation of upland areas from altered hydrology from runoff, introduction of nonnative plants, and increased risk of wildfire. Approximately 253 ac that provide habitat for vernal pool fairy



shrimp will be indirectly affected by the build out in the development area. Indirect effects to vernal pool fairy shrimp habitat will occur within the respective UGBs of the Cities of Fairfield (97 ac), Rio Vista (32 ac), Suisun City (100 ac), Vacaville (21.5 ac), and Vallejo (2.5 ac). No indirect impacts to vernal pool fairy shrimp habitat will occur within the UGB of Dixon.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Six vernal pool fairy shrimp occurrences are located in Covered Activity Zone 2. This species has been recorded in several agricultural areas, primarily irrigated hay fields in Vacaville and Fairfield. If vernal pool habitat is impacted by activities in this Covered Activity category, vernal pool fairy shrimp could be directly and indirectly affected by these activities. However, maximum avoidance of all wetlands is required for Covered Activities in Covered Activity Zone 2 (Avoidance and Minimization Measure VPG 1), which will likely substantially reduce impacts to this species.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Vernal pool fairy shrimp are known to occur in Covered Activity Zones 1 and 2. Six vernal pool fairy shrimp occurrences are located in Covered Activity Zone 2; two of these occurrences are located in Medium Value Vernal Pool Conservation Areas and the other four are located outside the boundaries of any of the vernal pool conservation categories. Protocols in Chapter 6.0 for vernal pool and wetland protection would be implemented to minimize impacts to this species habitat to the maximum extent practicable. Primary areas of concern for Covered Activity Zone 2 activities are the facilities that traverse vernal pool habitats.
 - a. **Direct Effects.** Operations and maintenance activities associated with waterline facilities that lie beneath vernal pool habitat can affect suitable vernal pool fairy shrimp habitat. Specifically, repairs and replacements to underground facilities may directly affect 1 ac of suitable vernal pool fairy shrimp habitat. Activities such as fire breaks, road grading, and the excavating of waterlines and sewage lines under existing vegetation could disturb habitat.
 - b. **Indirect Effects.** Operation and maintenance activities associated with various facilities may indirectly affect suitable vernal pool fairy shrimp habitat. The main indirect effect to suitable vernal pool fairy shrimp habitat is the introduction of nonnative plant species caused by routine operation and maintenance activities.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Vernal pool fairy shrimp occur in Covered Activity Zones 1, 2, and 3, with the majority of vernal pool fairy shrimp occurrences located in Covered Activity Zone 3. Implementation of management and restoration activities on preserves could result in impacts to the vernal pool fairy shrimp. Primary take activities that would result in take are monitoring surveys (aquatic sampling) and the collection of inoculum for vernal pool restoration. Management plans and restoration plans are required to account for the vernal pool fairy shrimp and associated fauna in order to minimize or avoid take during restoration and management activities. Additionally, Objective VPG 2.13 specifies the preservation and/or establishment of 10 populations of vernal pool fairy shrimp in the Plan Area.
5. **Requested Take Summary.** Covered Activities would result in the take of an unknown number of vernal pool fairy shrimp (eggs, immature shrimp, and adult shrimp) through development-related activities (estimated 181 ac of wetlands and in the 6,806 ac of vernal pool and valley grassland upland habitat). Routine operation and maintenance activities would avoid take of this species through implementation of the protocols in Chapter 6.0. However, new



construction and some maintenance activities may not be able to avoid impacting seasonal wetlands along the edges of covered facility rights-of-way. Requested take for Zone 2 Covered Activities is a maximum 5 ac per Plan Participant (20 ac total) over the life of the HCP. Compensation for any unavoidable take of habitat would be required in accordance with Mitigation Measure VPG 1. Take associated with activities on preserves and reserves includes an unknown number of individuals and cysts incidental to sampling/monitoring and restoration activities conducted by authorized individuals.

6. **Conservation Summary.** The vernal pool fairy shrimp is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The Recovery Plan calls for preservation/protection of 80 percent of known occurrences and 85 percent of remaining habitat (defined to include aquatic habitats and associated uplands). The HCP would contribute to this recovery goal by establishing new preserves and areas protected from development. Potential preserves include: Burke Ranch (1,290 ac), Muzzy Ranch (1,287 ac), and Gridley Ranch (1,100 ac). These preserves, in combination with existing reserves (Jepson Prairie, Wilcox Ranch, Calhoun Cut), will provide a large, approximately 7,600 ac block of interconnected, high-quality vernal pool habitat in the known distribution of this species in Solano County (i.e., preserve at least 11 of the 30 known occurrences). Establishment of between 1,750 ac and 3,000 ac of Contra Costa goldfield reserves would further protect known and potential habitat for this species (at least three or four additional occurrences).

Restoration activities on the Muzzy Ranch, Gridley Ranch, and North Suisun mitigation banks and other potential reserves will also result in an increase in secure, managed, suitable habitat for this species.

8.2.9.13 Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp inhabit seasonal pools, vernal pools, or swales that form in slight depressions after being inundated by fall and winter rains. The pools contain clear to highly turbid water and have an impervious layer of hard pan, clay pan, or basalt beneath the soil surface that retains water for a few months at a time (USFWS 1999a). Vernal pool tadpole shrimp often co-occur with vernal pool fairy shrimp and Conservancy fairy shrimp. Primary threats to the vernal pool tadpole shrimp in Solano County are urban development, agricultural conversion, agricultural use, and water supply and flood control projects.

1. **Development Effects (Covered Activity Zones 1 and 2).** Two of the currently known occurrences of vernal pool tadpole shrimp are located in Covered Activity Zone 1. As with the vernal pool fairy shrimp, vernal pool tadpole shrimp have a wide distribution through the vernal pool habitats in Solano County, with records from Vacaville through eastern Fairfield, Jepson Prairie, and into the Montezuma Hills. Given its broad distribution in Solano County, vernal pool tadpole shrimp can occur in almost any vernal pool or seasonal wetland in the valley floor communities. Maximum potential take is equal to the maximum take of habitat for the Valley Floor Grassland and Vernal Pool Natural Community.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** One of the currently known occurrences of vernal pool tadpole shrimp is located in Covered Activity Zone 2. If vernal pool habitat is impacted by these activities, vernal pool tadpole shrimp could be directly and indirectly affected by these activities. However, maximum avoidance of all wetlands is required for Covered Activities in



Zone 2 (Avoidance and Minimization Measure VPG 1). This will likely substantially reduce impacts to this species.

3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** One of the currently known occurrences of vernal pool tadpole shrimp is located in Covered Activity Zone 2. Potentially suitable habitat for vernal pool tadpole shrimp borders Plan Participant facilities in the Valley Floor Grassland and Vernal Pool Natural Community. Primary areas of occupied habitat are along the Alamo Creek and Ulatis Creek Flood Control Channels (SCWA) and an MPWD channel on Gridley Ranch. Protocols in Chapter 6.0 for vernal pool and wetland protection would be implemented to minimize impacts to this species' habitat to the maximum extent practicable. If the vernal pool tadpole shrimp were discovered in Covered Activity Zone 2, the protocols in Chapter 6.0 would be implemented to reduce impacts to this species. These protocols are designed to avoid impacts to vernal pools and species covered under the HCP.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** The majority of occurrences of vernal pool tadpole shrimp are located in Covered Activity Zone 3. Most of the current records for this species occur in existing and proposed vernal pool preserves, existing and proposed mitigation banks, and mitigation sites. Primary take activities are associated with monitoring surveys (aquatic sampling) and collection of inoculum for vernal pool restoration. Management plans and restoration plans are required to account for the vernal pool tadpole shrimp and associated fauna in order to minimize or avoid take during restoration and management activities (see Section 10.5). Additionally, Objective VPG 2.14 specifies the preservation and/or establishment of four populations of vernal pool tadpole shrimp in the Plan Area.
5. **Requested Take Summary.** Covered Activities would result in the take of an unknown number of vernal pool tadpole shrimp (eggs, immature shrimp, and adult shrimp) because of development-related Covered Activities (estimated 181 ac of wetlands and in the 6,806 ac of Valley Floor Grassland and Vernal Pool upland habitat). Routine operation and maintenance activities would avoid take of this species through implementation of the protocols in Chapter 6.0. However, new construction and some maintenance activities may not be able to avoid impacting seasonal wetlands along the edges of covered facility rights-of-way. Requested take for Covered Activity Zone 2 activities is a maximum 5 ac per Plan Participant (20 ac total) over the life of the HCP. Compensation for any unavoidable take of habitat would be required in accordance with Mitigation Measure VPG 1. Take from activities on preserves and reserves includes an unknown number of individuals and cysts incidental to sampling/monitoring and restoration activities conducted by authorized individuals.
6. **Conservation Summary.** The vernal pool tadpole shrimp is one of the species considered in the USFWS (2005b) Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. The Recovery Plan calls for the preservation/protection of 80 percent of known occurrences and 95 percent of remaining habitat (defined to include aquatic habitats and associated uplands). The HCP would contribute to these recovery goals by establishing new preserves and areas protected from development. Potential preserve areas at Burke Ranch (960 ac), Muzzy Ranch (1,390 ac), and Gridley Ranch (1,800 ac), in combination with existing reserves (Jepson Prairie, Wilcox Ranch, Calhoun Cut) will provide a large, approximately 7,600 ac block of interconnected, high-quality vernal pool habitat in the known distribution of this species in Solano County. Establishment of between 1,780 and 1,860 ac of Contra Costa goldfield reserves would further protect existing known and potential habitat for this species.



Restoration activities on the proposed Muzzy Ranch, Gridley Ranch, and North Suisun mitigation banks and other potential reserves will also result in increased secure and managed suitable habitat for this species.

8.2.9.14 California Tiger Salamander

Adult California tiger salamanders inhabit rodent burrows or other natural crevices in grassland and deciduous oak woodland communities (Shaffer et al. 1993). These communities must have seasonal or fishless perennial ponds, vernal pools, intermittent streams, or stock ponds (for spawning and larvae survival) in order to support a viable population of California tiger salamanders (Storer 1925, Twitty 1941, Anderson 1968, Feaver 1971, Shaffer et al. 1993).

While this species is typically considered a vernal pool species, it also uses stock ponds for breeding and, in many areas, may rely on these artificial habitats as their primary breeding/larval habitat. Adults and juveniles also inhabit upland habitats up to 1.3 mi from suitable breeding habitat (Trenham and Shaffer 2005). Therefore, habitat for the California tiger salamander may, and often does, extend beyond the primary vernal pool habitat.

1. **Development Effects (Covered Activity Zones 1 and 2).** One of the currently known California tiger salamander occurrences is located in the area planned for development in Covered Activity Zone 1. In Covered Activity Zone 1, the primary area where this species occurs is in the vernal pool habitats in the Upper Union Creek watershed (Figure 4-6) east of Vanden Road. Maximum take of this species' habitat consists of 3,009 ac of uplands and wetlands in the Valley Floor Grassland and Vernal Pool Natural Community and possibly some of the agricultural areas on or adjacent to vernal pool soils. In addition, approximately 205 ac of habitat in the Inner Coast Range falls within the range of the species and is proposed for development in Covered Activity Zone 1.

- a. **Direct Effects.** In Covered Activity Zone 1, 5,390 ac are designated for development in the Valley Floor Grassland and Vernal Pool Natural Community. Of this area, 4,417 ac are anticipated for development. The majority of the development area (3,982 ac) provides suitable terrestrial and breeding habitat for California tiger salamanders. As such, 973 ac in the high value conservation areas will be preserved as habitat and will not be subject to conversion to urban land uses. The remaining 3,009 ac, which includes 2,916 ac of suitable upland habitat and 93 ac of suitable breeding habitat for the California tiger salamander, will be developed for residences, businesses, roads, urban parks, and other urban uses. The majority of the direct impacts to California tiger salamander upland habitat will occur in Fairfield (1,213 ac), followed by Rio Vista (955 ac), Vacaville (517 ac), and Suisun City (231 ac). No California tiger salamander upland habitat will be directly affected by development in the Cities of Dixon or Vallejo because it is outside the known or potential range of the species in the Plan Area.

Direct effects to potential breeding habitat in the development area include fill of all or a portion of the ponds, pools, and wetlands that provide suitable breeding habitat for California tiger salamanders. The largest direct impact to potential California tiger salamander breeding habitat will occur in Fairfield (50 ac), followed by Vacaville (20 ac), Rio Vista (12 ac), and Suisun City (11 ac).

Direct effects to California tiger salamander habitat will also result from projects initiated by cities outside their respective UGBs. These projects may include construction of



detention basins, debris basins, wider roads, and walking trails. Such activities would result in additional direct effects to up to 20 ac of suitable California tiger salamander breeding habitat and up to 425 ac (395 ac in the Valley Floor Grassland and Vernal Pool Natural Community and 30 ac in the Inner Coast Range Natural Community) of suitable California tiger salamander upland habitat.

- b. **Indirect Effects.** California tiger salamander habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. Indirect effects may include isolation of upland areas from breeding ponds, loss of movement corridors, loss of burrows, light pollution, air pollution, noise pollution, water pollution, human disturbance, increased numbers and proximity of urban-adapted predators (skunks and raccoons), increased number and presence of domestic predators (dogs and cats), introduction of nonnative predators (fish and bullfrogs), changes in the duration of pond inundation, vehicle-caused mortality (roadkills), and increased risk of wildfire. Approximately 859 ac that provide terrestrial habitat for California tiger salamander will be indirectly affected by the build out in the development area. Additionally, 238 ac of suitable pond, pool, and wetlands that provide potential breeding habitat for adult California tiger salamander and rearing habitat for larval California tiger salamander also will be indirectly affected by development activities.

Indirect effects to California tiger salamander habitat will also result from projects initiated by cities outside their respective UGBs. These projects may include construction of detention basins or debris basins. Such activities would result in additional indirect impacts to 2 ac of suitable terrestrial habitat and 2 ac of suitable breeding habitat for the California tiger salamander.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** The construction of new irrigation and reclamation district facilities may have direct or indirect effects to occupied California tiger salamander habitat; however, this impact will likely be very small. If impacts occur to valley floor grassland or vernal pool habitat, they will most likely occur to remnant grassland habitat in the agricultural portions of the Plan Area where salamanders are unlikely to occur. The known range of the species (Figure 4-6) falls outside the Dixon RCD potential drainage service expansion area (Figure 2-2) and the DRW JPA locations of proposed new and enhanced facilities (see Figure A-12 in Appendix A). There is a small amount of overlap between the known range of the species and the SID potential annexation areas northeast of Travis AFB (Figure 2-9). There is an overlap between the potential range of the species and the DRW JPA locations of proposed new and enhanced facilities. There is also overlap between the known and potential range of the species and the SID existing service area (Figure 2-9) and MPWD service area. If new facilities are constructed in California tiger salamander habitat areas, all of the avoidance, minimization, and mitigation measures in Chapter 6.0 would apply.
 - a. **Direct Effects.** The maximum total direct effect from this activity is 5 ac of valley floor grassland habitat, 5 ac of vernal pool grassland habitat, and 2 ac of Inner Coast Range grasslands.
 - b. **Indirect Effects.** The maximum total indirect effect is 17 ac of valley floor grassland habitat and 8 ac of vernal pool grassland habitat.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Methods for calculating direct effects to California tiger salamander habitat to determine which facilities and activities occur in suitable tiger salamander habitat involved overlaying data on the flood



control facility maps presented in Appendix A (Figures A-5, A-10a, A-10b, A-15) with the known and potential California tiger salamander habitat map presented on Figure 4-6. Once the linear feet of the facilities in this habitat were determined, they were compared with the data (i.e., total length of the facilities, estimated impacts, and frequency of the activities over the term of the HCP) from the routine operation and maintenance activity tables presented in Appendix A (Tables A5, A10, A14, and A15). Only operation and maintenance activities for underground facilities that occur below suitable upland and wetland California tiger salamander habitat (i.e., underground sewer and water lines) were used in determining direct effects to this species.

- a. **Direct Effects.** The operation and maintenance activities of underground facilities that lie below vernal pools and grasslands may affect suitable California tiger salamander breeding and/or upland habitat. Specifically, repairs and replacements to underground sewer force mains (0.04 ac), underground irrigation supply piping (2.63 ac), and underground water lines (1.27 ac) may directly affect 3.9 ac of suitable California tiger salamander breeding and/or upland habitat.

Known habitat for the California tiger salamander borders the Alamo Creek and Ulatis Creek Flood Control Channels (SCWA), an MPWD channel on the Elsie Gridley Mitigation Bank and adjacent lands where this species may be present. Maintenance activities along these channels (i.e., primarily bank stabilization, rodent control, road grading, deposition of dredged material, and other ground-disturbing activities) could result in take of an unknown number of California tiger salamanders. Maintenance vehicles could also injure or kill California tiger salamanders. An estimated 36 ac of upland habitat are present within the rights-of way for these 7.5 mi of facilities. Protocols in Chapter 6.0 would be implemented to minimize impacts to this species.

- b. **Indirect Effects.** Operation and maintenance activities associated with various facilities may indirectly affect suitable California tiger salamander habitat. The main indirect effect to California tiger salamander habitat caused by routine operation and maintenance activities are the introduction of nonnative plants and the prevention of fossorial mammal colonization.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** California tiger salamanders are known to occur in Covered Activity Zones 1, 2, and 3.
 - a. **Direct Effects.** Management activities on reserves, primarily ground-disturbing activities associated with the construction/restoration of vernal pools and associated habitats could result in impacts to the California tiger salamander. These impacts could include losing California tiger salamanders inhabiting uplands during grading operations. Since California tiger salamanders move substantial distances from breeding habitats (in excess of 2,600 ft), restoration sites well removed from vernal pool complexes may also support this species. Aquatic sampling of vernal pools could also result in the incidental take of California tiger salamander. Grazing, weed abatement, and other management activities could also result in direct effects to this species. Management plans and restoration plans are required to minimize or avoid take of California tiger salamanders during restoration and management activities (see Section 10.5). Additionally, Objective VPG 2.15 specifies the preservation and/or establishment of 9,900 ac of California tiger salamander habitat in the High or Medium Value Vernal Pool Conservation Areas. Objective VPG 2.16 specifies the preservation of existing breeding habitat at a 3:1 (mitigation-to-impact) ratio and the creation of 3 ac of new breeding habitat for California tiger salamanders in lands acquired for the Solano HCP reserve system.



- b. **Indirect Effects.** Restoration and creation of preserves and reserves could indirectly affect California tiger salamander habitat by introducing nonnative plant species. Grazing, weed abatement, and other management activities could also result in indirect effects to this species.
5. **Requested Take Summary.** Requested take of California tiger salamander habitat for Covered Activity Zone 1 activities includes 3,009 ac of uplands and wetlands in the Valley Floor Grassland and Vernal Pool Natural Community and 30 ac in the Inner Coast Range Natural Community. Requested take for Covered Activity Zone 2 activities is 16 ac of upland habitat within Plan Participant rights-of-way of SCWA and MPWD facilities for regular maintenance actions. Covered Activity Zone 3 activities will also result in take of an unknown number of California tiger salamanders. Impacts associated with restoration activities are expected to be short term and would be offset by long-term gains in habitat quality and quantity. Reserve management standards (Section 10.5) include requirements (e.g., limits on rodent control) that should increase upland suitability. Species-specific measures require that a variety of pool types be created, including sites that would be suitable breeding habitat for the California tiger salamander.
6. **Conservation Summary.** No recovery strategy has been adopted for the California tiger salamander. The Solano HCP Conservation Strategy for this species is based on studies by Trenham and Shaffer (2005) that suggest a recovery goal of 95 percent protection of adults and subadults. Their studies at Olcott Lake and population modeling suggest a minimum protected upland buffer of at least 2,100 ft in width around a single breeding site or approximately 328 ac, including a breeding site. Under their stochastic model, a breeding site of this size has a good chance of persisting for 100 years. Modeling also showed increased potential for local extinctions with increasing upland loss because of reduced salamander abundance (e.g., individuals lost to the potential breeding population inhabiting lost uplands).

