Chapter 6
Conservation Strategy

6.1 Introduction

This chapter presents the Yolo HCP/NCCP conservation strategy, which was designed to meet the regulatory requirements of the federal Endangered Species Act (FESA) and the Natural Community Conservation Planning Act (NCCPA). The conservation strategy provides for the conservation of covered species in the Plan Area necessary to meet the requirements of the NCCPA, and includes the mitigation of impacts necessary under Section 10 of FESA to allow covered activities in the Plan Area to move forward. The conservation strategy also will build on decades of local, state, and federal conservation efforts in the Plan Area, including the establishment of the Yolo Wildlife Area, the implementation of the Cache Creek Resources Management Plan and Willow Slough Watershed Integrated Resources Management Plan, and the efforts of the Lower Putah Creek Coordinating Committee.

The conservation resulting from the Yolo HCP/NCCP will add to the 34,264 acres of baseline protected lands (category 1 baseline public and easement lands) in the Plan Area (Table 6-1(a), *Baseline Public and Easement Lands*). These lands already conserve a diverse array of natural communities and species habitat. Furthermore, existing conservation organizations working in the Plan Area, such as California Audubon, Yolo Audubon, Tuleyome, Center for Land-Based Learning and the Yolo County Resource Conservation District, have long worked to improve habitat in the Plan Area, including the installation of hedgerows on cultivated lands, and the restoration of riparian vegetation and ponds to benefit wildlife.

Implementation of the Yolo HCP/NCCP to meet the biological goals and objectives will result in 20,381 acres of newly protected natural communities and species habitat, up to 981 acres of restoration or creation if the maximum allowable wetland or riparian loss is reached, and 8,000 acres of additional pre-permit reserve lands enrolled into the reserve system, for a total of 29,362 acres conserved if all natural community and covered species habitat loss occurs. Tables 6-1(b), *Reserve System Land Types,* provides these acre amounts and definitions for newly protected, restored or created, and pre-permit reserve lands.

Furthermore, the JPA is developing the Yolo Local Conservation Strategy concurrent with the Yolo HCP/NCCP. The Local Conservation Strategy is a compatible but separate plan from the Yolo HCP/NCCP to guide the conservation of sensitive species that are not covered by the HCP/NCCP, and the natural communities upon which they depend. While the Yolo HCP/NCCP will have benefits to many of these species and natural communities, the Local Conservation Strategy extends the benefits of this HCP/NCCP to species and natural communities addressed at the project level through CEQA. The Local Conservation Strategy is included as Appendix E, *Local Conservation Strategy.*

Combined with the responsible land use planning of the Plan Area jurisdictions, existing and new conservation efforts will provide significant habitat for many species, including those covered by the Yolo HCP/NCCP. The Yolo HCP/NCCP is only one part of a significant conservation network in the Plan Area.

The Yolo HCP/NCCP conservation strategy identifies the intended biological outcomes of Yolo HCP/NCCP implementation and describes the means by which the JPA will achieve these outcomes. The conservation strategy includes specific and measurable biological goals and objectives and comprehensive conservation measures (Table 6-3, *Biological Goals and Objectives and Applicable Conservation Measures*) designed to provide for the conservation of covered species and the natural communities upon which they depend. Table 6-2(a), *Newly Protected Lands Commitments,* and Table 6-2(b), *Pre-permit Reserve Lands Commitments,* summarize the protection and enrollment commitments for natural communities and covered species.

To meet the NCCPA permit standards, the conservation strategy provides for the conservation of covered species by protecting, enhancing, restoring, and managing natural communities, covered species habitats, and occurrences of covered species. The conservation strategy achieves the objectives listed below, pursuant to the NCCPA (Section 2820).

- Conserve, restore, and provide for the management of representative natural and semi-natural landscapes.
- Establish reserves that provide for the conservation of covered species within the Yolo HCP/NCCP geographic area and linkages to adjacent habitat outside the Plan Area.
- Protect and maintain habitat areas that are large enough to support sustainable populations of covered species.
- Incorporate in the reserve system a range of environmental gradients and high habitat diversity to provide for shifting species distributions in response to changing circumstances (e.g., in response to climate change).
- Sustain the effective movement and genetic interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the reserve system.