The California tiger salamander conservation program attempts to maintain an intact 330 ac unit by requiring preservation of upland habitat at a ratio of 3:1 and creating 0.001 ac of breeding habitat per acre of upland habitat impacted. Impacts to suitable breeding habitat within the known or potential range of the species (Figure 4-6) will be mitigated by preserving known breeding habitat at a 3:1 ratio and creating breeding habitat at a ratio of 2:1 (created-to-impacted) or 0.35 ac, whichever is greater. The upland habitat mitigation ratio is intended to offset loss of adult and subadult individuals and to maintain all protected uplands within 2,100 ft of a breeding site. The size of created breeding habitat (0.35 ac) is also based on Trenham and Schaffer's data, which indicate that breeding sites of approximately 0.35 ac are the most productive and minimize the potential for inbreeding/genetic problems.

8.3 CALIFORNIA RED-LEGGED FROG IMPACT ASSESSMENT

The only known records for California red-legged frog in the Plan Area are from the hills in the western portion of Solano County (e.g., the Tri-City/County Panning Area and the hills north of I-80 and west of Suisun Valley) and in the Stebbins Cold Canyon Preserve in the northwestern corner of the County. Both of these areas have been identified as Core Recovery Areas in the USFWS Recovery Plan for the California Red-Legged Frog (USFWS 2002a; Figure 4-14). California red-legged frog uses a variety of habitat types, including aquatic, riparian, and upland habitats. Breeding habitat typically consists of aquatic communities with still or slow-flowing fresh water, containing minimum water depths of 20 inches and that are capable of providing space, food, and cover to sustain eggs, tadpoles, metamorphosing juveniles, non-breeding subadults, and



breeding and non-breeding adult frogs. Seeps and springs also provide important habitat for frogs, particularly late in the summer/early fall or during droughts when stock ponds and intermittent creeks dry out. In addition to aquatic habitats, uplands (grasslands, oak woodlands and savanna, and chaparral) are also extensively used for dispersal and cover. This section assesses impacts to California red-legged frogs from Covered Activities summarized in Section 2.5 following the methodology described in Section 8.1.1.

8.3.1 Development Effects (Zones 1 and 2)

Approximately 1,340 ac of California red-legged frog upland habitat lie within the urban development areas of Fairfield (460 ac) and Vallejo (880 ac) in the California Red-Legged Frog Conservation Area (Figure 4-14). However, much of this area is located on steep slopes prone to landslides and will not likely be impacted by development. Both Vallejo and Fairfield have adopted restrictions in their General Plans that limit development on slopes greater than 30 percent. To more accurately estimate impacts to California red-legged frog habitat in the California Red-Legged Frog Conservation Area, areas with a slope greater than 30 percent and approximately half of the areas with a slope greater than 20 percent were assumed to be avoided by development. Under this assumption, approximately 950 ac (approximately 420 ac in Fairfield and 530 ac in Vallejo) would be developed. The remaining area (approximately 390 ac) will presumably be set aside for preservation.

Other than development, the primary conservation issues concerning California red-legged frog in this area are to maintain connectivity and limit the expansion of aquatic predators such as bullfrog and warm water fish by preventing the “perennialization” of intermittent streams and construction of artificial water bodies. Mitigation Measure RLF 5 is designed to minimize the potential for aquatic predator expansion. Avoidance and Minimization Measure RLF 2 requires corridors and connectivity between existing habitat areas to be maintained. Mitigation Measures RLF 1, RLF 2, RLF 3, and RLF 4 are designed to protect and/or restore aquatic habitats and associated uplands.

8.3.1.1 Direct Effects

Within the UGBs, approximately 950 ac of upland habitat and an estimated 13 ac of suitable non-breeding aquatic habitat for California red-legged frogs are anticipated to be developed. No breeding habitat is anticipated to be directly affected by development. As such, 26 ac of aquatic habitat will be created/restored and 2,840 ac of upland habitat in the California Red-legged Frog Conservation Area will be preserved. The direct impacts to California red-legged frog habitat will occur in Fairfield (420 ac of upland habitat and 1 ac of aquatic habitat) and Vallejo (530 ac of upland habitat and 12 ac of aquatic habitat). No California red-legged frog habitat will be directly affected by development in the Cities of Dixon, Rio Vista, Suisun City, or Vacaville.

Direct effects to California red-legged frog habitat will also result from projects initiated by cities outside of their respective UGBs in Covered Activity Zone 2. These projects may include construction of detention basins or debris basins. Such activities would result in up to 100 ac of additional direct effects to suitable California red-legged frog habitat. The direct effects to California red-legged frog habitat outside of their respective UGBs will occur in the Cities of Fairfield (40 ac) and Vallejo (60 ac). No California red-legged frog habitat will be directly affected by development outside of the respective UGBs of the Cities of Dixon, Rio Vista, Suisun City, or Vacaville.



8.3.1.2 Indirect Effects

California red-legged frog habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. Indirect effects may include loss of movement corridors between aquatic and upland habitat, increased runoff of urban pollutants, road runoff, sedimentation, light pollution, human disturbance, increased numbers and proximity of urban-adapted predators (skunks and raccoons), increased number and presence of domestic predators (dogs and cats), introduction of nonnative predators (bullfrogs), introduction of nonnative plants, changes in water quantity and temperature, vehicle-caused mortality (roadkills), and increased risk of wildfire. Indirect effects to California red-legged frog habitat in the Inner Coast Range Natural Community include approximately 4 ac of potential breeding habitat in Fairfield and 13 ac of non-breeding wetland habitat in Vallejo. No indirect impacts to suitable California red-legged frog habitat occur in Dixon, Rio Vista, Suisun City, or Vacaville.

8.3.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands. Only a small area of the potential SID annexation area in Green Valley overlaps with the California Red-Legged Frog Conservation Area. California red-legged frogs are not known to occur in the agricultural portions of the Plan Area. SID annexations may potentially affect up to 1 ac of upland grassland, 1 ac of riparian habitat, and 5 ac of open water. It is unlikely that any of these impacts will occur in the California Red-Legged Frog Conservation Area.

8.3.2.1 Direct Effects

No direct effects to suitable California red-legged frog habitat are anticipated.

8.3.2.2 Indirect Effects

No indirect effects to suitable California red-legged frog habitat are anticipated.

8.3.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

The Cities of Fairfield and Suisun City and the Vallejo Sanitation and Flood Control District (VSFCD) have facilities located in the California Red-Legged Frog Conservation Area. Potential impacts to California red-legged frog from irrigation and flood control activities are primarily addressed through avoidance and minimization measures described in Chapter 6.0.

8.3.3.1 Direct Effects

Operation and maintenance activities associated with various facilities may directly affect suitable California red-legged frog habitat. The activities that will have the most impact to California red-legged frog aquatic habitat are bank construction (3.7 ac), sediment and silt removal (45 ac), placement of bank protection (0.4 ac), placement of temporary bank protection (1.9 ac), replacement of existing bank protection (0.7 ac), beaver dam removal (1 ac), the removal of concrete lining (less than 0.01 ac), the repair/replacement of underground sewage lines (0.05 ac),



underground irrigation supply lines (0.3 ac), and underground storm drains (0.02 ac). These activities may temporarily affect up to 53 ac of potential California red-legged frog habitat over the life of the HCP. Vegetation removal may also have temporary impacts on up to 290 ac of suitable California red-legged frog habitat for the term of the HCP. Vegetation/debris removal from drainages may also benefit California red-legged frog because applicants will be simultaneously controlling exotic species (see Objective RLF 1.2). Maintenance vehicles could also injure or kill California red-legged frogs. Significant portions of the sediment and silt removal will occur in the same locations (i.e., the total acres of area impacted will be much less; however, it will occur several times over the life of the Plan). A significant portion of these impacts will also occur in Lynch Canyon Creek and Jameson Canyon Creek in culverts and adjacent to outfalls in areas that are downstream of the known California red-legged frog occurrences. The lower portions of these creeks are targeted for restoration efforts under the Solano HCP Conservation Strategy (see Figure 4-10). If this restoration occurs, the amount of sediment removal necessary in Lynch Canyon Creek and Jameson Canyon Creek could be reduced substantially.

8.3.3.2 Indirect Effects

Operations and maintenance activities associated with various facilities may indirectly affect suitable California red-legged frog habitat. The main indirect effect to California red-legged frog habitat is the introduction of nonnative plant species caused by routine operations and maintenance activities.

8.3.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

Covered Activities on preserves and reserves are associated with reserve/preserve management (i.e., activities discussed in Chapters 5.0, 6.0, and 7.0).

8.3.4.1 Direct Effects

Activities that could result in take of California red-legged frog include but are not limited to periodic grading for road maintenance, repair and maintenance to stock pond dams, habitat restoration, predator (bullfrog and fish) control, translocating frogs within preserves, and passive recreational use.

Approximately 3,300 ac of upland, riparian, and aquatic habitats in the California Red-Legged Frog Conservation Area will be preserved for the benefit of California red-legged frogs. Some of these lands may provide passive, public recreational access. Such developments are expected to be limited in extent and primarily involve hiking, biking, horse trails, and day use facilities. Actual impacts and/or loss of habitat are expected to affect limited acreage and would typically be located in uplands removed from important aquatic and riparian habitats. Procedures for avoiding impacts are identified in Chapter 6.0.

Because the California Red-Legged Frog Conservation Area has been artificially divided into three discrete blocks of habitat by two major highways (I-80 and SR-12) and since re-establishing natural corridors between the blocks is impracticable, transplanting California red-legged frogs collected from reserves or salvaged from habitats impacted by Covered Activities is necessary in order to re-establish or increase California red-legged frog populations that support natural movement patterns, breeding, and metapopulation dynamics (see Goal RLF 1). Red-legged frogs



could be injured or killed during the translocation process. In addition, disease and fungus (e.g., chytrid fungus) could be spread from the translocated populations. Implementing measures to sanitize biologists' field equipment while conducting the translocation and inspecting frogs for signs of chytrid fungus prior to translocation would help prevent the spread of disease and fungus.

8.3.4.2 Indirect Effects

Restoration and creation of preserves and reserves could indirectly affect California red-legged frog habitat by introducing nonnative plant species; however, long-term management and monitoring will preclude this. Livestock management, weed abatement, and other management activities could also result in indirect effects to this species. These activities, however, will likely have a net positive effect on the species.

8.3.5 Requested Take Summary

The requested level of take of California red-legged frog habitat is summarized below:

- **Covered Activity Zone 1 – Urban Development**
 - 950 ac in the California Red-Legged Frog Conservation Area
 - Salvage, recovery, and relocation of all life stages of California red-legged frog to avoid direct injury or death to individual frogs during project implementation
- **Covered Activity Zone 2 – Remote Facilities and Operations and Maintenance Impacts**
 - A maximum 53 ac of temporary impacts to aquatic and associated upland habitat for the operation and maintenance of flood control and irrigation facilities for the life of the HCP
 - A maximum 290 ac of temporary impacts to aquatic and associated upland habitat for vegetation control (including invasive species control programs) in flood control and irrigation facilities for the life of the HCP
 - 100 ac in the California Red-Legged Frog Conservation Area for remote facilities over the life of the HCP
 - Salvage, recovery, and relocation of all life stages of California red-legged frog to avoid direct injury or death to individual frogs during covered project implementation
- **Covered Activity Zone 3 – Preserve Management and Implementation**
 - Salvage, recovery, and relocation of all life stages of California red-legged frog to avoid direct injury or death to individual frogs during implementation of habitat improvement or restoration projects in designated preserves or to relocate individuals to new habitat areas in accordance with USFWS- and CDFG-approved plans
 - Construction and maintenance of dirt/gravel roads, trails, and day use facilities conducted in compliance with the protocols in Chapter 6.0

8.3.6 Conservation Summary

The USFWS Recovery Plan for the California Red-Legged Frog (USFWS 2002a) identifies five criteria for recovery and seven general actions. The overall recovery strategy involves:



- Protecting existing populations by reducing threats;
- Restoring and creating habitat that will be protected and managed in perpetuity;
- Surveying and monitoring populations and conducting research on the biology and threats of subspecies; and
- Re-establishing subspecies populations within its historic range.

The USFWS Recovery Plan for the California Red-Legged Frog recommends management and protection plans for each watershed and Core Recovery Area to address the recovery strategies as applicable. Management and protection plans are to include proposals to incrementally protect (via conservation easements, fee title, acquisitions or other mechanisms) important breeding and dispersal habitats. Specific conservation needs identified in the Recovery Plan for the Jameson Canyon-Lower Napa River Core Recovery Area are:

Protect existing populations from current and future urbanization, create and manage alternative breeding habitats, protect dispersal corridors (Recovery Task 1.15).

In addition, the USFWS and other agencies have also expressed an interest in implementing bullfrog control programs in the Sulfur Springs Creek (Hiddenbrooke/Sky Valley/Lake Herman) watershed (as well as other areas where bullfrogs may be established) and providing habitat connectivity between the habitat areas north and south of I-80.

Mitigation Measure RLF 5 is designed to minimize aquatic predator expansion and reduce existing predator populations. Avoidance and Minimization Measure RLF 2 would require corridors and connectivity between existing habitat areas to be maintained. Mitigation Measures RLF 1, RLF 2, RLF 3, and RLF 4 are designed to protect and/or restore aquatic habitats and associated uplands. Objective RLF 1.4 would maintain genetic interchange between the three disjunct areas of the California Red-Legged Frog Conservation Area and establish new populations in currently unoccupied habitat or newly restored habitat.

8.4 CALLIPPE SILVERSPOT BUTTERFLY IMPACT ASSESSMENT

Habitat for the callippe silverspot butterfly consists of grassland with a significant component of native grasses and is characterized by shallow rocky soils or numerous rock outcrops. Grassland along ridgelines and hilltops is also considered to be important habitat. For grasslands to be considered habitat, the larval host plant, Johnny jump-up (*Viola pedunculata*) needs to be present in sufficient density to support a population of butterflies. The potential distribution of this species corresponds to that of the California Red-Legged Frog Conservation Area, with additional areas of potential occurrence in the Nelson Hill area of Cordelia and the Rockville Hills area.

8.4.1 Development Effects (Covered Activity Zones 1 and 2)

Approximately 1,560 ac of habitat occur in the potential urban development areas of Fairfield (680 ac) and Vallejo (880 ac) in the known/expected distribution of callippe silverspot butterfly in Solano County. However, much of this area is on steep, landslide-prone slopes and will not likely be impacted by development. Vallejo and Fairfield have both adopted restrictions in their General



Plans that limit development on areas with slopes greater than 30 percent. To more accurately estimate impacts in the Callippe Silverspot Butterfly Conservation Area, areas with a slope greater than 30 percent and approximately half of the areas with a slope greater than 20 percent were assumed to be avoided by development. Under this assumption, approximately 1,060 ac (approximately 530 ac in Fairfield and 530 ac in Vallejo) would be developed.

Future remote facilities (e.g., water supply reservoirs) may be sited in callippe silverspot butterfly habitat. Potential impacts would largely be avoided through implementation of Avoidance and Minimization Measures CSB 1 and CSB 2, which would require avoidance and establishment of buffers adjacent to core breeding areas.

8.4.1.1 Direct Effects

Approximately 1,060 ac (approximately 530 ac in Fairfield and 530 ac in Vallejo) of suitable callippe silverspot butterfly habitat would be directly affected by urban development activities (see Section 2.5) under the HCP. The remaining area that is zoned for planned development (approximately 500 ac) will be set aside for preservation. Additional areas may also be set aside considering that no more than 20 percent of any breeding habitat shall be impacted per the requirements of Avoidance and Minimization Measure CSB 1. In general, callippe silverspot avoidance and minimization measures focus on protecting significant viola stands and buffers from development, and maintaining corridors between core breeding sites (Avoidance and Minimization Measures CSB 1 and CSB 2, and Mitigation Measure CSB 2). If breeding habitat is impacted, known habitat shall be preserved in the Callippe Silverspot Butterfly Conservation Area at a 3:1 ratio (Mitigation Measure CSB 2).

Direct effects to callippe silverspot butterfly habitat will also result from projects initiated by cities outside their respective UGBs. These projects may include construction of storm water detention basins, among other projects. Such activities would result in up to 110 ac of additional direct effects to suitable callippe silverspot butterfly habitat. The direct effects to callippe silverspot butterfly habitat outside of the urban limit lines will occur in Fairfield (50 ac) and Vallejo (60 ac). No callippe silverspot butterfly habitat will be directly affected by development outside the respective UGBs of Dixon, Rio Vista, Suisun City, or Vacaville.

8.4.1.2 Indirect Effects

The callippe silverspot butterfly habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. Indirect effects may include loss of movement corridors between populations, introduction of nonnative plants, intensive agriculture, cultivated grassland/dry-land farming, off-road vehicle use, uncontrolled off-trail foot and equestrian traffic, inappropriate levels of livestock grazing practices, road construction, and fire management policies. Indirect effects to callippe silverspot butterfly habitat will occur in Fairfield (500 ac) and Vallejo (80 ac). No indirect impacts to suitable callippe silverspot butterfly habitat will occur in Dixon, Rio Vista, Suisun City, or Vacaville.



8.4.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands. Only a small area of the potential SID annexation area in Green Valley overlaps the Callippe Silverspot Butterfly Conservation Area. Callippe silverspot butterflies are not known to occur in the agricultural areas of the Plan Area. SID annexations may potentially affect up to 1 ac of upland grassland from construction of new facilities over the life of the HCP. It is unlikely that any of these impacts will occur in the Callippe Silverspot Butterfly Conservation Area.

8.4.2.1 Direct Effects

No direct effects to suitable callippe silverspot butterfly habitat are anticipated as a result of irrigation and reclamation district construction and annexation activities.

8.4.2.2 Indirect Effects

No indirect effects to suitable callippe silverspot butterfly habitat are anticipated as a result of irrigation and reclamation district construction and annexation activities.

8.4.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

Operation and maintenance activities associated with various facilities may affect suitable callippe silverspot butterfly habitat in the Cities of Fairfield and Vallejo and in the facilities maintained by VSFC, SCWA, SID, and FSSD.

8.4.3.1 Direct Effects

Operation and maintenance activities associated with various facilities may directly affect suitable callippe silverspot butterfly habitat. Approximately 3 ac of suitable callippe silverspot butterfly habitat may be directly impacted over the term of the HCP. These activities include the repair/replacement of underground sewage lines (0.05 ac), underground irrigation supply lines (2.9 ac), and underground storm drains (0.05 ac). Maintaining fire breaks, road grading, and the removal of vegetation in and around water tanks, maintenance roads, or adjacent to flood control channels may temporarily affect approximately 310 ac over the life of the Plan. Vegetation control activities in these areas are unlikely to affect callippe silverspot butterfly habitat. If they do occur adjacent to suitable habitat, avoidance and minimization measures identified in Chapter 6.0 to avoid impacts from routine operation and maintenance activities will greatly minimize adverse effects. Activities complying with these measures would not require additional compensatory mitigation and are likely to avoid direct impacts.

8.4.3.2 Indirect Effects

Operation and maintenance activities associated with various facilities may indirectly affect suitable callippe silverspot butterfly habitat. The main indirect effect to callippe silverspot butterfly habitat is the introduction of nonnative plant species caused by routine operation and maintenance activities. Activities such as fire breaks, road grading, and the excavating of waterlines and sewage



lines under existing vegetation could disturb habitat and encourage the spread of nonnative plant species.

8.4.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

8.4.4.1 Direct Effects

Activities on preserves and reserves are associated with open space/preserve management. Activities that could result in take include but are not limited to periodic grading for road maintenance, repair and maintenance of stock pond dams, habitat restoration, and livestock management.

The primary concern for activities on preserves and reserves is the construction of new trails, roads, and other remote facilities within or through areas supporting larval host plants or adult nectar sources. Construction of such facilities would be subject to the same avoidance and minimization measures that apply to Covered Activity Zone 1 and 2 activities. Additionally, Objective CSB 1.1 specifies the preservation and management of suitable callippe silverspot butterfly breeding habitat at a 3:1 (mitigation-to-impact) ratio for direct unavoidable impacts to suitable breeding habitat and a minimum of a 1.5:1 ratio for indirect impacts to suitable breeding habitat. Breeding habitat preservation and management would be accomplished in combination with the 3,300 ac of Inner Coast Range habitats to be acquired under Objective RLF 1.1 (Section 5.4.1).

8.4.4.2 Indirect Effects

No indirect effects to suitable callippe silverspot butterfly habitat are anticipated as a result of activities on preserves and reserves.

8.4.5 Requested Take Summary

Requested take is no more than 10 percent (area basis) of any area supporting larval host plants with a density greater than 100 viola plants per 40 ac. Permanent loss of core breeding habitat shall be limited to no more than 20 percent of any breeding habitat.

8.4.6 Conservation Summary

No formal recovery plans or standards have been established for this species. Identified threats to this species include cumulative loss of and alteration of habitat, pesticide use, invasive species, and human collection. The Solano HCP focuses conservation efforts on preserving extant colonies and establishing preserves in the core area of its distribution in Solano County. The overall conservation goal for the callippe silverspot butterfly is to preserve multiple populations in secure core areas and to provide connectivity between preserved core areas. Callippe silverspot butterfly conservation in the Plan Area will: permanently protect existing butterfly populations where they occur (primarily through avoidance and minimization); minimize activities that could lead to the expansion of invasive plant species; and provide appropriate funding for land management to maintain and, where possible, improve the distribution and abundance of the larval host plant, Johnny jump-up.



8.5 RIPARIAN, STREAM, AND FRESHWATER MARSH NATURAL COMMUNITY IMPACT ASSESSMENT

Primary impacts to riparian, stream, and freshwater marsh habitats are caused by agricultural and urban development that results in channelization and/or removal of riparian vegetation. Subsequent impacts include downcutting from increased peak and base flows and sedimentation from runoff. These effects have degraded the stream environment and reduced the amount of associated riparian vegetation. Direct loss of habitat is expected from construction of road crossings, trails and bike paths in urban areas, and storm drain outfalls and flood control activities. This section assesses impacts to the Riparian, Stream, and Freshwater Marsh Natural Community and associated Covered Species. Impacts to the Natural Community are addressed first followed by a section for each associated Covered Species.

8.5.1 Development Effects (Covered Activity Zones 1 and 2)

8.5.1.1 Direct Effects

For habitats associated with the Riparian, Stream, and Freshwater Marsh Natural Community, avoidance is always desirable but it is not always practical. The primary direct effects from urban development activities in Covered Activity Zone 1 to riparian, stream, and freshwater marsh habitat include construction/installation of new or expanded road crossings, storm drain outfalls, utility corridors, and bike/pedestrian trails along riparian corridors. In total, approximately 107 ac of riparian, stream, and freshwater marsh habitat and other habitat associated with this Natural Community (e.g., non-vernal pool seasonal wetlands and agricultural drainage ditches) will be directly impacted by development activities in Covered Activity Zone 1.

City development activities outside the UGB (e.g., flood control facilities, roads) will directly affect 9 ac of riparian, stream, and freshwater marsh habitat (4 ac in Vacaville and 1 ac each in Fairfield, Rio Vista, Suisun City, Dixon, and Vallejo).

8.5.1.2 Indirect Effects

Indirect effects include changes in channel morphology (e.g., down-cutting, bank erosion) from increased peak and base flows. Avoidance and minimization measures and conservation measures are designed to maintain peak and base flows by establishing buffers and detention basins. Establishing buffers would protect the remaining riparian resources, channel morphology, and the quality of in-stream habitat. There will also be substantial riparian and stream restoration.

8.5.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands. The second habitat type anticipated to be most directly affected by this Covered Activity category is open water habitat (approximately 30 ac). Open water habitat may be disproportionately affected because new/improved irrigation ditches will likely follow existing irrigation ditches. The open water habitat that will be affected will be limited to existing irrigation ditches and will have little direct effects on Covered Species. In addition, open water habitat that is impacted will likely be replaced with open water habitat in new facilities. Most of the existing irrigation ditches have little



to no riparian habitat. Only 3 ac of riparian habitat and 14 ac of existing levees will be impacted over the life of the HCP.

8.5.2.1 Direct Effects

Up to 30 ac of open water habitat, 3 ac of riparian habitat, and 14 ac of existing levee habitat will be directly affected over the life of the HCP for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.

8.5.2.2 Indirect Effects

Indirect effects to the Riparian, Stream, and Freshwater Marsh Natural Community could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from draining additional farmland. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.

8.5.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

8.5.3.1 Direct Effects

Operation and maintenance activities that may result in direct effects to riparian, stream, and freshwater marsh habitats include: flood control channel maintenance; sediment removal; bank reconstruction, protection, and erosion control; trash and debris removal; vegetation management (i.e., removal); and outfall maintenance (e.g., sediment and silt removal). Estimated impacts¹ to linear facilities include 1,917 ac of channelized streams (Fairfield, Suisun City, Vacaville, SCWA, SID), 3,143 ac of unmodified streams (Fairfield, Vacaville, Vallejo, MPWD, SCWA), 1 ac of drainage ditch (Fairfield and Suisun City), 139 ac of roadside drainage ditch (Fairfield and Vacaville), 3,210 ac of irrigation ditch (Dixon RCD and SID), and 1.5 ac of underground irrigation supply (SID) over the 30-year HCP period.

8.5.3.2 Indirect Effects

Indirect impacts to riparian, stream, and freshwater marsh habitat may occur from operation and maintenance activities. The main indirect effect is the introduction of nonnative plant species caused by the disturbance of habitat.

8.5.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

Objective RSM 1.1 involves the preservation, restoration, and enhancement of 50 ac of riparian and 36 ac of freshwater marsh, pond, and seasonal wetland habitat in Priority Watersheds and Drainages. Objective RSM 1.3 involves the restoration and expansion of riparian and floodplain habitats in at least 2.5 mi of existing channelized stream and flood channels of old Alamo Creek

¹ Impacts will occur in the same locations (i.e., in bridge culverts and outfalls). The acreage estimates are cumulative totals for temporary impacts over the life of the HCP.



and old Ulatis Creek, upper Union Creek, other streams identified for restoration efforts, and future development along Priority Drainages (see Chapter 5.0).

8.5.4.1 Direct Effects

The primary direct effect of riparian, stream, and freshwater marsh habitat restoration will be the grading and vegetation removal activities associated with tree planting, channel realignment, and other riparian restoration activities. Such activities may impact nesting birds, aquatic species (fish and amphibians), and other common wildlife. The acreage of this impact is unknown since restoration plans have not yet been developed. Regardless, the long-term benefit associated with the restoration of riparian, stream, and freshwater marsh habitats is expected to outweigh short-term impacts associated with restoration activities.

8.5.4.2 Indirect Effects

Activities on preserves and reserves may indirectly affect riparian, stream, and freshwater marsh habitat. The main indirect effect is the introduction of nonnative plant species caused by the disturbance of habitat during restoration activities and increased recreational use.

8.5.5 Requested Take Summary

Approximately 107 ac of riparian, stream, freshwater marsh, and other associated aquatic habitats in Covered Activity Zone 1 (56 percent) could be developed (Table 8.9). Direct effects are anticipated to be due to construction of road projects, utility crossings, high-flow flood control and bypass channels, and storm water outfalls. Direct effects are also anticipated from flood control channel maintenance. Loss of habitat from bridge crossings or construction of outfall structures would be estimated at no greater than 10 percent of a stream (or 500 ft per mile of stream) as it is surrounded by urban development. Otherwise, the establishment of requisite buffers would preclude take.

Table 8.9: Riparian, Stream, Freshwater Marsh and Other Aquatic Habitat Impacted by Development in Covered Activity Zones 1 and 2 (acres)

Community Type	Dixon	Fairfield	Rio Vista	Suisun City	Vacaville	Vallejo	Total
Riparian, Stream, and Freshwater Marsh	0	3	1.5	2.5	22	1.5	30.5
Other habitat associated with the Riparian, Stream, and Freshwater Marsh Natural Community	1.5	11	3	8	30	32	85.5
Total Planned Development	1.5	14	4.5	10.5	52	33.5	116

Temporary, short-term impacts are anticipated as the result of routine operation and maintenance activities conducted by Plan Participants in their facilities. These short-term impacts may result in the temporary reduction in value of riparian areas as disturbed areas revegetate over time. Plan Participants will compensate for temporary impacts by committing to develop and implement programs to control aggressive invasive species (Objective RSM 1.2).



In addition, temporary impacts to an unknown number of acres of riparian, stream, and freshwater marsh habitat may also occur as the result of restoration activities. The actual number of acres temporarily affected by restoration activities will be roughly 214 ac, which is double that affected by development (Mitigation Measure RSM 1).

The primary concerns regarding Covered Activities are their indirect effects on water quality and hydrology. Mitigation Measures RSM 5, RSM 6, RSM 7, RSM 8, and RSM 9 are designed to minimize and mitigate for potential indirect effects by requiring new development in priority upstream natural drainage areas to incorporate detention facilities that will prevent increases in downstream base flows that could lead to further channel degradation and loss of riparian vegetation downstream.

8.5.6 Conservation Summary

Habitats associated with the Riparian, Stream, and Freshwater Marsh Natural Community play an important role in the overall reserve design of the Solano HCP. Riparian or streamside vegetation provide important habitat for over 225 species of fish, amphibians, reptiles, birds, and mammals in California (RHJV 2000) and represent hot spots of biodiversity on the landscape. In addition, because of their linear nature, streams provide natural corridors between other high value conservation areas. Stream environments are also very sensitive to development in the surrounding watershed, making it important to address conservation issues for this Natural Community at a landscape scale.

The conservation strategy for this Natural Community involves preservation, restoration, invasive species control, and protection of water quality and hydrogeomorphic processes. In Section 4.3.6, Priority Drainages and Watersheds were identified based on specific conservation criteria (Figure 4-10). Priority Drainages were further subdivided into specific conservation areas based on targeted conservation actions. The designated conservation actions for each area outline the overall conservation approach for the Riparian, Stream, and Freshwater Marsh Natural Community.

Due to the extensive loss of riparian and freshwater marsh vegetation throughout the Plan Area and the State (see Section 4.6.5 for more details), preservation is a key component of the Solano HCP Conservation Strategy. The preservation of existing riparian, stream, and freshwater marsh habitat will primarily be accomplished through implementation of avoidance and minimization measures. However, permanent impacts to riparian, stream, and freshwater marsh habitats will be mitigated through the preservation and enhancement of existing habitat or major restoration/creation of new in-kind habitat. Implementation of the conservation measures will provide for a net increase in the quantity and quality of riparian, stream, and freshwater marsh habitat in the Plan Area.

The preservation and enhancement of existing habitats will occur in Priority Drainages and Watersheds in Conservation Area RSM 1 (Figure 4-10). Major restoration or creation efforts, such as the restoration of a two-stage floodplain corridor, will be targeted in Priority Drainages in Conservation Area RSM 3. This conservation area includes the stream reaches that meander through the alluvial fans, terraces, basins, and Delta marshlands of Solano County (Noss et al. 2002; Figure 3-2). Riparian, stream, and freshwater marsh habitat in this portion of the County has been significantly altered by residential, commercial, and agricultural development. Most urban development occurs on or upslope of the alluvial fans, terraces, basins, and Delta marshlands. In addition, palustrine wetlands, floodplains, and riparian forests that historically bordered the larger



rivers and adjacent sloughs and waterways in these areas have largely been drained and converted into farmland over the last century or more. Priority drainages in Conservation Area RSM 3 represent the drainages within the alluvial fans, terraces, basins, and Delta marshland geographical provinces of Solano County that have been the least altered by residential, commercial, and agricultural development and have the highest restoration potential.

In general, the upper and lower reaches of Priority Drainages are targeted for preservation and restoration (Conservation Areas RSM 1 and RSM 3). For example, upstream of Gibson Canyon Road, Ulatis Creek falls within Conservation Area RSM 1; and downstream of Brown Road, Ulatis Creek falls within Conservation Area RSM 3. Similarly, upstream from its confluence with Encinosa Creek, Alamo Creek falls within Conservation Area RSM 1; and east of Leisure Town Road, Alamo Creek falls within Conservation Area RSM 3 (Figure 4-11). The respective portions of Alamo Creek and Ulatis Creek between these two conservation segments fall within Conservation Area RSM 2. Riparian and stream habitats designated as Conservation Area RSM 2 represent key corridor streams that provide connectivity between other high value conservation areas in Solano County.

The conservation approach for Conservation Area RSM 2 (i.e., riparian and stream habitats in and near urban areas) focuses on maintaining and enhancing the quality of the riparian corridor and protecting water quality and hydrogeomorphic processes. Much of the “riparian” habitat in and near cities (i.e., in Conservation Area RSM 2) is very narrow (i.e., only one or two tree canopies wide) and characterized by nonnative trees and shrubs. Maintaining and enhancing the quality of remaining riparian corridors will be accomplished through implementation of setbacks and buffer zones in new urban development projects, targeted revegetation of severely degraded areas, removal and control of aggressive invasive species that reduce habitat quality, and removal of in-stream barriers to dispersal and migration. With restoration and control of invasive species, urban riparian vegetation, particularly along parts of Ulatis Creek and Alamo Creek will provide important corridor habitat linking the Vaca Mountains to the valley floor. In addition, Plan Participants will develop and implement programs to remove existing in-stream barriers and prevent the creation of new in-stream barriers as new development occurs along the lower reaches of Jameson Canyon, American Canyon, Ledgewood, Suisun, and Green Valley Creeks and their tributaries.

Maintaining water quality and hydrogeomorphic processes in Conservation Area RSM 2 involves minimizing and mitigating impacts from new urban development projects upstream in Conservation Area RSM 1. Mitigation measures include providing appropriate vegetated buffers between development and stream corridors to protect riparian and stream community quality, avoiding excess erosion, maintaining base flood elevations and 24-hour storm event discharges, and minimizing impervious surface areas directly connected to storm drain systems. These mitigation measures, in addition to National Pollutant Discharge Elimination System (NPDES) permit requirements established by the Regional Water Quality Control Board (RWQCB) to minimize increases in non-point source pollution, are designed to maintain water quality and the natural hydrogeomorphic processes of riparian, stream, and freshwater marsh habitat throughout the entire Plan Area.

8.5.7 Effects on Covered Species

A variety of Covered Species occur in the stream and riparian habitats of Solano County. These species include those that live in and are dependent on the watercourses and species associated with



the vegetation supported by these watercourses. Steelhead, California red-legged frog, and giant garter snake are all intimately associated with a variety of watercourses including smaller streams and sloughs and adjacent habitat. Chinook salmon occurs in the Sacramento River, and juvenile Chinook salmon occur in sloughs and marshes prior to entering the ocean. Valley elderberry longhorn beetle and its host plant, blue elderberry, are associated with the upper terrace of riparian areas. Swainson's hawks and tricolored blackbirds nest in riparian areas or in suitable vegetation away from riparian areas.

Some of the species listed above are addressed in the species-specific sections of the HCP, including the California red-legged frog, giant garter snake, and Swainson's hawk. The remaining species are discussed below.

8.5.7.1 Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle is closely associated with blue elderberry, which is an obligate host for beetle larvae. Adult valley elderberry longhorn beetles are usually found on or flying between elderberry plants. In Solano County, valley elderberry longhorn beetles have been documented from a number of areas. Elderberry shrubs are abundant along Ulatis Creek and Alamo Creek and in many other areas in Vacaville. The species is also known to occur along Putah Creek and in several locations around Fairfield.

1. **Development Effects (Covered Activity Zones 1 and 2).** Approximately 130 mi of watercourses, supporting approximately 470 ac of riparian habitats of varying quality, occur in Covered Activity Zone 1. In the City of Dixon, a population of valley elderberry longhorn beetle was found in elderberry shrubs situated away from a watercourse, along a fence between residences and an agricultural field. Any elderberry in Solano County has the potential to support this species even though a specific plant may not show evidence of beetle use. Substantial loss or direct conversion of riparian and marsh habitats in Covered Activity Zone 1 is unlikely.

Establishing buffers to protect the remaining riparian resources would most likely protect the majority of elderberry shrubs. Nevertheless, some elderberry shrubs grow apart from the immediate riparian area; these shrubs could be affected by development. Maintenance activities often entail trimming vegetation to provide access to trails and utility corridors. In some cases, buffers around individual trees may help to reduce impacts in these situations. Nevertheless, elderberry shrubs are likely to be affected by maintenance activities in urban areas.

- a. **Direct Effects.** In Covered Activity Zone 1, 220 ac are designated for development in the Riparian, Stream, and Freshwater Marsh Natural Community, of which an estimated 22.5 ac of habitat will be affected. Direct effects to suitable habitat for valley elderberry longhorn beetles include the removal of elderberry bushes as a result of the construction/installation of new or expanded road crossings, storm drain outfalls, utility corridors, and bike/pedestrian trails along riparian corridors. The majority of the direct impacts to valley elderberry longhorn beetle habitat will occur in Vacaville (18 ac), followed by Fairfield (2 ac), Suisun City (1.5 ac), Rio Vista (0.5 ac), and Vallejo (<0.1 ac). No valley elderberry longhorn beetle habitat will be directly affected by development in the City of Dixon.

Direct effects to valley elderberry longhorn beetle habitat will also result from projects initiated by cities outside their respective UGBs. Such activities would result in up to 15.6 ac of additional direct effects to suitable valley elderberry longhorn beetle habitat. The



direct effects to valley elderberry longhorn beetle habitat outside of their respective UGBs will occur in Dixon (0.1 ac), Fairfield (2 ac), Rio Vista (1.5 ac), Suisun City (2 ac), Vacaville (6 ac), and Vallejo (4 ac).

As mitigation for anticipated impacts, 65 ac of created/restored riparian, stream, and freshwater marsh habitat in the high value conservation areas will be preserved as habitat and will not be subject to conversion to urban land uses. All the elderberry bushes that are removed will be relocated in mitigation areas. In addition, for each removed elderberry bush, a minimum of five elderberry seedlings or rooted cuttings and five associated native, woody riparian plants will be planted in a mitigation area. Mitigation plantings shall occur, to the maximum extent practicable, in areas adjacent to the impact area and/or in existing gaps in riparian corridors. Priority areas for riparian revegetation and planting of elderberry include Alamo, Ulatis, and Putah Creeks in order to expand suitable habitat for the valley elderberry longhorn beetle in the Plan Area.

- b. **Indirect Effects.** Valley elderberry longhorn beetle habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. Indirect effects include changes in channel morphology (e.g., down-cutting, bank erosion) from increased peak and base flows, fragmentation of riparian habitats caused from development, grazing, insecticide use, vegetation control practices, and possibly the introduction of the invasive Argentine ant (*Linepithema humile*) from new urban development that may exclude populations of valley elderberry longhorn beetles from otherwise suitable habitat.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands. Most of the existing irrigation ditches have little to no riparian habitat. Only 3 ac of riparian habitat will be impacted over the life of the Plan.
 - a. **Direct Effects.** Up to 3 ac of riparian habitat, which could include an unknown number of elderberry shrubs, will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. In addition, an unknown number of individual elderberry shrubs not associated with riparian habitat may be directly affected. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
 - b. **Indirect Effects.** The main indirect effect to valley elderberry longhorn beetle habitat is the introduction of nonnative plant species caused by disturbance to habitat as a result of constructing new facilities.
 3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Most of the Plan Participant irrigation and flood control facilities are regularly maintained and, except in a few limited areas, support little or no riparian vegetation. Operation and maintenance of water district facilities, however, could affect the valley elderberry longhorn beetle, especially along unmodified streams where elderberry shrubs are present.
 - a. **Direct Effects.** Operation and maintenance activities associated with unmodified streams may directly affect potential valley elderberry longhorn beetle habitat in Fairfield, Vacaville, Vallejo, Rio Vista, and in facilities maintained by SWCA, MPWD, and VSFC. In unmodified stream channels, bank reconstruction (78 ac), placement of bank protection (2 ac), placement of temporary bank protection (12 ac), replacement of existing bank protection (51 ac), and vegetation removal (3,708 ac) may affect approximately 7,662 ac of suitable valley elderberry longhorn beetle habitat during the 30-year term of the HCP.



Protocols in Chapter 6.0 prescribe measures that, in most instances, will avoid take of valley elderberry longhorn beetle. In instances where avoidance is not possible or maintenance activities would result in the trimming of elderberry limbs over 1 inch in diameter, mitigation measures would be required to re-establish habitat at applicable levels.