The conservation strategy is also designed to streamline compliance by the covered activities with the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and other applicable environmental regulations (Chapter 1, *Introduction*), once these projects are implemented. The conservation strategy achieves this goal by providing for the conservation of the species in the Plan Area, and by incidentally providing for habitat needs of non-covered native species associated with each of the natural communities.

The conservation strategy follows a logical sequence from the biological goals and objectives, to the conservation measures, to the monitoring and adaptive management strategy. The biological goals and objectives (Section 6.3) articulate *what* the conservation strategy is meant to achieve. The conservation measures (Section 6.4) describe *how* the JPA will meet the biological goals and objectives (i.e., the actions to be implemented to achieve the goals and objectives). Section 6.4 includes 3 broad categories of conservation measures:

- Section 6.4.1, *Conservation Measure 1*, *Establish Reserve System,* describes the Yolo HCP/NCCP commitments for land acquisition and enrollment to establish the reserve system. It includes acreage commitments for natural communities and species, describes land protection mechanisms and enrollment requirements, and provides guidelines and commitments for identifying lands to acquire.

Table 6-1(a). Baseline Public and Easement Lands

Baseline Public and Easement Lands are all lands throughout the Plan Area with varying levels of conservation prior to HCP/NCCP permit issuance (all categories below). These categories are used for the gap analysis to assess the baseline level of natural community and covered species habitat conservation in the Plan Area, and are factored into the amount of additional conservation needed through the HCP/NCCP.

Type of Conservation	Definition	Acres
Category 1	Land for which the primary management goal is related to ecological protection. The land predominantly consists of suitable habitat and is covered by an irrevocable conservation mandate that precludes changes in land use that could result in degradation or loss of ecological functions. The irrevocable conservation mandate is a perpetual conservation easement or, in the case of Yolo Bypass Wildlife Area, a state mandate. This category is also referred to as "baseline protected lands."	34,264
Category 2	Land without an irrevocable conservation mandate, but with a management goal and/or acquisition purpose related to ecological protection. The land is predominantly natural habitat or in a use that supports covered species habitat. This category includes public lands held in fee title and private lands in cases where a conservation entity (e.g., land trust) holds fee title without permanent easements in place. While Category 2 Public and Easement Lands were used to inform the development of the HCP/NCCP conservation commitments, these lands are not considered to meet the definition of "protected" under the Yolo HCP/NCCP conservation strategy.	53,730
Category 3	Land that consists of public open space, but its primary goal is not related to ecological protection and it has no irrevocable conservation mandate. The land includes natural habitat or use that supports covered species habitat. This category includes public land without a conservation mandate or private lands held in fee title by a conservation organization (i.e., agricultural land trust) without permanent conservation easements in place.	2,973
TOTAL		90,967

Table 6-1(b). Reserve System Land Types

The *reserve system* consists of all lands that are protected, monitored, and adaptively managed consistent with commitments in the Yolo HCP/NCCP. All lands defined below comprise the reserve system.

Type of Conservation	Definition	Mitigation/Conservation	Commitment (acres)
Newly Protected Lands	Lands that were not previously protected through a conservation easement or other mechanism, and that the JPA places under a permanent conservation easement and enrolls in the reserve system. These include lands protected for mitigation and conservation lands to meet NCCPA requirements. Category 2 baseline public and easement lands (Section 6.2.2.2, Baseline *Public and Easement Lands*) will only count toward newly protected lands upon wildlife agency approval, and if placed in a perpetual conservation easement.	Newly protected *mitigation lands* are those lands the JPA will protect to mitigate the impacts of take consistent with Section 10(a)(1)(B) of the Endangered Species Act.	16,349
		Newly protected *conservation lands* are those that the JPA will protect above and beyond the *mitigation land* commitments, to meet conservation requirements of the NCCP Act.	4,032[1]
Restored/Created Lands	Lands that the JPA places under a permanent conservation easement,≤ or that are already protected through a conservation easement, and the JPA restores or creates as a wetland natural community type. (Restoration and Creation are further defined in Conservation Measure 2.)	Restored/created *mitigation lands* are those lands that the JPA will restore or create to mitigate the impacts of take consistent with Section 10(a)(1)(B) of the Endangered Species Act (mitigation will occur through a combination of newly protected and restored lands).	A sufficient number of acres to achieve a 1:1 ratio for wetlands, open water, and riparian ≤ 981
		Restored/created *conservation lands* are those that the JPA will restore or create above and beyond the *mitigation land* commitments, to meet conservation requirements of the NCCP Act. This restoration or creation will take place regardless of the level of natural community and habitat loss.	0