- b. **Indirect Effects.** Operation and maintenance activities associated with various facilities may indirectly affect suitable valley elderberry longhorn beetle habitat. The main indirect effect to valley elderberry longhorn beetle habitat is the introduction of nonnative plant species caused by routine operation and maintenance activities. Operation and maintenance activities may also indirectly affect suitable valley elderberry longhorn beetle habitat by introducing nonnative Argentine ants that may be present in the maintenance vehicles or equipment.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Activities on preserves and reserves will promote riparian establishment, and most activities will avoid impacts to the valley elderberry longhorn beetle.
 - a. **Direct Effects.** Removal of elderberry bushes for preserve and reserve activities will be limited to 10 per year. Additionally, Objective RSM 2.3 specifies the increase of valley elderberry longhorn beetle habitat in the riparian areas of Alamo, Ulatis, Green Valley, Suisun Valley, Ledgewood, and Putah Creeks and other creeks supporting extant valley elderberry longhorn beetle populations by replacing impacted elderberry plants at a minimum ratio of 2:1 (mitigation-to-impact).
 - b. **Indirect Effects.** Activities on preserves and reserves may indirectly affect suitable valley elderberry longhorn beetle habitat. The main indirect effect to valley elderberry longhorn beetle habitat is the introduction of nonnative plant species caused by disturbance of habitat during restoration activities and increased recreational use. Restoration and recreational activities may also indirectly affect suitable valley elderberry longhorn beetle habitat by introducing nonnative Argentine ants that may be present in maintenance vehicles or equipment.
 5. **Requested Take Summary.** The precise amount of take that is likely to occur in Covered Activity Zones 1 and 2 is based on the best available data on the distribution of elderberry bushes in Solano County. Buffers required along streams in new development areas will greatly reduce the amount of take.

The requested amount of take includes:

- a. *An unlimited amount of trimming of elderberry shrubs for maintenance along utility corridors, bike trails, etc. on a 5-year maintenance cycle.* Such trimming shall not reduce the potential for dispersal of the valley elderberry longhorn beetle. Trimming of limbs greater than 1 inch in diameter shall be mitigated in accordance with Mitigation Measure RSM 12. Mitigation shall also entail establishing dispersal corridors in the course of planting elderberry shrubs.
- b. *Removal of a maximum of 100 elderberry bushes per year for Covered Activity Zone 1 and 2 Activities.* Such removal shall not reduce the potential for dispersal of the valley elderberry longhorn beetle by creating gaps no larger than 100 ft. In other words, a corridor containing elderberry bushes must be maintained such that the valley elderberry longhorn beetle can disperse from one locality to another. Such take shall be mitigated in accordance with applicable mitigation measures prior to or concurrent with anticipated take and shall involve maintaining or reestablishing dispersal corridors.



6. **Conservation Summary.** Implementation of the HCP would protect host plants of the valley elderberry longhorn beetle along existing watercourses in undeveloped areas. In addition, impacts to elderberry shrubs would be mitigated in accordance with Mitigation Measure RSM 12.

Buffers surrounding the watercourses would be large enough to allow for the re-establishment of elderberry shrubs, thereby enhancing or re-establishing dispersal corridors along the length of County watercourses. The HCP would provide the opportunity to re-establish elderberry savanna, valley oak woodland, and riparian habitats within buffer areas along remaining watercourses. These habitats formerly occurred along Solano County watercourses.

The HCP would also facilitate the re-establishment of dispersal corridors along watercourses where elderberry shrubs have been removed. Establishing these dispersal corridors would entail planting elderberry shrubs. More information on re-establishing connectivity for valley elderberry longhorn beetle is provided in Appendix B.

Removal or control of invasive species such as pampas grass, arundo, eucalyptus, and other invasive species will also benefit riparian community health and provide additional areas for elderberry and native riparian vegetation establishment (Mitigation Measures RSM 1 and RSM 10).

8.5.7.2 Steelhead

National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA NMFS) identifies two Evolutionarily Significant Units (ESUs) in Solano County: the Central California Coast ESU, which encompasses the San Pablo Bay/Napa River watersheds; and the Central Valley ESU, which encompasses the Suisun Bay/Sacramento River Delta watersheds. Waterways currently known to support breeding/rearing habitat for steelhead in Solano County include Green Valley, Suisun Valley, and Lynch Canyon Creeks.

1. **Development Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to steelhead from development are discussed below.
 - a. **Direct Effects.** Direct effects to steelhead from urban development in Covered Activity Zones 1 and 2 include the following:
 - 1) Straightening and channelizing of watercourses (thereby reducing the number of pools, riffles, and runs; reducing the amount of habitat for spawning, foraging, and refugia; and changing flow velocities);
 - 2) Placing barriers such as dams within watercourses;
 - 3) Removal of woody debris and other cover;
 - 4) Increased disturbance during spawning; and
 - 5) Introduction of nonnative fish.
 - b. **Indirect Effects.** Indirect effects to steelhead habitat from urban development in Covered Activity Zones 1 and 2 include:
 - 1) A reduction in water quality due to polluted run-off from adjacent urban development;
 - 2) An increase in water temperature due to removal of the riparian overstory;



- 3) An increase in sedimentation that accompanies increased run-off from adjacent development; and
 - 4) Down-cutting of the channel due to the increased run-off from paved surfaces during peak flows.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to steelhead from the construction of new irrigation and flood control facilities are discussed below.
- a. **Direct Effects.** Construction of new infrastructure will directly affect watercourses in the Green Valley and Suisun Creek watersheds where SID provides water service and SCWA maintains flood control channels. Direct effects will be limited to a maximum of 3 ac over the life of the Plan. Avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented during the construction of new infrastructure to minimize direct effects.
 - b. **Indirect Effects.** Potential indirect effects to steelhead habitat from the construction of new irrigation and flood control facilities include decreased water quality from excess sedimentation during construction activities, but such effects will be minimized through the implementation of erosion control BMPs during such activities. Additional longer term indirect effects could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from draining additional farmland. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to steelhead from operations and maintenance activities are discussed below.
- a. **Direct Effects.** The only operations and maintenance activities with potential to directly affect steelhead are those associated with Green Valley and Lynch Canyon Creeks, both of which are maintained by the City of Fairfield. The two maintenance activities with the potential to directly affect steelhead is sediment removal in and adjacent to culverts or bridge crossings and bank reconstruction in unmodified streams. The main impacts to steelhead habitat will be in Lynch Canyon and Green Valley Creeks. Impacts from sediment and silt removal in these streams will be approximately 30 ac in Lynch Canyon Creek and less than 5 ac in Green Valley Creek. Impacts from bank reconstruction in these streams will be approximately 2 ac in Lynch Canyon Creek and less than 0.35 ac in Green Valley Creek.
 - b. **Indirect Effects.** Potential indirect effects to steelhead habitat from operation and maintenance activities include decreased water quality from excess sedimentation during bank reconstruction activities, but such effects will be minimized through the implementation of erosion control BMPs during such activities (see Chapter 6.0).
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Potential direct and indirect effects to steelhead from creek restoration activities on preserves and reserves are discussed below.
- a. **Direct Effects.** Creek restoration activities could have short-term direct effects on steelhead habitat. Overhanging banks and other refuge areas could be removed to stabilize banks. Bank stabilization activities and construction to restore meanders could result in the removal of riparian vegetation that shades the watercourses. Bank stabilization could also result in a temporary increase in sediment that could affect steelhead rearing habitat.



However, the long-term benefit associated with improved habitat quality via the provision of in-stream cover and shade from overhanging riparian vegetation is expected to outweigh these short-term temporary effects.

- b. **Indirect Effects.** Since creek restoration activities on preserves and reserves will result in improved habitat quality for steelhead in the long term, no indirect effects are anticipated.
5. **Requested Take Summary.** The take of steelhead entails no net loss of habitat although construction would be allowed along 2 mi of watercourse per year throughout Covered Activity Zone 1. Any loss of habitat, such as for construction of a bridge crossing or restoration of a watercourse, would be compensated by protecting and enhancing existing stream habitats at a 4:1 ratio or at a 2:1 ratio if new in-kind habitats are constructed or restored. Loss of habitat from the construction of new bridge crossings or outfall structures would be estimated at no greater than 10 percent (or 500 ft per mile of stream) of a stream as it is surrounded by urban development. Otherwise, the establishment of requisite buffers would preclude take.
6. **Conservation Summary.** NOAA NMFS has not adopted a recovery plan for steelhead. The Solano HCP contributes to likely recovery actions by promoting establishment of buffers along watercourses, minimizing adverse effects of urban development on water quality and stream flow, and restoring and/or retaining riparian vegetation along watercourses. Implementing the conservation objectives for riparian species will improve steelhead habitat.

The conservation strategy for the Riparian, Stream, and Freshwater Marsh Natural Community and associated Covered Species includes measures to limit steelhead impacts. Implementation of the avoidance and minimization measures and conservation measures provides protection for direct and indirect effects to steelhead. These measures mirror the current trend to completely avoid impacts to watercourses that support steelhead, and it is likely that impacts will be avoided in the future.

8.5.7.3 Chinook Salmon

Three Chinook salmon ESUs may occur in the Plan Area: (1) Sacramento River winter-run ESU; (2) Central Valley spring-run ESU; and (3) Central Valley fall and late fall-run ESU. Historical information regarding Chinook salmon populations and occurrence in Solano County is limited. Leidy et al. (2003) reported that a 1973 CDFG document noted that a possible run or population of Chinook salmon occurred in Suisun Creek. Leidy et al. (2003) determined that a current run or population of Chinook salmon may exist in the Suisun Creek watershed; however, no observations have been made of this species. NOAA NMFS reported that spawning Chinook salmon or redds were observed in Green Valley Creek in 1999. Chinook salmon were also observed in Putah Creek in December 2003.

The lower reaches of most streams in Solano County flow through major agricultural and urban areas. These reaches would be used primarily as migration habitat because summer temperatures are typically too warm for Chinook salmon (LSA 2008b). The upper reaches of streams in the western portion of the County, however, may provide suitable spawning conditions.

Migrating Chinook salmon also occur in the waterways of Suisun Marsh and the Delta region of the County.



1. **Development Effects (Covered Activity Zones 1 and 2).** Direct and indirect effects to Chinook salmon habitat from urban development (Covered Activity Zones 1 and 2) are similar to those described above for steelhead.
 - a. **Direct Effects.** Direct effects include:
 - 1) Straightening and channelizing watercourses (thereby reducing the number of pools, riffles, and runs, and reducing the amount of habitat);
 - 2) Removal of woody debris and other cover; and
 - 3) Increased disturbance during spawning.
 - b. **Indirect Effects.** Indirect effects include:
 - 1) A reduction in water quality due to polluted runoff from adjacent urban development;
 - 2) An increase in water temperature due to removal of the riparian overstory;
 - 3) An increase in sedimentation that accompanies increased runoff from adjacent development; and
 - 4) Down-cutting of the channel due to the increased runoff from paved surfaces during peak flows.

2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to Chinook salmon from the construction of new irrigation and flood control facilities are discussed below.
 - a. **Direct Effects.** Construction of new infrastructure could directly affect watercourses in the Green Valley and Suisun Creek watersheds where SID provides water service and SCWA maintains flood control channels. A maximum of 3 ac of riparian and channel habitat will be impacted over the life of the Plan. If new infrastructure was constructed along these drainages the avoidance, minimization, and mitigation measures in Chapter 6.0 would minimize direct effects.
 - b. **Indirect Effects.** Potential indirect effects to Chinook salmon habitat from the construction of new irrigation and flood control facilities include decreased water quality from excess sedimentation during construction activities, but such effects will be minimized through the implementation of erosion control BMPs during such activities. Additional longer term indirect effects could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from draining additional farmland. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.

3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to Chinook salmon from operation and maintenance activities are discussed below.
 - a. **Direct Effects.** The only operations and maintenance activities with potential to directly affect Chinook salmon are those associated with Green Valley Creek, which is maintained by the City of Fairfield. The two main impacts to Chinook salmon habitat will be from sediment removal in and adjacent to culverts or bridge crossings and bank reconstruction activities in Green Valley Creek. Impacts from sediment and silt removal in this stream will be less than 5 ac, and impacts from bank reconstruction will be less than 0.35 ac.



- b. **Indirect Effects.** Potential indirect effects to Chinook salmon habitat from operation and maintenance activities include decreased water quality from excess sedimentation during bank reconstruction activities, but such effects will be minimized through the implementation of erosion control BMPs during such activities.
- 4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Potential direct and indirect effects to Chinook salmon from creek restoration activities on preserves and reserves are discussed below.
 - a. **Direct Effects.** Creek restoration activities could have short-term direct effects on Chinook salmon, including mortality of individuals and destruction of habitat. Bank stabilization activities and construction to restore meanders could result in the removal of riparian vegetation that provides refuge and shades watercourses. Bank stabilization could also result in a temporary increase in sediment that could affect rearing habitat. However, the long-term benefit associated with improved habitat quality via the provision of in-stream cover and shade from overhanging riparian vegetation is expected to outweigh these short-term temporary effects. No more than 50 ac of riparian habitat will be restored or enhanced during the life of the HCP.
 - b. **Indirect Effects.** Since creek restoration activities on preserves and reserves will result in improved habitat quality for Chinook salmon in the long term, no indirect effects are anticipated.
- 5. **Requested Take Summary.** The take of Chinook salmon entails no net loss of habitat although construction would be allowed along 2 mi of watercourse per year throughout Covered Activity Zone 1. The design and installation of road crossings are required to prevent the creation of barriers to upstream movement. Loss of habitat from the construction of bridge crossings or outfall structures would be estimated at no greater than 10 percent (or 500 ft per mile of stream) of a stream as it is surrounded by urban development. Otherwise, the establishment of requisite buffers would preclude take.
- 6. **Conservation Summary.** As with steelhead, NOAA NMFS has not adopted a recovery plan for Chinook salmon. It is also unlikely that Solano County streams are a significant component of or contributor to salmon populations even in historic times. However, the Solano HCP contributes to recovery actions by promoting the establishment of buffers along watercourses, minimizing adverse effects of urban development on water quality and stream flow, and restoring and/or retaining riparian vegetation along watercourses. Additionally, any loss of habitat, such as for the construction of a bridge crossing or restoration of a watercourse, would be compensated for by protecting and enhancing existing stream habitats at a 4:1 ratio, or at a 2:1 ratio if new in-kind habitats are constructed or restored (Mitigation Measure RSM 1).

8.5.7.4 Tricolored Blackbird

Tricolored blackbirds usually nest in large flocks in dense vegetation near open water, in emergent wetland vegetation (especially cattails and tules), or in thickets of willow, blackberry, wild rose, and tall herbs, and in some agricultural crops. The species frequents open habitats, such as croplands and grassy fields, during the non-breeding season (Granholm 1990). Tricolored blackbirds are present throughout much of Solano County, with periodic breeding occurring in a number of areas.



1. **Development Effects (Covered Activity Zones 1 and 2).** Potential direct and indirect effects to tricolored blackbird from development are discussed below.
 - a. **Direct Effects.** While only one known tricolored blackbird occurrence is located in Covered Activity Zone 1, the species is mobile and relocates colonies regularly; therefore, they can be present in an area one year and not the next. The Riparian, Stream, and Freshwater Marsh Conservation Program requires the avoidance of riparian areas and includes the establishment of buffers and stream restoration. These measures would prevent direct effects on tricolored blackbirds nesting in riparian areas and would retain potential nesting habitat. In the event that habitat is destroyed or eliminated (either temporary or permanently) as a result of Covered Activities, impacts will be mitigated in accordance with Mitigation Measures RSM 13 and RSM 14. The foraging habitat of tricolored blackbirds primarily consists of agricultural fields and grasslands, including those surrounding vernal pools. Development is expected to impact 4,250 ac of valley floor grassland and vernal pool habitat and 5,500 ac of irrigated agriculture habitat.
 - b. **Indirect Effects.** Potential indirect effects of urban development on tricolored blackbirds include mortality from pets, increased predation from raccoons, striped skunks, and opossums, and increased disturbance from human activity.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of land, most if not all of which will occur on agricultural lands. However, there may be minor impacts to open water, grassland, and riparian habitats. These impacts are discussed below.
 - a. **Direct Effects.** Approximately 535 ac of irrigated agriculture, 30 ac of open water habitat, 3 ac of riparian habitat, and 12 ac of grassland habitat will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. Most of the open water habitat in existing irrigation ditches has very little vegetation and does not provide suitable breeding habitat for tricolored blackbirds; however, there are a few areas that do. Tricolored blackbirds have also been observed using patches of thistle for cover and may possibly nest in it (S. Foreman pers. obs.¹). This Covered Activity category has the potential to impact up to 33 ac of potential breeding habitat and 547 ac of suitable foraging habitat. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
 - b. **Indirect Effects.** The indirect effects of new facility construction are the potential temporary impacts that occur during the post-construction maintenance of that facility.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** One known occurrence of tricolored blackbird is located in Covered Activity Zone 2, and one known occurrence is located in Covered Activity Zone 1 in the McCoy Wasteway (a Federal facility). It is possible for tricolored blackbirds to establish nesting colonies in Plan Participant facilities where suitable herbaceous or emergent vegetation is present (i.e., storm water detention basins, irrigation ditches that are not well maintained).

¹ Steve Foreman, Principal/Wildlife Biologist, LSA Associates, Inc., personal observations in April 2010 and April 2011.



- a. **Direct Effects.** Avoidance and Minimization Measure RSM 7 will prevent direct effects to active nests during vegetation removal and/or sediment and silt removal. Avoidance and Minimization Measure RSM 7 applies to any facility within 250 ft of suitable tricolored blackbird breeding habitat. Although flood control channels and irrigation ditches can support stands of emergent wetland vegetation (cattails and/or tules), it is unlikely that the majority of such stands reach sufficient size to support tricolored blackbird nesting colonies. Vegetation removal in irrigation drainage ditches maintained by Plan Participants will be a maximum of 380 ac per year, or 11,400 ac over the life of the HCP. Another maintained facility type that may support suitable breeding habitat for tricolored blackbirds is detention basins. Most detention basins do not hold water long enough to support stands of emergent wetland vegetation (cattails and/or tules). However, there are a few detention basins that do, such as the Strassberger Detention Basin in Fairfield (Figure A-3, facility F43). Tricolored blackbirds have been observed in this detention basin and the adjacent irrigation ditch maintained by SID. Vegetation removal will affect approximately 60 ac of storm water detention basins over the 30-year HCP period, only a fraction of which will contain suitable habitat for tricolored blackbirds.
 - b. **Indirect Effects.** Indirect effects to tricolored blackbird from operation and maintenance activities are expected to be minimal since they are temporary and do not result in permanent changes to the physical structure of the affected features. The removal of vegetative cover from these features may temporarily render storm water detention basins as unsuitable for tricolored blackbirds; however, given how mobile this species is in its nesting locations from year to year, it is highly unlikely that it would be affected by such short-term habitat loss.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Implementation of management and restoration activities on preserves could result in impacts to tricolored blackbirds. These impacts could include human activity during nesting, alteration of habitat (i.e., removal of thistle or other weed species), and other effects of ground-disturbing activities. Management plans and restoration plans should be written to account for tricolored blackbirds. Management actions should include avoiding existing occurrences and establishing suitable habitat in new areas.
5. **Requested Take Summary.** No take of tricolored blackbird nesting colonies during nesting season is authorized under the Solano HCP. Covered Activities will result in the loss and modification of a 12,505 ac of potential foraging habitat (see impacts for Swainson's hawk); however, such losses are anticipated to be offset by the establishment of new, secure habitats in Valley Floor Grassland and Vernal Pool and Irrigated Agriculture (e.g., Swainson's hawk) reserves.
6. **Conservation Summary.** The HCP would establish new preserves and areas protected from development. These new preserves include 10,500 ac of valley floor grassland habitat, 3,300 ac of grassland/oak savanna in the Inner Coast Range, and 5,700 ac of Irrigated Agriculture habitat, all of which could potentially support tricolored blackbird. Objective RSM 2.5 in the Conservation Strategy will preserve one known tricolored breeding site for each known breeding colony affected by development. Breeding sites may also be protected if located in stands of cattails and bulrushes that grow in sloughs meandering between Contra Costa goldfield populations. Restoration activities, as part of restoring the freshwater marsh habitat for the giant garter snake, would create nesting habitat for tricolored blackbird. In addition, the HCP would establish a minimum of 70 ac of new, suitable nesting habitat for tricolored blackbird in agricultural reserves established as Swainson's hawk foraging and nesting habitat



mitigation. Creating additional tricolored blackbird nesting habitat would be a significant benefit. In addition, 175 ac of aquatic habitat shall be restored and enhanced for giant garter snakes (Objective GGS 1.2) that will also contribute to the conservation of tricolored black bird by providing additional breeding habitat.

Implementation of BMPs and other procedures in Chapter 6.0 will also lessen effects to tricolored blackbird and contribute to its recovery by ensuring that operation and maintenance activities do not disrupt active nesting activity.

8.6 GIANT GARTER SNAKE IMPACT ASSESSMENT

Suitable habitat for giant garter snakes is limited to the eastern portion of the Plan Area in the historic and current range of this species (Figure 4-18). Suitable habitat for this species, with the exception of a few areas in Rio Vista, fall outside the anticipated urban expansion areas; therefore, the primary concerns for this species are the indirect effects of increased urban runoff in downstream receiving waters and flood control channels, and the direct impacts from operation and maintenance activities in Plan Participant facilities.

8.6.1 Development Effects (Covered Activity Zones 1 and 2)

Giant garter snakes are not known from Covered Activity Zone 1; however, the City of Rio Vista falls in the Mid-Valley Recovery Unit (MVRU) (Figure 4-18).

8.6.1.1 Direct Effects

In Rio Vista, an estimated 3 ac of aquatic habitat suitable for giant garter snakes will be directly impacted. As such, 9 ac of created/restored riparian, stream, and freshwater marsh habitat and 18 ac of associated upland habitat will be preserved as habitat and will not be subject to conversion to urban land uses. No giant garter snake habitat will be directly affected by development in Dixon, Fairfield, Suisun City, Vacaville, and Vallejo.

Direct effects to giant garter snake habitat may also result from projects initiated by the City of Rio Vista outside its UGB in Covered Activity Zone 2. Such activities would result in 1 to 2 ac of additional direct effects to upland habitat. All aquatic habitat outside of Covered Activity Zone 1 will be avoided to the maximum extent practicable.

8.6.1.2 Indirect Effects

Giant garter snake habitat in Covered Activity Zone 1 will also be indirectly affected by development activities. In Covered Activity Zone 1, the primary concern for this species involves the indirect effects of increased urban runoff in downstream receiving waters. This runoff may also include contaminated runoff that could impact the fish that giant garter snakes use as prey. Other indirect effects may include light pollution, human disturbance, increased number and presence of domestic predators (dogs and cats), vehicle-caused mortality (roadkills), and increased risk of wildfire. Approximately 30 ac of potential giant garter snake habitat in Rio Vista will be indirectly affected by the build out in the development area. No indirect impacts to suitable giant garter snake habitat occur in Dixon, Fairfield, Suisun City, Vacaville, or Vallejo.



8.6.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Three historic occurrences of giant garter snake are known from Covered Activity Zone 2. The construction of new irrigation and flood control facilities could affect this species. Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands. Potential effects include construction of new irrigation and flood control facilities for irrigation, reclamation, and special district service area inclusions and annexations. Other effects may also include the construction of new facilities to update or improve aging infrastructure. If the construction of new facilities affects suitable giant garter snake habitat, implementation of measures addressed in Chapter 6.0 will mitigate for these effects.

8.6.2.1 Direct Effects

Up to 30 ac of open water habitat, 10 ac of valley floor grassland and vernal pool habitat, and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.

8.6.2.2 Indirect Effects

Indirect effects to giant garter snake could include increased sedimentation and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.

8.6.3 Operations and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

No occurrences of giant garter snake are known from Covered Activity Zone 1, but three historic occurrences of the giant garter snake are known from Covered Activity Zone 2. The City of Rio Vista is the only participant in Covered Activity Zone 1 that contains potential giant garter snake habitat, while high-quality giant garter snake habitat occurs in facilities maintained by SCWA, MPWD, Dixon RCD, and RD 2068. In the facilities identified as high-quality giant garter snake habitat, operation and maintenance activities could affect this species. Impacts may include vegetation trimming and removal, bank stabilization, and levee strengthening. Removal of vegetation to allow for the free flow of water along irrigation ditches, canals, and other facilities could result in the take of giant garter snake.

In Covered Activity Zone 2, the estimated extent of potential giant garter snake habitat in Plan Participant facilities, based on the presence of five essential habitat elements identified in the giant garter snake habitat model (Section 4.3.7.2), is approximately 390 ac. The amount of wetland and upland components in each of the Plan Participants' water features is presented in Table 8.10.



Table 8.10: Estimated Potential Giant Garter Snake Habitat in Covered Activity Zone 2

Plan Participants	Aquatic Habitat (acres)	Upland Habitat (acres)	Total (acres)
Maine Prairie Irrigation District	6	12	18
Dixon Resource Conservation District	6	17	23
Solano County Water Agency	70	112	182
Reclamation District 2068	88	79	167
Total Plan Area	170	220	390

8.6.3.1 Direct Effects

Operation and maintenance of facilities could directly affect unmodified and channelized streams and/or supply/drainage ditches maintained by the City of Rio Vista, SCWA, MPWD, Dixon RCD, and/or RD 2068. Operation and maintenance activities associated with the streams and ditches may affect suitable giant garter snake habitat within the jurisdiction of these entities. Objective GGS 1.2 provides a one-time mitigation for temporary impacts associated with operation and maintenance activities in core habitat areas. An estimated 170 ac of perennial marsh and aquatic habitats and 220 ac of associated uplands are present in Plan Participant facilities in the Giant Garter Snake Conservation Area (Table 8.10). Operation and maintenance activities in these areas involve periodic clearing of vegetation and sediment. Typically, clearing of these waterways cannot be practicably accomplished during the desired periods for avoidance and minimization (see Section 6.3.6). Clearing schedules vary by feature, but only limited areas of channel are cleared in any given year. Clearing cycles range from once every few years in smaller channels to more than once every 10 years in larger channels. The effects of channel vegetation removal tend to be temporary, lasting only 1 to 2 years. Specifically, activities that may directly affect giant garter snakes are bank reconstruction, placement of bank protection, replacement of existing bank protection, vegetation removal, submerged weeds removal, sediment and silt removal, sediment and debris removal, spoil pile removal, beaver dam removal, trash and debris removal, repair of leaks, and raising banks (see Appendix A for details on frequencies of these activities during the 30-year term of the HCP).

8.6.3.2 Indirect Effects

Indirect effects caused from operation and maintenance activities may include the introduction of invasive plant species, the cumulative adverse effects of urban storm water runoff on downstream receiving waters in the region, and vehicle-caused mortality (roadkills).

8.6.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

Goal GGS 1 promotes actions to re-establish or expand giant garter snake populations and habitat in the Plan Area and contribute to their recovery through protection, management, restoration, and enhancement of suitable habitat in the Yolo Basin-Liberty Farms population area. Additionally, Objective GGS 1.1 calls for increasing the quality of Delta waterways and tributaries in the Plan Area by implementing programs to control invasive exotic plants and animals and improve water quality. Control of invasive species is expected to occur on 100 to 170 ac of coastal marsh habitat annually or 3,000 to 5,100 ac within Delta waterways and Suisun and Napa River Marshes over the life of the HCP.



8.6.4.1 Direct Effects

Temporary impacts to giant garter snake habitat may occur as a result of restoring 175 ac of aquatic habitat and 121 ac of associated upland habitat (see Objective GGS 1.2). Management plans and restoration plans are required to minimize management actions that could affect Covered Species (see Section 10.5). Implementation of the protocols in Chapter 6.0 would also limit direct effects to this species.

8.6.4.2 Indirect Effects

Activities on preserves and reserves may indirectly affect suitable giant garter snake habitat. The main indirect effect to giant garter snake habitat is the alteration of normal water regimes during restoration activities and increased recreational use. Inappropriately timed dry down of marshes can alter the prey base or expose garter snakes to predators. The disturbance of habitats may also permit the introduction of invasive nonnative plant species such as yellow water primrose. This introduced plant species can alter the structure of the aquatic environment, thereby creating conditions that would no longer be suitable for giant garter snakes.

8.6.5 Requested Take Summary

Maximum take from development would be approximately 3 ac of direct impacts and 30 ac of indirect impacts to aquatic habitat in Rio Vista. A take request for Zone 2 Covered Activities would result in temporary impacts to 170 ac of aquatic habitat and 220 ac of upland habitat. A take request for Zone 3 Covered Activities includes restoring 175 ac of aquatic habitat and 121 ac of associated upland habitat for giant garter snake. In addition, an unknown number of giant garter snake could be captured as part of the long-term Monitoring and Adaptive Management Program.

8.6.6 Conservation Summary

Contributions to recovery for giant garter snake include: (1) protection from direct impacts; (2) implementation of restoration activities in watercourses that could eventually support these snakes (up to 175 ac of aquatic habitat and 120 ac of associated upland habitat); and (3) reduction of take to allow the giant garter snake population to reach a sustainable level. Implementation of BMPs and other avoidance and minimization measures included in Chapter 6.0 will also lessen the effects to giant garter snake and will contribute to its recovery.

The primary concerns for this species involve indirect effects of increased urban runoff in downstream receiving waters and flood control channels, and direct impacts from operation and maintenance activities in Plan Participant facilities. Therefore, the main conservation approach for giant garter snake involves implementing avoidance and minimization measures that will minimize adverse effects of operation and maintenance activities and urban storm water runoff. However, certain operation and maintenance activities, such as the clearing of waterways, cannot be practicably accomplished during the desired time frames for avoidance and minimization of this species. To mitigate for the potential take of giant garter snake during routine operation and maintenance activities, Plan Participants will provide a one-time mitigation for temporary impacts associated with channel clearing in high-quality habitat areas. Mitigation shall entail the creation of new aquatic habitat at a ratio of 0.5:1, resulting in the conservation and restoration of approximately 85 ac of aquatic habitat and a minimum of 22 ac of associated upland habitat in the Giant Garter Snake High Value Conservation Area (Figure 4-19). The location of conservation



areas will be designed to maintain interconnected blocks of habitat that support natural movement patterns and provide opportunities for populations to re-establish themselves in Solano County, and will be appropriately restored and managed to achieve historical levels of productivity and value for giant garter snake. In addition, 90 ac of aquatic habitat and 95 ac of associated upland habitat for giant garter snake will be acquired, enhanced, and managed as mitigation for direct and indirect impacts to habitat in Rio Vista (Mitigation Measure GGS 2).

8.7 COASTAL MARSH NATURAL COMMUNITY IMPACT ASSESSMENT

The Coastal Marsh Natural Community in the Plan Area comprises approximately 86,000 ac. The largest contiguous area is Suisun Marsh. Additional large marsh areas include Southamptton Marsh and the Napa Marshes. Much of Suisun Marsh and the Napa Marshes are managed by the CDFG for waterfowl and provide important habitat for wintering birds. Southamptton Marsh is owned and operated by the California Department of Parks and Recreation. There are 10 Covered Species primarily associated with the Coastal Marsh Natural Community (see Section 4.3.8). These species consist of plant species that occur mostly along the edge of sloughs in tidally influenced areas, animal species that spend their entire lives in the marshes, and animal species that are dependent on the marshes but also utilize other habitats during various stages of their life cycles.

The California Legislature passed the Suisun Marsh Protection Act in 1974 to preserve Suisun Marsh from residential, commercial, and industrial development. By the time the Act was passed, much of the fringes of the marsh had been developed. The Act directs the San Francisco Bay Conservation and Development Commission (BCDC) and CDFG to prepare the Suisun Marsh Protection Plan “to preserve the integrity and assure continued wildlife use” of Suisun Marsh. The objectives of the Protection Plan are to preserve and enhance the quality and diversity of the aquatic and wildlife habitats and to retain upland areas adjacent to Suisun Marsh in uses compatible with its protection. The combination of significant legislative protection for Suisun Marsh and the extent of public ownership of the remaining marshes in Solano County have resulted in the protection of over 95 percent of the Coastal Marsh communities, associated waterways, areas surrounding Suisun Marsh, adjacent uplands, and agricultural lands from activities that would directly affect existing values.

8.7.1 Development Effects (Covered Activity Zones 1 and 2)

8.7.1.1 Direct Effects

Approximately 615 ac of Coastal Marsh occur in the urban development boundaries of the Plan Participants. However, conversion of coastal marsh habitat from development-related activities will be limited to approximately 25 ac under the HCP (see Table 8.1). Most of the coastal marsh habitat in the Plan Area does not occur in urban boundaries; those that do are managed or incorporated into established open space areas to protect and enhance existing values (e.g., White Slough, River Park, and Mare Island in Vallejo). However, some minor direct impacts are anticipated as a result of new road projects (e.g., widening of Cordelia Road in Fairfield), and the construction of new utility crossings, high-flow flood control channels, bypass channels, and storm water outfalls.

City development activities outside the UGB (e.g., flood control facilities, roads) will directly affect 4.2 ac of coastal marsh habitat (0.2 ac in Fairfield, 1 ac in Rio Vista, 1 ac in Suisun City, and 2 ac in Vallejo; see Table 8.2).



8.7.1.2 Indirect Effects

The primary concern for additional urban growth in Solano County is the potential for indirect effects to coastal marshes. The potential indirect effects consist of increased human visitation, increased fire frequency, increased nonnative plant species, increased habitat fragmentation, increased predation by domestic animals (pets), alteration of hydrologic and salinity regimes, potential increased channelization of watercourses, increased sedimentation, and increased input of pesticides and chemical fertilizers. Indirect impacts to coastal marsh habitat are difficult to quantify. The potential effects on the Coastal Marsh Natural Community and associated Covered Species are generally detailed in the narrative conceptual model in Appendix B.

In Covered Activity Zone 1, the primary indirect impact of concern is alterations in hydrology due to increases in freshwater inputs associated with urbanization. In general, urbanization can result in increased peak discharge, reduced infiltration, increased runoff during the dry season and during dry years, increased annual runoff volume, and a longer runoff season (Noss et al. 2002). Sources of freshwater input are the FSSD wastewater treatment plant and urban-generated run-off (i.e., nuisance flow runoff).

The capacity of the FSSD wastewater treatment plant is anticipated to expand from 17.5 million gallons per day (mgd) to an estimated 25 mgd over the next 10 years. Currently, an average of 11 percent of the plant capacity (1.6 mgd) is recycled, and the remainder is discharged into Boynton Slough. To accommodate projected growth, FSSD has constructed a redundant outfall pipeline that discharges into Chadbourne Slough. The EIR for the Fairfield-Suisun Sewer District Master Plan (Environmental Science Associates 2005) assessed the environmental effects of this new discharge point and the effects of projected discharges associated with planned urban growth in the region. The EIR concluded that projected increases would result in less than significant impacts to vegetation, wildlife, fisheries, hydrology, and water quality if BMPs are followed. Impacts associated with increased effluent outflow or discharge were generally considered to be localized at the outflow location and decrease rapidly downstream as effluent volumes are diluted (FSSD 2006).

Water entering storm drain systems and shallow groundwater from landscape irrigation, car washing, and other activities associated with residential and other urban development typically flow into local creeks that ultimately drain into estuarine habitats such as Suisun Marsh and the Napa River/San Pablo Bay. This phenomenon is referred to as nuisance flow, and can have significant adverse effects on native plants and animals. In brackish to salt marsh communities, additional freshwater inflow especially during the summer dry season can substantially alter species composition and result in the loss of important native species in the area near the outflow. Primary marsh areas of concern for nuisance flow runoff (i.e., adjacent to outflows) include the marshes in Hill Slough, Peytonia Slough, and Rush Ranch, which are primarily adjacent to existing urban areas. These marshes contain remnant blocks of tidal marsh that support the remaining known populations of soft bird's-beak and Suisun thistle that rely on high salinity periods to maintain a competitive advantage over other plant species. Mason's lilaepsis, a covered but more widespread plant species, has a broader tolerance for a range of salinities (e.g., fairly freshwater to brackish water) and are unlikely to be significantly impacted by dry season decreases in salinity.

The amount of nuisance flow can be highly variable, and the extent to which nuisance flows enter estuarine habitats is dependent on a number of factors, including evaporation and transpiration of the water by riparian and in-channel wetlands and percolation to local groundwater. Various studies have shown nuisance flow rates to be within the range of 0.025 to 0.05 cubic feet per



second (cfs) per square mile (640 ac) of residential development (McBride 1975, Roberts and Hecht 1989, White et al. 1999). This flow rate is equivalent to 16,157 to 32,314 gallons per day or 0.05 to 0.1 acre-feet per day per square mile of development. Given that 6,000 ac of urban development could occur in Fairfield and Suisun City, the potential cumulative increase in dry-season freshwater inflow to Suisun Marsh could be in the range of 1 to 2 acre-feet per day entering important tidal marsh habitats primarily from McCoy Creek (Hill Slough Ecological Reserve), Suisun Slough, Ledgewood Creek (Peytonia Slough Ecological Reserve), and Green Valley Creek. Additional nuisance flows could enter Southampton Marsh and the Napa River and San Pablo Bay marshes from development in Vallejo.

Because of the large size of Suisun Marsh, and the relatively small amount of additional freshwater discharge from upgrades to the FSSD wastewater treatment plant and other sources compared to the total volume of water in the marsh, such discharges are not likely to adversely affect the overall habitat quality of Suisun Marsh (C. Enright, pers. comm.¹).

8.7.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of land, most if not all of which will occur on agricultural lands. However, there may be minor impacts to coastal marsh habitat. These impacts are discussed below.

8.7.2.1 Direct Effects

Up to 1 ac of coastal marsh habitat and 14 ac of existing levee habitat will be converted over the life of the Plan for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.

8.7.2.2 Indirect Effects

Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, implementation of programs to improve water quality.

8.7.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

8.7.3.1 Direct Effects

Operation and maintenance activities that may result in direct effects to coastal marsh habitat include: flood control channel maintenance; sediment removal; bank reconstruction, protection, and erosion control; trash and debris removal; vegetation management; and outfall maintenance (e.g., sediment and silt removal). Estimated impacts to linear facilities include 138 ac of

¹ Christopher Enright, Senior Water Resources Engineer, California Department of Water Resources, personal communication with Steve Foreman, Principal/Wildlife Biologist, LSA Associates, Inc. (2008).



channelized streams (Rio Vista, SCWD, and VSFCD), 23 ac of unmodified streams (Rio Vista and VSFCD), 2.3 ac of drainage ditch (Suisun City and VSFCD), and 57 ac of irrigation ditch (SID) over the 30-year HCP period. Approximately 23 outfall structures located in Coastal Marsh will be subject to periodic maintenance that may result in temporary impacts to coastal marsh habitat.

8.7.3.2 Indirect Effects

Indirect effects to coastal marsh habitat from operation and maintenance activities are expected to be minimal since such activities are temporary and do not result in permanent changes to the physical structure of the affected features (e.g., channels and outfalls). The biggest indirect impact may be the spread of invasive species. The Plan Participants' commitment to implementing programs to control invasive exotic plants and animals will minimize this indirect effect.

8.7.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

Objective CM 2.1 involves the preservation, management, and restoration of 80 ac of coastal brackish marsh habitats. Objective CM 2.2 involves the restoration and management of 175 ac of shallow water habitat suitable for Delta smelt and Sacramento splittail (see Chapter 5.0). Control measures for invasive species are expected to occur annually on 100 to 170 ac of coastal marsh habitat or on 3,000 to 5,100 ac in Delta waterways and Suisun and Napa River Marshes over the life of the HCP.

8.7.4.1 Direct Effects

The primary direct effect of Coastal Marsh restoration will be the creation of new tidal channels, which will require the excavation of existing coastal marsh habitat. The acreage of this impact is unknown since restoration plans have not yet been developed. Regardless, the long-term benefit associated with the restoration of coastal brackish marsh is expected to outweigh short-term impacts associated with restoration activities.

8.7.4.2 Indirect Effects

Activities on preserves and reserves may indirectly affect coastal marsh habitat. The main indirect effect is the introduction of nonnative plant species caused by the disturbance of habitat during restoration activities. Resource Management Plans for reserves will address this issue and work to minimize this indirect effect.