[1] [note to reader] This does not include 33.7 acres of alkali prairie on the Woodland Regional Park, which was previously considered pre-permit reserve land but for the Public Review Draft will be treated as newly protected land.

Table 6-1(b). Reserve System Land Types

The *reserve system* consists of all lands that are protected, monitored, and adaptively managed consistent with commitments in the Yolo HCP/NCCP. All lands defined below comprise the reserve system.

Type of Conservation	Definition	Mitigation/Conservation	Commitment (acres)
Pre-permit Reserve Lands	Categories 1 and 2 baseline public and easement lands (Table 6-1(a)) that are enrolled into the Reserve System. Category 2 baseline public and easement lands that are counted as newly protected lands (defined about) are not counted as pre-permit reserve lands.	Pre-permit reserve lands are *conservation lands.*	8,000
		TOTAL	**29,362**[2]

[2] Assuming the full 981 acres of restoration.

Table 6-2(a). Newly Protected Lands Commitments

Natural Community	Natural Community Protection Requirements	Covered Species Protection Requirements
Cultivated Lands (non-rice)	11,810 acres in Conservation Reserve Area	2,500 acres western burrowing owl habitat
		11,810 acres Swainson's hawk foraging habitat
Cultivated Lands (rice)	1,300 acres in Conservation Reserve Area	1,300 acres in giant garter snake habitat
Grassland	4,500 acres, of which at least 3,000 acres is in planning unit 5.	3,000 acres western burrowing owl habitat
		At least 1,500 acres California tiger salamander habitat (prioritize protection in critical habitat)
		4,500 acres Swainson's hawk foraging habitat
Oak Woodland	21 acres (mitigation for loss of 7 acres of Blue Oak Foothill Pine and Blue Oak Woodland)[3]	_
Alkali Prairie	33.7 acres on Woodland Regional Park	33.7 acres on Woodland Regional Park
Fresh Emergent Wetland	300 acres in Conservation Reserve Area	300 acres giant garter snake habitat
		200 acres tricolored blackbird nesting habitat, and one active tricolored blackbird nesting colony (colony may be on pre-permit reserve lands, Table 6-2(b), *Pre-permit Reserve Lands Commitments*).
Valley Foothill Riparian	1,600 acres in Conservation Reserve Area, primarily in planning units 5 and 7.	Prioritize protection of valley elderberry longhorn beetle populations
		230 acres western yellow-billed cuckoo habitat
		600 acres least Bell's vireo habitat
Lacustrine and Riverine	800 acres in the Conservation Reserve Area	At least 50 acres of aquatic California tiger salamander habitat. At least 5 pools that are each found to support all life stages of the salamander through at least all water year types
		At least 420 acres of giant garter snake habitat.
Other (Bank Swallow)	50 acres in planning unit 7	50 acres bank swallow habitat in planning unit 7, with at least one active bank swallow colony
All Natural Communities Protected (Total)	20,415 in the Conservation Reserve Area[4]	At least 1,160 acres giant garter snake active season upland movement habitat, and 2,315 acres giant garter snake overwintering habitat
		At least 34 Swainson's hawk nest trees (active within last 5 years)
		[To be determined] western burrowing owl occurrences, each consisting of at least [To be determined] breeding pairs.

[3] [note to reader] The Public Review Draft will address oak woodland conservation in greater detail.

[4] [Note to reader] This includes the 33.7 acres of alkali prairie on Woodland Regional Park, which was not included in Chapter 8 for the cost analysis and is not included on Table 6-1(b) for newly protected lands. The Public Review Draft will include this acreage in the cost analysis and in Table 6-1(b).

Table 6-2(b). Pre-permit Reserve Lands Commitments

Natural Community	Natural Community Enrollment Requirement	Covered Species Requirements
Cultivated lands (non-rice)	2,417 acres	489 acres western burrowing owl habitat
		2,416 acres Swainson's hawk foraging habitat
Cultivated lands (rice)	3,340 acres	3,340 acres in giant garter snake habitat
Grassland	190 acres	190 acres western burrowing owl habitat
		190 acres Swainson's hawk foraging habitat
Alkali prairie	162.9 acres	162.9 acres palmate-bracted bird's beak habitat
Fresh emergent wetland	243 acres	21 acres tricolored blackbird nesting habitat
		243 acres giant garter snake habitat
Other Land Cover Types	1,674 acres	
Total	**8,000 acres**	

- Section 6.4.2, *Conservation Measure 2, Restore Natural Communities,* describes the Yolo HCP/NCCP commitments for natural community and species habitat restoration. It defines *restoration*, specifies restoration commitments, and provides restoration criteria and techniques.
- Section 6.4.3, *Manage and Enhance the Reserve System*, describes the Yolo HCP/NCCP commitments for natural community and species habitat management and enhancement. It defines *management* and *enhancement,* describes the requirements for preparing reserve management plans, and describes management and enhancement actions at the landscape, natural community, and species levels.

The monitoring and adaptive management strategy (Section 6.5) describes how the JPA will know whether it is meeting the goals and objectives, and how the JPA will adjust the strategy as needed to ensure that the goals and objectives are met. The following sections introduce these elements in more detail.

6.1.1 Biological Goals and Objectives

The biological goals and objectives reflect the expected ecological outcomes of full implementation of the Yolo HCP/NCCP. The biological goals set out the broad principles the JPA used to help guide the development of the conservation strategy. The biological objectives describe the conservation commitments. Objectives are measurable and quantitative; they clearly state a desired result and will collectively achieve the biological goals. Biological goals and objectives are the foundation of the conservation strategy and are intended to provide the following functions.

- Describe the desired biological outcomes of the conservation strategy and how those outcomes will provide for the conservation of covered species and their habitats.
- Provide quantitative commitments and timeframes for achieving the desired outcomes.
- Serve as benchmarks by which to measure progress in achieving those outcomes across multiple temporal and spatial scales.
- Provide metrics for the monitoring program that will evaluate the effectiveness of the conservation measures and, if necessary, provide a basis to adjust the conservation measures to achieve the desired outcomes.

Table 6-3, *Biological Goals and Objectives and Applicable Conservation Measures,* provides each of the biological goals and objectives at the landscape, natural community, and covered species levels. For each biological objective, Table 6-3 indicates which conservation measures the JPA will implement to achieve the objective.

Section 6.2.1, *Process of Developing the Biological Goals and Objectives*, describes how the biological goals and objectives were developed. Section 6.3, *Biological Goals and Objectives*, describes the role of biological goals and objectives in the HCP/NCCP, presents the biological goals and objectives, and describes the underlying rationale for each goal and objective.

6.1.2 Conservation Measures

The conservation measures are the actions the JPA will implement to meet the biological goals and objectives. Although the conservation measures have been developed to meet all of the biological

goals and objectives, the relationship between goals and objectives and conservation measures is not direct; most of the conservation measures address several goals and objectives, and most objectives will be met through a combination of conservation measures.

The conservation measures are described with sufficient detail and specificity to allow for their implementation. As a result of the large scale and long timeframe over which the Yolo HCP/NCCP will be implemented, the conservation measures are also designed to be flexible to allow for adaptive management with increasing knowledge over time. Preserving this flexibility is an important component of the conservation strategy. Section 6.4, *Conservation Measures*, describes each of the conservation measures in detail.