8.7.5 Requested Take Summary

Impacts to the Coastal Marsh Natural Community from Covered Activities are anticipated to result from changes in hydrology and water quality associated with development in the watershed rather than from direct impacts to habitat. In most instances, coastal marsh habitats do not occur within city urban boundaries; those that do are managed or are already incorporated into established open space areas to protect and enhance existing values (e.g., White Slough, River Park, and Mare Island in Vallejo). Some minor direct impacts are anticipated as a result of development-related activities (approximately 25 ac). These include the construction of road projects (e.g., widening of Cordelia



Road in Fairfield), new utility crossings, high-flow flood control, bypass channels, storm water outfalls, and flood control channel maintenance.

8.7.6 Conservation Summary

The Coastal Marsh Natural Community Conservation Strategy is designed to maintain water and sediment quality standards, hydrology, and the ecological functions of the natural community; contribute to the restoration of tidally-influenced coastal marsh habitat; contribute to the conservation and recovery of associated Covered Species; and promote habitat connectivity. Primary conservation actions include preservation (primarily through avoidance), restoration, invasive species control, and maintenance of water quality and hydrogeomorphic processes by implementing BMPs and avoidance and minimization measures.

8.7.7 Effects on Covered Species

The following provides information on the potential effects of Covered Activities on Covered Species associated with the Coastal Marsh Natural Community.

8.7.7.1 Suisun Thistle

Suisun thistle grows in brackish tidal marshes including the high marsh zone of Suisun Marsh. Its historic range is limited to Suisun Marsh, and its current range is limited to the northwestern portion of Suisun Marsh in the vicinity of Peytonia Slough and Rush Ranch (CSCC 2003). Currently, changes in hydrology, invasive plant species (including peppergrass [*Lepidium latifolium*]), erosion, and feral pigs pose the greatest threats to Suisun thistle. Populations are partly protected at Rush Ranch and the Peytonia Slough Ecological Reserve (CDFG 2004a, CNPS 2011).

1. **Development Effects (Covered Activity Zones 1 and 2).** There are no known Suisun thistle occurrences and no Suisun thistle habitat located in Covered Activity Zones 1 and 2.
 - a. **Direct Effects.** Because there are no known occurrences in Covered Activity Zones 1 and 2, development is not expected to result in direct effects on the species.
 - b. **Indirect Effects.** Development in Covered Activity Zone 1 may result in indirect effects on Suisun thistle. Potential indirect effects include unauthorized visitation to habitat in areas adjacent to Covered Activity Zone 1, increased summertime freshwater flows, alteration of tidal regimes, introduction of invasive plant species (including peppergrass), potential hybridization with nonnative thistles, erosion, mosquito abatement activities, and water pollution (CNPS 2011, L.C. Lee Associates 2003, USFWS 2003c). No indirect effects to Suisun thistle are anticipated in Covered Activity Zone 2.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** The only areas where coastal marsh habitat may be affected are if facilities along the lower portions of the green valley flood Control Project or the Lower Ulatis Creek Flood Control Channel are worked on. Up to 1 ac of coastal marsh habitat and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the



- construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
- b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Operation and maintenance activities are not expected to affect Suisun thistle since all three known occurrences are in protected areas.
 - a. **Direct Effects.** Operation and maintenance activities will not result in any direct effects to Suisun thistle.
 - b. **Indirect Effects.** Operation and maintenance activities will not result in any indirect effects to Suisun thistle.
 4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Three occurrences of Suisun thistle are located in Covered Activity Zone 3, and all of these occurrences are located in protected areas.
 - a. **Direct Effects.** Coastal marsh restoration activities on preserves and reserves are not expected to result in direct effects to Suisun thistle. New preserve areas that could provide habitat for this species are anticipated to be established as a result of implementing the Solano HCP, thereby providing opportunities to establish additional populations.
 - b. **Indirect Effects.** Marsh restoration activities on preserves and reserves will not result in indirect effects to Suisun thistle.
 5. **Requested Take Summary.** Suisun thistle is known from only one location in Solano County (Rush Ranch/Peytonia Slough) and is not known to occur anywhere else. Because of its limited distribution, the adverse modification of Suisun thistle or its habitat will not be allowed. Collection of seed from no more than 10 percent of any one population or stand would be authorized for restoration efforts to establish new colonies.
 6. **Conservation Summary.** No specific recovery plan has been adopted for this species. Desirable recovery objectives for this species would include the preservation of existing populations in secure reserves, establishment of new populations, and measures to control invasive exotic species that may compete with native species. All known populations occur in protected conservation areas. Given the extent of essential protected coastal marsh habitat and limited direct impact, the Solano HCP mitigation measures do not propose significant increases in protection of coastal marsh habitat into reserves. However, potential habitat on which populations could be restored will be preserved in western Suisun City on the Tooby and Barnfield sites (approximately 159 ac) as part of the proposed mitigation for the Gentry-Suisun Development Project (Raney Planning and Management, Inc. 2006). Under the HCP, conservation efforts for coastal marsh habitats primarily focus on invasive species control (Objective CM 1.1).

8.7.7.2 Soft Bird's-Beak

Soft bird's-beak grows in coastal salt marshes, usually in the marsh/upland transition zone with jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), and gumplant (*Grindelia stricta* var.



angustifolia). Habitat includes seasonally flooded areas in a hypersaline or euysaline environment (CDWR 1996). Soft bird's-beak, like many other *Cordylanthus* species, is a hemiparasite; it is partially dependent on other plants for mineral nutrients and water. Current threats to soft bird's-beak include invasive plants, erosion, alteration of hydrology, and feral pigs (CNPS 2011, CDFG 2004a).

1. **Development Effects (Zones 1 and 2).** No known occurrences of soft bird's-beak are located in Covered Activity Zones 1 or 2. Potential habitat for this species is present in western Suisun City, but was not identified during botanical surveys conducted on the property in 2000 and 2001 (Vollmar 2003). This area is to be established as a preserve as part of the Contra Costa goldfield conservation.
 - a. **Direct Effects.** No direct effects to this species are anticipated from Covered Activity Zone 1 or 2 development activities.
 - b. **Indirect Effects.** Development in Covered Activity Zone 1 may indirectly affect soft bird's-beak habitat as a result of urban runoff, but water quality mitigation measures will reduce this potential indirect effect. Other indirect effects to soft bird's-beak habitat may include the introduction of invasive plants, erosion, and alteration of hydrology, as well as water pollution and habitat fragmentation in general. No indirect effects to soft bird's-beak are anticipated in Covered Activity Zone 2.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Approximately 595 ac or 99 mi of new irrigation and flood control facilities may be constructed during the life of the HCP. Most if not all of the land impacted by these activities will be agricultural lands and not habitat for soft bird's-beak, with a few minor exceptions.
 - a. **Direct Effects.** The only area where coastal marsh habitat may be affected by Covered Activities in this category is if additional facilities are worked on along the lower portions of the Green Valley Flood Control Project or in the lower Ulatis Creek Flood Control Channel. New facilities in these areas are highly unlikely; however, up to 1 ac of marsh vegetation and 14 ac of existing levees will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. Levees are not necessarily considered habitat for this species, but suitable habitat may be present adjacent to the levees. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
 - b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from draining additional farmland. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Operation and maintenance activities that may result in direct and indirect effects to soft bird's-beak are discussed below.
 - a. **Direct Effects.** Potential direct effects to soft bird's-beak from operation and maintenance activities include flood control channel maintenance; sediment removal; bank reconstruction, protection, and erosion control; trash and debris removal; vegetation management; and outfall maintenance (e.g., sediment and silt removal). Estimated impacts to linear facilities include 138 ac of channelized streams (Rio Vista, SCWD, and VSFCD),



- 23 ac of unmodified streams (Rio Vista and VSFCD), 2.3 ac of drainage ditch (Suisun City and VSFCD), and 57 ac of irrigation ditch (SID) over the 30-year HCP period. Tidally influenced portions of these features may support undocumented occurrences of soft bird's-beak. Approximately 23 outfall structures located in Coastal Marsh will be subject to periodic maintenance that may impact soft bird's-beak if it is present on channel banks adjacent to the outfalls. Avoidance and Minimization Measure CM 5 (see Section 6.3.7.2) specifically addresses potential impacts to soft bird's-beak.
- b. **Indirect Effects.** Indirect effects to soft bird's-beak from operations and maintenance activities are expected to be minimal since such activities are temporary and do not result in permanent changes to the physical structure of the affected features (e.g., channels and outfalls).
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** There are 13 occurrences of soft bird's-beak located in preserves and reserves in Solano County. Of these 13 occurrences, 8 are located in existing protected areas managed by agencies/organizations that are not direct participants in the Solano HCP. Soft bird's-beak is also reported to occur at the proposed North Suisun Mitigation Bank site, which is expected to be certified to provide mitigation for Solano HCP Covered Activities.
 - a. **Direct Effects.** Marsh restoration activities on preserves and reserves are not expected to result in direct effects to soft bird's-beak. Although no specific plans have been formulated for establishing new populations, plant material (seeds and plants) from existing populations could be collected for future restoration efforts. There is also a concern that plants may be trampled by cattle. If cattle grazing is used on preserves with soft bird's-beak, the population will be closely monitored to ensure that trampling does not occur.
 - b. **Indirect Effects.** Marsh restoration activities on preserves and reserves will not result in indirect effects to soft bird's-beak.
 5. **Requested Take Summary.** Soft bird's-beak is very rare in California, and Solano County supports several populations. No direct loss of plants or occupied habitat for Zone 1 or Zone 2 Covered Activities is requested. In Covered Activity Zone 3, no more than 10 percent of any one population or stand of soft bird's-beak may be harvested for transplanting efforts.
 6. **Conservation Summary.** As with the other Coastal Marsh plant species, no specific recovery plan has been adopted for this species. Desirable recovery objectives for this species would include preservation of existing populations in secure reserves, establishment of new populations, and measures to control invasive exotic species that may compete with native species. Potential new reserves with areas suitable for establishing or expanding populations include the tidal marsh transitional areas at the North Suisun Mitigation Bank and the Tooby and Barnfield sites in western Suisun City. Under the HCP, conservation efforts in coastal marsh habitats primarily focus on invasive species control (Objective CM 1.1).

8.7.7.3 Mason's Lilaepsis

Mason's lilaepsis grows in regularly flooded tidal zones, freshwater marshes, brackish marshes, riparian scrub, and on banks and mud flats that are in some way influenced by saline water (CSCC 2003, Fiedler and Zebell 1995). Mason's lilaepsis also grows with the following Special Management Species: Delta mudwort (*Limosella subulata*), Suisun Marsh aster (*Aster lentus*), and Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*). Mason's lilaepsis is a colonizing species in that it "exploits" newly deposited or exposed sediments (CDFG 2004a, CNPS 2011).



Mason's lilaepsis is widespread through the tidally influenced areas of Solano County. It is known from all parts of Suisun Marsh, around Mare Island, from Dutchman's Slough in the west to Collinsville Slough in the east, and from Roe Island and Van Sickle Island in the south to Peytonia Slough in the north. It is also present in the Jepson Prairie Preserve. Mason's lilaepsis is threatened by erosion, bank and channel stabilization, flood control projects, development, agriculture, and invasion by exotic aquatic plant water-hyacinth (*Eichhornia crassipes*) (CDFG 2004a, CNPS 2011).

1. **Development Effects (Covered Activity Zones 1 and 2).** Three existing occurrences and one historical occurrence of Mason's lilaepsis are located in Covered Activity Zone 1.

- a. **Direct Effects.** Because Mason's lilaepsis occurs on the mud banks at the edge of sloughs, impacts are possible as a result of adding infrastructure (such as bridges, storm water outfalls, or slope stabilization) to support development in Fairfield, Suisun City, Vallejo, and Rio Vista in Covered Activity Zone 1.

Up to 25 ac of development are allowed in the Coastal Marsh Natural Community in Coastal Marsh Zone 1. Direct effects to suitable habitat for Mason's lilaepsis may result from adding infrastructure (such as bridges, storm water outfalls, or slope stabilization) to support development in Fairfield, Suisun City, Vallejo, and Rio Vista in Covered Activity Zone 1. As such, 75 ac of created/restored coastal marsh habitat in the high value conservation areas will be preserved as habitat and will not be subject to conversion to urban land uses. Direct impacts to Mason's lilaepsis habitat will occur in the Cities of Fairfield (2 ac), Rio Vista (3 ac), Suisun City (5 ac), and Vallejo (15 ac). No Mason's lilaepsis habitat will be directly affected by development in the Cities of Dixon or Vacaville.

Direct effects to suitable Mason's lilaepsis habitat will also result from projects initiated by the cities outside their respective UGBs. Such activities will result in up to approximately 4.2 ac of additional direct effects to coastal marsh habitat. The direct effects to the Coastal Marsh Natural Community outside of their respective UGBs will occur in the Cities of Fairfield (0.2 ac), Rio Vista (1 ac), Suisun City (1 ac), and Vallejo (2 ac). No direct effects to the Coastal Marsh Natural Community outside of their respective UGBs will occur in Dixon and Vacaville.

- b. **Indirect Effects.** Mason's lilaepsis habitat in Covered Activity Zone 1 may be indirectly affected by development activities. Indirect effects include trampling by fishermen and the introduction of water-hyacinth (*Eichhornia crassipes*), an extremely invasive aquatic plant (CNDDDB 2008, CNPS 2008).

2. **Irrigation and Reclamation District Construction and Annexation Effects (Zones 1 and 2).** Approximately 595 ac or 99 mi of new irrigation and flood control facilities may be constructed during the life of the HCP. Most if not all of the land impacted by these activities will be agricultural lands and not habitat for Mason's lilaepsis, with a few minor exceptions.

- a. **Direct Effects.** The only area where coastal marsh habitat may be affected is if additional facilities are worked on along the lower portions of the Green Valley Flood Control Project or in the lower Ulatis Creek Flood Control Channel. New facilities in these areas are highly unlikely; however, up to 1 ac of coastal marsh habitats and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the construction of new irrigation and



- reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
- b. **Indirect Effects.** Indirect effects to coastal marsh habitats could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Suitable habitat for Mason's lilaepsis may occur in the southern tidally influenced portions of Covered Activity Zone 2 in channels and sloughs administered by SCWA (Ulatis Creek and Green Valley) and in areas adjacent to the FSSD or Suisun City outfall.
 - a. **Direct Effects.** Operation and maintenance activities are not likely to result in direct effects to Mason's lilaepsis if the protocols in Chapter 6.0 are implemented. These protocols are designed to avoid impacts to species covered under the HCP. In the event impacts are unavoidable, they would be mitigated at a 3:1 ratio, including salvage and transplanting requirements to re-establish impacted populations on mitigation sites.
 - b. **Indirect Effects.** Indirect effects to Mason's lilaepsis from operation and maintenance activities are expected to be minimal since such activities are temporary and do not result in permanent changes to the physical structure of the affected features (e.g., channels and outfalls).
 4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** There are 32 occurrences of Mason's lilaepsis in Covered Activity Zone 3. Eight of these occurrences are located in protected areas.
 - a. **Direct Effects.** Marsh restoration activities that could directly affect Mason's lilaepsis include channel and levee construction and maintenance. Management and restoration plans should account for impacts to Mason's lilaepsis, avoid existing occurrences, and establish populations in new areas.
 - b. **Indirect Effects.** Since marsh restoration activities will result in improved habitat conditions for Mason's lilaepsis and other Coastal Marsh species in the long term, no indirect effects are expected.
 5. **Requested Take Summary.** An unknown number of individuals could be affected by development in Covered Activity Zones 1 and 2. The maximum direct permanent take of habitat as a result of Covered Activity Zone 1 and 2 activities is 30.2 ac. For Covered Activity Zone 3, no more than 10 percent of any population/stand per year would be harvested for seed or adversely modified through other management activities.
 6. **Conservation Summary.** No specific recovery plan has been adopted for this species. Desirable recovery objectives for this species include preservation of existing populations in secure reserves, establishment of new populations, and measures to control invasive exotic species that may compete with native species. Potential new reserves with areas suitable for establishing or expanding populations include the Barker Slough area in the Elsie Gridley Mitigation Bank, which was established, in part, to help fulfill anticipated Solano HCP conservation actions. Under the HCP, conservation efforts in coastal marsh habitats primarily focus on invasive species control (Objective CM 1.1). Mitigation requirements for unavoidable Covered Activities would require replacement of occupied habitat and populations at a ratio of 3:1.



8.7.7.4 California Black Rail

California black rail has been observed using fresh, brackish, and pickleweed-dominated salt marshes (Cogswell 1977, Ehrlich et al. 1988). California black rails appear to prefer tidal salt marshes with a heavy canopy of pickleweed (*Salicornia*) and an open structure below the canopy for nesting and accessibility (Evens and Page 1983). Manolis (1978) found that 95 percent of California black rails were in marshes dominated by either *Salicornia virginica* or bulrush (*Scirpus* spp.). In freshwater marshes, California black rail is usually found in bulrushes, cattails, and saltgrass. In Solano County, California black rail appears to be widely distributed and relatively common in tidal marshes along San Pablo Bay and in portions of Suisun Marsh.

1. **Development Effects (Covered Activity Zones 1 and 2).** Two California black rail occurrences are located in Covered Activity Zone 1, and at least one of these occurrences is located in a protected area.
 - a. **Direct Effects.** Direct effects to California black rail are not likely because of the Suisun Marsh Protection Plan and other regulations that limit direct impacts to the marsh. Some direct effects may occur in Covered Activity Zone 2 as a result of the expansion of Cordelia Road in Fairfield. If development occurs adjacent to areas with suitable habitat, Avoidance and Minimization Measure CM 8 will minimize direct impacts to nesting birds during construction by maintaining a 700 ft buffer.
 - b. **Indirect Effects.** In Covered Activity Zone 1, the primary indirect effects on California black rail are associated with disturbance and predation from feral animals, pets, and increased populations of urban-adapted native predators. Avoidance and Minimization Measure CM 8 will minimize disturbance during construction.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** The only area where coastal marsh habitat may be affected is if additional facilities are worked on along the lower portions of the Green Valley Flood Control Project or in the lower Ulatis Creek Flood Control Channel. New facilities in these areas are highly unlikely; however, up to 1 ac of coastal marsh habitat and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
 - b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** California black rail is not known to occur in Covered Activity Zone 2, although it may occur in stands of cattails, tules, or other vegetation associated with tidally influenced portions of flood control channels (channelized and unmodified streams), irrigation ditches, and drainage ditches.



- a. **Direct Effects.** Operation and maintenance activities are not likely to result in direct effects to California black rail if Avoidance and Minimization Measure CM 8 (see Section 6.3.7.2) is implemented.
 - b. **Indirect Effects.** Indirect effects to California black rail from operation and maintenance activities are expected to be minimal since such activities are temporary and do not result in permanent changes to the physical structure of the affected features (e.g., channels and outfalls). The removal of vegetative cover from these features may temporarily render small areas of channels unsuitable for California black rail, but given the frequency of maintenance, it is highly unlikely that California black rail regularly use them.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Nine occurrences of California black rail are located in Covered Activity Zone 3 and eight occurrences are located in protected areas.
- a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be the creation of new tidal channels on marsh restoration sites, which will require the excavation of existing marsh habitat. If conducted during the breeding season, such activities could destroy California black rail nests and/or cause nest abandonment due to disturbance. Implementation of Avoidance and Minimization Measure CM 8 will ensure that this impact is avoided. The implementation of programs to control invasive exotic species may have temporary direct effects on California black rail populations.
 - b. **Indirect Effects.** Since marsh restoration activities will result in improved habitat conditions for California black rail and other Coastal Marsh species in the long term, no indirect effects are expected.
5. **Requested Take Summary.** Implementation of the Solano HCP Conservation Strategy will greatly reduce, if not eliminate, direct impacts to California black rail. Take of habitat will include up to 29.2 ac of permanent impacts for development and the temporary loss of up to 10 ac throughout the life of the HCP.
6. **Conservation Summary.** No specific recovery plan has been adopted for this species. Potential habitat for this species will be protected in western Suisun City on the Tooby and Barnfield sites (approximately 159 ac) as part of the proposed mitigation for the Gentry-Suisun Development Project (Raney Planning and Management, Inc. 2006). Under the HCP, conservation efforts in coastal marsh habitats primarily focus on invasive species control (Objective CM 1.1).

8.7.7.5 California Clapper Rail

California clapper rails inhabit tidal salt and brackish marshes of the greater San Francisco Bay Estuary. They prefer tall stands of pickleweed (*Salicornia virginica*) and Pacific cordgrass (*Spartina foliosa*) but are also associated with gumplant (*Grindelia* spp.), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia grandifolia*), bulrush (*Scirpus* spp.), and jaumea (*Jaumea carnosa*) (Grinnell et al. 1918, DeGroot 1927, Harvey 1988, Collins et al. 1994). Brackish wetland habitat occurs in parts of the Napa Marsh, Petaluma River, Sonoma Creek, and Suisun Bay (Gill 1979). California clapper rail prefers tidal sloughs that provide direct tidal circulation. This species also requires shallow water and mudflats with sparse vegetation and abundant invertebrate populations for foraging and escape routes from predators (Zembal and Massey 1983, Foerster et al. 1990). Higher elevation marshes are utilized for nesting habitat and refuge from high tides (DeGroot 1927, Harvey 1988, Foerster et al. 1990, Evens and Collins 1992, Collins et al. 1994).



In Solano County, this species primarily occurs in the tidal marshes bordering San Pablo Bay and the Napa River. California clapper rails have periodically occurred at several sites in Suisun Bay, indicating that populations are present some years and not others (Albertson and Evens 2000).

1. **Development Effects (Covered Activity Zones 1 and 2).** Although California clapper rail is known from the White Slough and San Pablo Bay tidal marshes adjacent to development zones in Vallejo, no direct or indirect effects on clapper rails are anticipated.
 - a. **Direct Effects.** Direct effects to California clapper rail are not likely because of the Suisun Marsh Protection Plan and other regulations that limit direct impacts to the marsh. Some direct effects may occur in Covered Activity Zone 2 as a result of the expansion of Cordelia Road in Fairfield. If development occurs adjacent to areas with suitable habitat, Avoidance and Minimization Measure CM 8 will minimize direct impacts to nesting birds during construction by maintaining a 700 ft buffer.
 - b. **Indirect Effects.** In Covered Activity Zone 1, the primary indirect effects on California clapper rail are associated with disturbance and predation from feral animals, pets, and increased populations of urban-adapted native predators. Avoidance and Minimization Measure CM 8 will minimize disturbance during construction.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** The only area where coastal marsh habitat may be affected is if additional facilities are worked on along the lower portions of the Green Valley Flood Control Project or in the lower Ulatis Creek Flood Control Channel. No more than 1 ac of coastal marsh habitat and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
 - b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** The only operation and maintenance activity with the potential to affect California clapper rail is vegetation removal at the 23 outfall structures in the Coastal Marsh. This species is not expected to occur in flood control channels, irrigation ditches, or drainage ditches since none of the affected channels contain fully tidal coastal marsh habitat.
 - a. **Direct Effects.** Possible direct effects from outfall vegetation removal activities include increased exposure to predators when moving in response to equipment noise, reduced foraging efficiency during vegetation removal activities, and short-term loss of vegetative cover. Implementation of Avoidance and Minimization Measure CM 8 (see Section 6.3.7) will ensure that substantial adverse effects are avoided.



- b. **Indirect Effects.** Indirect effects to California clapper rail from operation and maintenance activities are expected to be minimal since such activities are temporary and appropriate avoidance and minimization measures in Chapter 6.0 will be followed. The removal of vegetative cover from maintenance features may temporarily render small areas of channels as unsuitable for California clapper rail, but given the frequency of maintenance, it is highly unlikely that California clapper rail regularly use them.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Potential direct and indirect effects to California clapper rail from marsh restoration activities on preserves and reserves are discussed below.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be the creation of new tidal channels on marsh restoration sites, which will require the excavation of existing marsh habitat. If conducted during the breeding season, such activities could destroy California clapper rail nests and/or cause nest abandonment due to disturbance. Implementation of Avoidance and Minimization Measure CM 8 will ensure that this impact is avoided. The implementation of programs to control invasive exotic species may have temporary direct effects on California clapper rail populations.
 - b. **Indirect Effects.** Since marsh restoration activities will result in improved habitat conditions for California clapper rail and other Coastal Marsh species in the long term, no indirect effects are expected.
 5. **Requested Take Summary.** Implementation of the Solano HCP Conservation Strategy will greatly reduce, if not eliminate, direct impacts to California clapper rail. Take of habitat will include up to 29.2 ac of permanent impacts for development and the temporary loss of up to 10 ac throughout the life of the HCP.
 6. **Conservation Summary.** Development of the diked marshes in Vallejo, if authorized, would require 3:1 compensation at minimum, most likely by establishing additional tidal marsh habitat that could ultimately support this species. Under the HCP, conservation efforts in coastal marsh habitats primarily focus on invasive species control (Objective CM 1.1).

8.7.7.6 Salt Marsh Harvest Mouse

Salt marsh harvest mouse is dependent on dense cover of native halophytes (salt-tolerant plants), and prefer saline emergent wetlands dominated by pickleweed (*Salicornia virginica*) (Shellhammer 1977). The most suitable habitat for salt marsh harvest mouse is deep (60 to 75 centimeters [cm] tall), dense pickleweed intermixed with fat hen (*Atriplex patula*) and alkali heath (*Frankenia grandifolia*) (Shellhammer 1982), although harvest mice also use uplands adjacent to marshes during some seasons. The species requires non-submerged, salt tolerant vegetation to escape the high tide (Shellhammer et al. 1982). During high tides, populations of salt marsh harvest mice tend to concentrate in relatively flat areas of the high marsh zone (Fisler 1965). Unlike many of the Coastal Marsh endemic species addressed above that are primarily restricted to tidal marsh habitats, the salt marsh harvest mouse has also been found in diked, nontidal marsh habitats.

Populations of the northern subspecies of salt marsh harvest mouse exist in Solano County in the pickleweed habitat fringing the northern shore of San Pablo Bay, Southampton Marsh, and throughout most of Suisun Marsh.



1. **Development Effects (Covered Activity Zones 1 and 2).** Salt marsh harvest mouse and suitable habitat in Covered Activity Zone 1 occur in western Suisun City and the Mare Island and White Slough areas of Vallejo. Planned urban development includes western Suisun City and approximately 485 ac of marsh and adjacent upland habitat on Mare Island; however, only 15 ac of coastal marsh habitat in Vallejo will be developed under the HCP. coastal marsh habitat and the majority of the adjacent vernal pool grassland habitat on the Tooby property in western Suisun City would be preserved as part of the proposed mitigation for the Gentry-Suisun Development Project (Raney Planning and Management, Inc. 2006). The status of potential habitat in Vallejo would need to be determined prior to development.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities will only occur in agricultural areas and will not occur in suitable salt marsh harvest mouse habitat.
 - a. **Direct Effects.** No direct effects to suitable salt marsh harvest mouse habitat are anticipated.
 - b. **Indirect Effects.** No indirect effects to suitable salt marsh harvest mouse habitat are anticipated.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Potentially suitable habitat for salt marsh harvest mouse occurs along the lower reaches of the Ledgewood Creek and Green Valley Creek flood control channels (downstream of Cordelia Road). The only operation and maintenance activity with the potential to affect this species is vegetation removal at the 23 outfall structures in these areas. This species is not expected to occur in flood control channels, irrigation ditches, or drainage ditches since none of the affected channels are located in fully tidal Coastal Marsh.
 - a. **Direct Effects.** Possible direct effects from outfall vegetation removal activities include increased exposure to predators when moving in response to equipment noise, reduced foraging efficiency during vegetation removal activities, and short-term loss of vegetative cover. Implementation of Avoidance and Minimization Measure CM 6 will ensure that substantial adverse effects are avoided.
 - b. **Indirect Effects.** Indirect effects to salt marsh harvest mouse from operation and maintenance activities are expected to be minimal since such activities are temporary and do not result in permanent changes to the physical structure of the affected features.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Potential direct and indirect effects to salt marsh harvest mouse from marsh restoration activities on preserves and reserves are discussed below.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be the creation of new tidal channels on marsh restoration sites, which will require the excavation of existing coastal marsh habitat. Such activities could result in the take of individual salt marsh harvest mice. Implementation of Avoidance and Minimization Measure CM 6 will ensure that this impact is avoided.
 - b. **Indirect Effects.** Since marsh restoration activities will result in improved habitat conditions for salt marsh harvest mouse and other Coastal Marsh species in the long term, no indirect effects are expected.
5. **Requested Take Summary.** Implementation of the Solano HCP Conservation Strategy will greatly reduce, if not eliminate, direct impacts to the salt marsh harvest mouse. Take of habitat



will include up to 29.2 ac of permanent impacts for development and the temporary loss of up to 10 ac throughout the life of the HCP.

6. **Conservation Summary.** Approximately 160 ac of tidal marsh habitat on the Tooby and Barnfield sites in western Suisun City would be preserved as part of the proposed mitigation for the Gentry-Suisun Development Project (Raney Planning and Management, Inc. 2006). In addition, Objective CM 1.1 (which is related to invasive species control) will contribute to this species' recovery. Riparian, Stream and Freshwater Marsh mitigation measures for habitat replacement associated with temporary and permanent impacts would contribute to re-establishing habitat for this species along maintained channels.

8.7.7.7 Delta Smelt

In Solano County, Delta smelt are found in Suisun Bay/Suisun Marsh sloughs upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. In Solano County, Delta smelt have been known to spawn in the Sacramento River and in the Barker, Lindsey, and Cache sloughs (Wang 1991). Delta smelt also spawn north of Suisun Bay in the Montezuma and Suisun sloughs and their tributaries.

1. **Development Effects (Covered Activity Zones 1 and 2).** Development-related effects would be limited to indirect effects. No direct effects are anticipated.
 - a. **Direct Effects.** Delta smelt habitat is largely excluded from Covered Activity Zone 1, and direct effects are not anticipated.
 - b. **Indirect Effects.** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality. While a number of the endemic Coastal Marsh plant species appear to require high salinity and can be adversely affected by urban runoff and wastewater effluent discharge, such discharges appear to be beneficial for the Delta smelt.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** No direct effects to suitable Delta smelt habitat are anticipated.
 - b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Suitable habitat for Delta smelt occurs along the lower reaches of the McCoy Creek, LedgeWood Creek, Green Valley Creek, and lower Ulati Creek Flood Control Channels.
 - a. **Direct Effects.** Maintenance activities in the McCoy Creek, LedgeWood Creek, Green Valley Creek, and lower Ulati Creek Flood Control Channels periodically disturb habitat for this species. Avoidance and Minimization Measure CM 7 (see Section 6.3.7) addresses potential impacts to this and other fish species.
 - b. **Indirect Effects.** No indirect effects to suitable Delta smelt habitat are anticipated.



4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Temporary direct effects on Delta smelt habitat may occur as the result of Covered Activities.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be restoring 175 ac of shallow water aquatic breeding and rearing habitat in the lower Delta area of Solano County. Such activities could temporarily affect Delta smelt. Implementation of Avoidance and Minimization Measure CM 7 will ensure that this impact is avoided.
 - b. **Indirect Effects.** No indirect effects to suitable Delta smelt habitat are anticipated.
5. **Requested Take Summary.** The Delta smelt is not likely to be affected by the actions of the Solano HCP. Urban runoff from development authorized under the Solano HCP will be treated to the maximum extent practicable such that significant harm is avoided. Take will only be allowed in conjunction with operations and maintenance activities and would only consist of temporary impacts to habitat outside the breeding season (see Avoidance and Minimization Measure CM 7).
6. **Conservation Summary.** Covered Activities will have little direct effect on the Delta smelt or its critical habitat. The primary population/habitat areas lie outside of the Plan Area or occur in areas with existing regulatory protection (e.g., Suisun Marsh). Primary issues for this species are associated with the effects on water quality from urban runoff into the Delta and Suisun Marsh, which will be minimized by implementing Mitigation Measure RSM 9. In addition, Plan Participants will restore and manage 175 ac of shallow water aquatic breeding and rearing habitat in the lower Delta area of Solano County (Mitigation Measure CM 7).

8.7.7.8 Sacramento Splittail

Historically, the Sacramento splittail resided throughout the Sacramento-San Joaquin River drainage in California's Central Valley (USFWS 2002b). Currently, native populations are restricted to the San Francisco Bay Delta, Suisun Bay, Suisun Marsh, Napa River, Petaluma River, and other parts of the Sacramento-San Joaquin Estuary (Caywood 1974, Moyle 1976). In Solano County, splittail are year-round residents of the Suisun Marsh, concentrating in the dead-end sloughs that typically have small streams feeding into them. Splittail may also be locally common in and around the marshy areas of the upper Delta in the Yolo Bypass and upper reaches of other tidally influenced sloughs.

1. **Development Effects (Covered Activity Zones 1 and 2).** Splittail habitat is largely excluded from Covered Activity Zone 1.
 - a. **Direct Effects.** No direct effects to suitable Sacramento splittail habitat are anticipated.
 - b. **Indirect Effects.** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality. While a number of the endemic Coastal Marsh plant species appear to require high salinity and can be adversely affected by urban runoff and wastewater effluent discharge, such discharges appear to be beneficial for the Sacramento Splittail. Objective CM 1.1 will implement programs to improve water quality in the marsh and mitigate for potential indirect effects to Sacramento Splittail.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.



- a. **Direct Effects.** The only area where coastal marsh habitat may be affected is if additional facilities are worked on along the lower portions of the Green Valley Flood Control Project or in the lower Ulatis Creek Flood Control Channel. New facilities in these areas are highly unlikely; however, up to 1 ac of coastal marsh habitat and 14 ac of existing levee habitat will be directly affected over the life of the Plan for the construction of new irrigation and reclamation district facilities. All avoidance, minimization, and mitigation measures in Chapter 6.0 will be implemented to reduce direct effects.
- b. **Indirect Effects.** Indirect effects to coastal marsh habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Suitable habitat for Sacramento splittail occurs along the lower reaches of the McCoy Creek, Ledgewood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels.
 - a. **Direct Effects.** Maintenance activities in the McCoy Creek, Ledgewood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels periodically disturb habitat for Sacramento splittail. Avoidance and Minimization Measure CM 7 (see Section 6.3.7) addresses potential impacts to this and other fish species.
 - b. **Indirect Effects.** No indirect effects to suitable Sacramento splittail habitat are anticipated.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Temporary direct effects on Sacramento splittail habitat may occur as the result of activities on preserves and reserves.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be restoring 175 ac of shallow water aquatic breeding and rearing habitat in the lower Delta area of Solano County. Such activities could temporarily affect Sacramento splittail. Implementation of Avoidance and Minimization Measure CM 7 will ensure that this impact is avoided.
 - b. **Indirect Effects.** No indirect effects to suitable Sacramento splittail habitat are anticipated.
5. **Requested Take Summary.** The Sacramento splittail will be minimally affected by the actions of the Solano HCP. Discharge from new urban development authorized under the Solano HCP will be treated to the maximum extent practicable such that significant impacts are avoided. Take will only be allowed in conjunction with Covered Activity Zone 2 and 3 activities and would consist of temporary impacts to habitat outside the breeding season.
6. **Conservation Summary.** Covered Activities will have little direct effect on the Sacramento splittail or its habitat. The primary population/habitat areas lie outside of Covered Activity Zone 1 or occur in areas with existing regulatory protection (e.g., Suisun Marsh) or limited threat of future habitat reduction. Primary issues for this species are associated with the effects on water quality from urban runoff into the Delta and Suisun Marsh. Other concerns for this species are related to water export and the effects of pumping in the Delta, and are not Covered Activities under the Solano HCP.



8.7.7.9 Longfin Smelt

The longfin smelt was accepted as a candidate for endangered species status on February 7, 2008. Abundance of the longfin smelt has reached record lows in the San Francisco-Delta population, and the species may already be extinct in some northern California estuarine populations, resulting in an overall threat of extinction to the species in California (USFWS 2008a).

1. **Development Effects (Covered Activity Zones 1 and 2).** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality. Longfin smelt habitat is largely excluded from Covered Activity Zone 1.
 - a. **Direct Effects.** No direct effects to suitable longfin smelt habitat are anticipated.
 - b. **Indirect Effects.** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality. While a number of the endemic Coastal Marsh plant species appear to require high salinity and can be adversely affected by urban runoff and wastewater effluent discharge, such discharges appear to be beneficial for this species. Objective CM 1.1 will implement programs to improve water quality in the marsh and mitigate for potential indirect effects to this species.
2. **Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** No direct effects to suitable longfin smelt habitat are anticipated.
 - b. **Indirect Effects.** Indirect effects to longfin smelt habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Suitable habitat for longfin smelt occurs along the lower reaches of the McCoy Creek, Ledgewood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels.
 - a. **Direct Effects.** Maintenance activities in the McCoy Creek, Ledgewood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels periodically disturb habitat for longfin smelt. Avoidance and Minimization Measure CM 7 (see Section 6.3.7) addresses potential impacts to this and other fish species.
 - b. **Indirect Effects.** No indirect effects to suitable longfin smelt habitat are anticipated.
4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Temporary direct effects on longfin smelt habitat may occur as the result of activities on preserves and reserves.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be restoring 175 ac of shallow water aquatic breeding and rearing habitat in the lower Delta area of Solano County. Such activities could temporarily affect longfin smelt. Implementation of Avoidance and Minimization Measure CM 7 will ensure that this impact is avoided.
 - b. **Indirect Effects.** No indirect effects to suitable longfin smelt habitat are anticipated.



5. **Requested Take Summary.** The longfin smelt is not likely to be harmed by the actions of the Solano HCP. Runoff from urban developments authorized under the Solano HCP will be treated to the maximum extent practicable such that significant harm is avoided. Take will only be allowed in conjunction with Covered Activity Zone 2 and 3 activities and would consist of temporary impacts to habitat outside the breeding season.
6. **Conservation Summary.** Covered Activities have little direct effect on the longfin smelt or its habitat. The primary population/habitat areas lie outside of the Plan Area or occur in areas with existing regulatory protection (e.g., Suisun Marsh). Primary issues for this species are associated with the effects on water quality from urban runoff into the Delta and Suisun Marsh, which will be minimized through the implementation of Mitigation Measure RSM 9.

8.7.7.10 Green Sturgeon

Green sturgeon is known to be present in small numbers in the Delta, Suisun Bay, and San Pablo Bay; however, good data on population levels are not available.

1. **Development Effects (Covered Activity Zones 1 and 2).** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality.
 - a. **Direct Effects.** Green sturgeon habitat is largely excluded from Covered Activity Zone 1 and direct effects are not anticipated.
 - b. **Indirect Effects.** Development-related effects would be limited to indirect effects associated with urban runoff and poor water quality. While a number of the endemic Coastal Marsh plant species appear to require high salinity and can be adversely affected by urban runoff and wastewater effluent discharge, such discharges appear to be beneficial for green sturgeon. Objective CM 1.1 will implement programs to improve water quality in the marsh and mitigate for potential indirect effects to green sturgeon.
2. **Irrigation and Reclamation Construction and Annexation Effects (Covered Activity Zones 1 and 2).** Construction of new irrigation and flood control facilities for special districts may affect approximately 595 ac or 99 mi of habitat, most if not all of which will occur on agricultural lands.
 - a. **Direct Effects.** No direct effects to suitable green sturgeon habitat are anticipated.
 - b. **Indirect Effects.** Indirect effects to suitable green sturgeon habitat could include changes to hydrology from increased agricultural runoff, increased sedimentation, and a decrease in water quality from additional farmland runoff. These indirect effects will be partially minimized by Objective GGS 1.1, the implementation of programs to improve water quality.
3. **Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2).** Suitable habitat for green sturgeon occurs along the lower reaches of the McCoy Creek, Ledge wood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels.
 - a. **Direct Effects.** Maintenance activities in the McCoy Creek, Ledge wood Creek, Green Valley Creek, and lower Ulatis Creek Flood Control Channels periodically disturb habitat for green sturgeon. Avoidance and Minimization Measure CM 7 (see Section 6.3.7) addresses potential impacts to this and other fish species.
 - b. **Indirect Effects.** No indirect effects to suitable green sturgeon habitat are anticipated.



4. **Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3).** Temporary direct effects on green sturgeon habitat may occur as the result of Covered Activities on preserves and reserves.
 - a. **Direct Effects.** The primary direct effect of Covered Activities on preserves and reserves will be restoring 175 ac of shallow water aquatic breeding and rearing habitat in the lower Delta area of Solano County. Such activities could temporarily affect green sturgeon. Implementation of Avoidance and Minimization Measure CM 7 will ensure that this impact is avoided.
 - b. **Indirect Effects.** No indirect effects to suitable green sturgeon habitat are anticipated.
5. **Requested Take Summary.** The green sturgeon is not likely to be harmed by the actions of the Solano HCP. Runoff from urban developments authorized under the Solano HCP will be treated to the maximum extent practicable such that significant harm is avoided. Take will only be allowed in conjunction with Covered Activity Zone 2 and 3 activities and would consist of temporary impacts to habitat outside the breeding season.
6. **Conservation Summary.** Covered Activities have little direct effect on green sturgeon or its habitat. The primary population/habitat areas lie outside of the Plan Area or occur in areas with existing regulatory protection (e.g., Suisun Marsh). Primary issues for green sturgeon are associated with the effects on water quality from urban runoff into the Delta and Suisun Marsh, which will be minimized through implementation of Mitigation Measure RSM 9.

8.8 SWAINSON'S HAWK IMPACT ASSESSMENT

In California's Central Valley, Swainson's hawk is primarily associated with agricultural fields, with alfalfa providing the highest quality foraging habitat, but forages in a wide range of habitat types including grassland and oak savanna. Nest sites are typically located in riparian woodlands or lone trees or groves of trees in agricultural fields. Not surprisingly, the majority of known Swainson's hawk nest records in the Plan Area are associated with irrigated agriculture.

8.8.1 Development Effects (Covered Activity Zones 1 and 2)

8.8.1.1 Direct Effects

Approximately 16,095 ac of suitable Swainson's hawk foraging habitat will be developed under the Solano HCP, including 5,970 ac of Irrigated Agriculture, 6,620 ac of Valley Floor and Vernal Pool Grassland, and 3,505 ac of inner coast range habitat (see Table 8.11).

Table 8.11: Conversion of Swainson's Hawk Foraging Habitat in Covered Activity Zone 1 (acres)

Community Type	Dixon	Fairfield	Rio Vista	Suisun City	Vacaville	Vallejo	Total
Irrigated Agriculture Conservation Area	1,930	430	50	0	3,550	10	5,970
Valley Floor and Vernal Pool Grassland Conservation Area	14	2,430	1,393	473	2,048	262	6,620
Inner Coast Range Conservation Area	0	1,705	0	0	590	1,210	3,505
Total Planned Development	1,944	4,565	1,443	473	6,188	1,482	16,095



Anticipated development in Dixon, Vacaville, and Fairfield will result in the take of 27 known Swainson’s hawk nest trees (i.e., trees where breeding activity has been observed at least once since 2000). Most development in the Inner Coast Range will occur in northwestern Fairfield, in an area referred to as the Rancho Solano North Master Plan Area, and in the eastern hills of Vallejo. While both areas encompass a large expanse of land, the extent of development is expected to be limited due to other constraints such as steep slopes and visual considerations (see Section 3.6 for more details). The Fairfield General Plan (City of Fairfield 2002, 2003) also calls for creation of a large regional park for the Rancho Solano North Master Plan Area. Therefore, conversion of inner coast range habitat will likely be less than what is listed in Table 8.11. Future urban development in the HCP Plan Area would represent a substantial, cumulative loss of foraging habitat and known nest sites in Solano County (approximately 19 percent of the estimated active nests).

Direct effects to Swainson’s hawk foraging habitat will also result from development activities implemented by the Cities of Dixon, Vacaville, and Fairfield outside their respective UGBs, such as construction of new storm water detention basins and treatment plants, road widening, new road construction, and recreation facilities (e.g., walking trails). Such activities will result in approximately 1,237 ac of additional direct effects to Swainson’s hawk foraging habitat, including 552 ac of Irrigated Agriculture, 345 ac of Valley Floor and Vernal Pool Grassland, and 340 ac of inner coast range habitat (see Table 8.12).

Table 8.12: Conversion of Swainson’s Hawk Foraging Habitat from City Activities Outside of UGBs (Covered Activity Zone 2) (acres)

Community Type	Dixon	Fairfield	Rio Vista	Suisun City	Vacaville	Vallejo	Total
Irrigated Agriculture Conservation Area	200	45	5	0	300	2	552
Valley Floor and Vernal Pool Grassland Conservation Area	0	150	100	25	50	20	345
Inner Coast Range Conservation Area	0	160	0	0	120	60	340
Total Planned Development	200	355	105	25	470	82	1237

8.8.1.2 Indirect Effects

The primary indirect effect on Swainson’s hawk from urban development will be an increased human presence in areas that were formerly rural. Pairs that traditionally nested in rural areas subject to less human disturbance will now be exposed to increased traffic levels and possibly increased harassment from humans. For example, pairs that nested in roadside tree rows that once hosted little traffic will be subject to increased traffic levels (including heavy trucks and construction equipment) as urbanization spreads onto outlying agricultural lands.

8.8.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

8.8.2.1 Direct Effects

The HCP allows the future construction of approximately 595 ac of new irrigation and flood control facilities for irrigation and reclamation district service area inclusions and potential annexations. This includes the construction of new facilities to update or improve aging infrastructure. All Covered Activities in this category are located in the agricultural portion of the Plan Area. The primary direct effect to Swainson’s hawk from such activities is the loss of suitable



agricultural foraging habitat due to the construction of new irrigation ditches or expansion of existing channels into adjacent agricultural land (e.g., converting a drainage-only ditch to a supply ditch). The 595 ac total is an estimate since some future construction in this category will replace existing and aging infrastructure and will not necessarily intrude into adjacent agricultural fields.

Construction of new irrigation and flood control facilities could disturb active Swainson's hawk nests if any are present nearby, resulting in nest abandonment. However, implementation of Avoidance and Minimization Measures SH 3, SH 4, and SH 5 (see Section 6.3.8) would ensure that such effects are avoided.

8.8.2.2 Indirect Effects

The main indirect effect to Swainson's hawk from the construction of new irrigation and flood control facilities or the annexation of new lands into irrigation districts would be the loss of additional suitable foraging habitat by conversion to incompatible crop types. Avoidance and Minimization Measure SH 2 will minimize this indirect effect by only allowing SID to annex additional lands into their service area until either the 3,000 ac maximum has been annexed or 600 ac of annexed lands have been converted into crop types or land uses that are incompatible with Swainson's hawk foraging (see Avoidance and Minimization Measure SH 2 in Chapter 6.0).

8.8.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

8.8.3.1 Direct Effects

In the Plan Area, Swainson's hawk often nests in native riparian vegetation along unmodified streams or in planted tree rows (windbreaks) along irrigation canals. The following operations and maintenance activities along such features (see Appendix A) have the potential to directly affect nesting Swainson's hawk via disturbance of nesting pairs or destruction of known nest trees; flood control channel bank maintenance; bank reconstruction, protection, and erosion control activities; grading of access roads; and vegetation management. Such activities will affect approximately 6,600 ac of City-maintained channels and 155,220 ac of irrigation district channels over the 30-year HCP period. Implementation of Avoidance and Minimization Measures SH 3, SH 4, and SH 5 will greatly reduce, if not eliminate, these direct effects.

8.8.3.2 Indirect Effects

Indirect effects to Swainson's hawk from routine operation and maintenance activities are expected to be minimal, since many such activities occur in rural areas or along City-owned rights-of-way that are closed to the public. These activities will not introduce a new long-term source of human disturbance to areas where Swainson's hawk nests and forages.

8.8.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

8.8.4.1 Direct Effects

Restoration and management activities on preserves and reserves are not expected to result in direct effects on Swainson's hawk. Disturbance of active nests will be avoided through the implementation of Avoidance and Minimization Measures SH 3, SH 4, and SH 5 (see Section 6.3.8).



8.8.4.2 Indirect Effects

Indirect effects on Swainson's hawk from restoration and management activities on preserves and reserves are expected to be beneficial since many Covered Activities in this category will be aimed at improving habitat for the species (e.g., planting of new nest trees as mitigation for development-related impacts).

8.8.5 Requested Take Summary

The maximum requested take for Swainson's hawk is 17,949 ac of suitable foraging habitat, including 7,117 ac of Irrigated Agriculture, 6,987 ac of valley floor grassland and vernal pool habitat, and 3,840 ac of inner coast range habitat (see Tables 8.11 and 8.12). In addition, development in Dixon, Vacaville, and Fairfield will result in the take of 27 known Swainson's hawk nest trees (i.e., trees where breeding activity has been observed at least once since 2000). No currently occupied nests would be taken in compliance with State and Federal regulations, although an unknown number of active foraging territories could be affected. No more than 600 ac of lands annexed by SID will be converted into crop types or land uses that are incompatible with Swainson's hawk foraging.

8.8.6 Conservation Summary

The CDFG has not adopted specific recovery standards or objectives for Swainson's hawk. Identified threats to this species include cumulative loss and alteration of foraging habitat, pesticide poisoning of prey animals, urban encroachment, poaching, competition from other raptors, and human disturbance at nest sites. The CDFG and others have also expressed concerns about limited recruitment of trees in agricultural areas that may lead to a future shortage of nest sites.

The Swainson's Hawk Conservation Strategy in this HCP includes conservation actions designed to: minimize potential adverse effects of Covered Activities; maintain sufficient suitable foraging habitat and nesting habitat in proximity to suitable foraging habitat to support the existing Swainson's hawk population in the Plan Area; and contribute to the range-wide recovery of the species. The primary conservation actions include preserving suitable foraging habitat, planting potential nest trees, preserving known nest trees, and minimizing potential impacts through the implementation of avoidance and minimization measures and BMPs. Under the Solano HCP Conservation Strategy, if the maximum allotted take occurs, a minimum of 17,949 ac of foraging habitat would be protected in the Swainson's Hawk Potential Reserve Areas (Figure 4-27).

Implementation of the mitigation measures contained in the HCP will result in the preservation of 17,949 ac of suitable Swainson's hawk foraging habitat in the Plan Area, consisting of 7,117 ac in the Irrigated Agriculture Potential Reserve Area, 6,987 ac in the Valley Floor Grassland Potential Reserve Area, 3,840 ac of oak savanna/grassland in the Inner Coast Range Potential Reserve Area, and an additional 1,000 ac in the Irrigated Agriculture Potential Reserve Area near known or active nest sites through direct acquisition or conservation easement.

Mitigation also entails the planting of new trees in Swainson's hawk reserves and the preservation of a known or active nest tree for every nest tree impacted. SCWA will also implement interim measures to protect active and known Swainson's hawk nests until such time as the HCP reserve system supports a number of nests equal to or greater than the number of nests lost as a result of HCP Covered Activities.



8.9 BURROWING OWL IMPACT ASSESSMENT

The majority of the burrowing owl records in Solano County are located in agricultural areas in the north-central portion of the County. In these agricultural areas, nesting habitat is primarily located along ditch and canal banks, railroad rights-of-way, and other set-aside areas where ground squirrel burrows or debris piles provide suitable nesting and cover sites. Burrowing owls are also known from vernal pool habitats in Jepson Prairie and the hills and valleys of the Potrero Hills (wintering only), and also occur in many urban areas in vacant lots, fields, and utility, railroad, and road/highway rights-of-way. The primary pressures directly affecting burrowing owls in Solano County are urbanization, intensive agriculture, cultivated grassland/dry-farming, and the current and past use of rodenticides.

8.9.1 Development Effects (Covered Activity Zones 1 and 2)

8.9.1.1 Direct Effects

Approximately 16,095 ac of suitable burrowing owl habitat will be developed under the Solano HCP, including 5,970 ac of Irrigated Agriculture, 6,620 ac of valley floor grassland and vernal pool habitat, and 3,505 ac of Inner Coast Range oak savanna (see Swainson's hawk impact discussion in Section 8.8). Long-term urban development and conversion of these habitats will result in the loss of at least 14 burrow sites known to support burrowing owls in the last 10 years; however, no currently occupied burrows would be taken in compliance with State and Federal regulations.

Direct effects to burrowing owl habitat will also result from development activities implemented by cities outside their respective UGBs, such as construction of detention or debris basins, communication service facilities, roads, and recreation facilities. Such activities will result in approximately 1,237 ac of additional direct effects to burrowing owl habitat, including 552 ac of irrigated agriculture, 345 ac of valley floor grassland and vernal pool habitat, and 340 ac of inner coast range habitat.

8.9.1.2 Indirect Effects

The primary indirect effect of urban development on burrowing owls will be further habitat fragmentation and isolation of breeding pairs from large blocks of suitable foraging and nesting habitat. Pairs in small, isolated habitat fragments (e.g., urban vacant lots) surrounded by development are more vulnerable to predation by nonnative predators (i.e., house cats) and disturbance by humans than those that nest in agricultural areas or large areas of grassland. Urbanization also results in increased densities of nonnative predators such as domestic dogs, cats, and red fox, which have been identified by several researchers as burrowing owl predators (Thomsen 1971, Martin 1973, Haug et al. 1993).

Increased vehicle traffic in formerly rural areas will result in a commensurate increase in burrowing owl vulnerability to vehicular collisions, which can be a significant source of mortality in some populations (see species account in Appendix B). This risk is exacerbated by the tendency of burrowing owl to forage and perch along roads at night.



8.9.2 Irrigation and Reclamation District Construction and Annexation Effects (Covered Activity Zones 1 and 2)

8.9.2.1 Direct Effects

The HCP allows the future construction of approximately 595 ac of new irrigation and flood control facilities for irrigation, reclamation, and special district service area inclusions and potential annexations. This includes the construction of new facilities to update or improve aging infrastructure. All Covered Activities in this category are located in the agricultural portion of the Plan Area. The primary direct effect to burrowing owl from such activities is the loss of suitable agricultural foraging habitat due to the construction of new irrigation ditches or expansion of existing channels into adjacent agricultural land (e.g., converting a drainage-only ditch to a supply ditch). The 595 ac total is considered a liberal estimate since some future construction in this category will replace existing and aging infrastructure and will not necessarily intrude into adjacent agricultural fields.

Construction of new facilities may also result in direct effects to burrowing owl if occupied burrows are present. Given their tendency to occur along irrigation ditches in agricultural areas, burrowing owl is especially susceptible to construction-related effects (e.g., disturbance, direct impacts to occupied burrows) associated with the replacement and/or modification of existing and aging irrigation and flood control ditches. Implementation of Avoidance and Minimization Measures BO 1, BO 2, and BO 3 will ensure that direct effects to occupied burrows are avoided during the construction of new irrigation and flood control facilities.

8.9.2.2 Indirect Effects

The main indirect effect to burrowing owl would be similar to that of Swainson's hawk, which is the loss of additional suitable foraging habitat by conversion to incompatible crop types after being annexed. Avoidance and Minimization Measure SH 2 will minimize this indirect effect by only allowing SID to annex additional lands into their service area until either the 3,000 ac maximum has been annexed or 600 ac of annexed lands have been converted into crop types or land uses that are incompatible with burrowing owl foraging. The creation of new irrigation ditches may actually benefit burrowing owl by providing additional burrowing habitat (i.e., earthen banks) for ground squirrels. This would be a beneficial indirect effect of new irrigation and flood control facility construction.

8.9.3 Operation and Maintenance Activity Effects (Covered Activity Zones 1 and 2)

8.9.3.1 Direct Effects

Burrowing owls often nest in the canal rights-of-way of the Plan Participants, particularly in irrigated agricultural areas in Solano County. Operation and maintenance activities associated with these facilities (e.g., road grading, bank maintenance) can result in the loss or damage of occupied nests and/or disturbance to nest sites. Bank maintenance activities will affect approximately 900 ac of existing irrigation district channels (e.g., unmodified streams, channelized streams, irrigation and drainage ditches) and 282 ac of City-maintained channels over the 30-year HCP period. Road grading will affect approximately 62,700 ac of existing irrigation district access roads and approximately 2,900 ac of City maintenance roads over the 30-year HCP period. These acreages reflect the amount of potential burrowing owl habitat that may be affected by Covered Activities. Bank maintenance and road grading activities in areas that are free of ground squirrel burrows are



not expected to adversely affect the species. Disking of firebreaks around Plan Participant facilities could also result in the destruction of occupied burrowing owl nests. Disking of City-maintained facilities for fire control will impact approximately 12,700 ac over the 30-year HCP period. All activities will follow the avoidance and minimization measures outlined in Chapter 6.0. Operation and maintenance activities will result in the direct loss of no more than five known nest sites during the life of the HCP.

8.9.3.2 Indirect Effects

Indirect effects on burrowing owls from routine operation and maintenance activities are expected to be minimal, since many such activities occur in rural areas or along City-owned rights-of-way that are closed to the public.

8.9.4 Activities on Preserves and Reserves (Covered Activity Zones 1, 2, and 3)

8.9.4.1 Direct Effects

Activities associated with reserve and preserve management are not anticipated to result in take of this species. Implementation of Avoidance and Minimization Measures BO 1 and BO 3 will ensure that any restoration or management activities that involve significant disturbance and/or noise (e.g., grading, mowing) will avoid impacts to occupied burrows.

8.9.4.2 Indirect Effects

Indirect effects on burrowing owl from restoration and management activities on preserves and reserves are expected to be beneficial since many Covered Activities in this category will be aimed at improving habitat for the species (e.g., controlling vegetation via mowing, artificial burrow installation).

8.9.5 Requested Take Summary

Requested take for burrowing owl habitat in Covered Activity Zones 1 and 2 is approximately 17,949 ac. Development in Vacaville, Dixon, Fairfield, and Suisun City will result in the loss of at least 14 burrow sites known to support burrowing owl in the last 10 years. This take estimate was derived from California Natural Diversity Database (CNDDDB) occurrence information as well as from known locations documented in various EIRs (i.e., Peabody-Walters Master Plan [Stephen Lafer & Associates 1994] and Gentry-Suisun Project Draft EIR [Raney Planning and Management, Inc. 2006]). In reality, the actual number of burrowing owl pairs that will be displaced by urban development may be higher. The maximum take of known nest sites as a result of operation and maintenance activities will be no more than five during the life of the Plan. Under current regulations, no direct take of burrowing owl is authorized under the Solano HCP. If agencies can authorize active relocation of nesting owls, no more than five pairs will be relocated per Plan Participant per year.

8.9.6 Conservation Summary

No formal recovery plans, standards, or objectives have been established for the burrowing owl, although the CDFG is currently preparing a statewide Burrowing Owl Conservation Strategy.



Identified threats to this species include cumulative loss and alteration of foraging habitat, pesticide poisoning of prey, exotic species, urban encroachment, poaching, competition from other raptors, and human disturbance at nest sites.

Under the Solano HCP, conservation actions for the burrowing owl focus on establishing secure suitable habitats in reserves and preserves and enhancing the suitability and carrying capacity of these lands to support burrowing owl populations. Under the Solano HCP Conservation Strategy, approximately 13,000 to 15,000 ac of valley floor grassland and vernal pool habitat and 5,970 ac of irrigated agriculture habitat will be preserved that will benefit burrowing owl. Reserve design and management standards (Section 10.5) would further enhance the capability of new preserves to support burrowing owl by limiting fossorial rodent control within preserve boundaries.

Covered Activities that result in the take of a known or active burrowing owl nest site will preserve an active nest site through purchase of occupied nest credits at an HCP-certified mitigation bank or through the establishment of an approved project-specific reserve. SCWA will also implement interim measures to protect active and known burrowing owl nest burrows until such time as the HCP reserve system supports a number of nest burrows equal to or greater than the number of burrows lost as a result of HCP Covered Activities. Project proponents that need to mitigate for take of a known or active burrowing owl nest site may provide funding to SCWA's Interim Nest Protection Program if nest credits at mitigation banks or project-specific reserves are unavailable.

Covered Activities that have the potential to impact occupied burrows will be required to implement avoidance and minimization measures such as preconstruction surveys, construction buffers, and discouraging burrowing owl use of a site by allowing vegetation to grow (see Section 6.3.9 for further details).



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