The Yolo HCP/NCCP breaks all the conservation actions that will be implemented into three broad conservation measures: Conservation Measure 1, *Establish Reserve System* (Section 6.4.1); Conservation Measure 2, *Restore Natural Communities* (Section 6.4.2), and Conservation Measure 3, *Manage and Enhance Natural Communities* (Section 6.4.3). Each conservation measure includes a table that lists the biological goals and objectives the measure is intended to achieve. For each objective, the table lists those components of the conservation measure that specifically contribute toward that objective.

6.1.3 Monitoring and Adaptive Management

The monitoring and adaptive management program is an integral component of the conservation strategy. This important program has been designed to use new information and insight gained during the course of HCP/NCCP implementation to ensure conservation measures can achieve the biological goals and objectives. The adaptive management process will afford the flexibility to allow the JPA to make changes to the conservation measures to improve their effectiveness over time. The JPA will use the results of monitoring and research efforts to assess progress toward achieving the biological goals and objectives and gauge the effectiveness of the conservation strategy. The monitoring and adaptive management program and its regulatory basis are described in Section 6.5, *Monitoring and Adaptive Management*.

6.2 Methods and Approach

This section describes the methods and the approaches used to develop the conservation strategy. Section 6.2.1, *Process of Developing the Biological Goals and Objectives,* describes the general process applied to developing the goals and objectives. Section 6.2.2, *Planning Units*, describes the areas that have been defined within the Plan Area for analysis and planning purposes.

6.2.1 Process of Developing the Biological Goals and Objectives

The conservation strategy is based on the best scientific data available (Chapter 2, *Existing Ecological Conditions*, and Appendix A, *Covered Species Accounts*,) and was designed using a multi-level ecological approach in accordance with principles of conservation biology, to be quantitative and measurable. (Noss 1987).

The quantitative objectives are explicit, clear, and transparent, and they guide the conservation actions in the Plan Area, including adaptive management and compliance monitoring (Margules and Pressey 2000).

The objectives are based on both the need to provide for the conservation of the covered species consistent with NCCPA standards, and need for mitigation for the effects of covered activities. The level of additional contribution to species conservation, beyond mitigation, was based on the following factors.

- The life history needs of each species (see Appendix A, *Covered Species Accounts*).
- Conservation needs based on recovery plans, five-year reviews, and other relevant conservation planning documents (see Chapter 2, *Existing Ecological Conditions* and this chapter).
- The importance of the Plan Area to species conservation, in terms of the rarity of the species and the proportion of the species' range and population that is present in the Plan Area. In general, species with a large portion of their range in the Plan Area may require more conservation than species with a small portion of their range in the Plan Area.
- The extent to which species habitat is already protected in the Plan Area (baseline protected lands). If most of the habitat for a covered species is already protected in the Plan Area, this warrants less additional habitat protection than would be necessary if only a small fraction of the habitat was already protected.
- Reserve land configuration and quality.
- Plan specific factors such as land use policies and growth patterns in the Plan Area.

The rationale provided in subsections of Section 6.3, *Biological Goals and Objectives* describes how the JPA used these factors to determine each of the quantitative objectives.

The conservation strategy addresses conservation of ecological processes, environmental gradients, regional biological diversity, and regional wildlife linkages primarily in the landscape-level biological goals and objectives. These goals and objectives were inherently difficult to develop because of the large scale of the processes and the general lack of data regarding their operation in the Plan Area. The land cover mapping described in Chapter 2, *Existing Ecological Conditions* was assumed to be an adequate surrogate for regional biological diversity. If adequate and representative stands of these land cover types are preserved and enhanced, the JPA assumes that native biological diversity in general will be preserved and enhanced within the reserve system.

The JPA has developed the biological goals and objectives in accordance with the principles of conservation biology (Noss 1987); as such, they address, among other things, ecological processes, environmental gradients, biological diversity, and regional aquatic and terrestrial linkages. The biological goals and objectives fit into the ecological hierarchy described below.

- **Landscape.** Landscape-level biological goals and objectives are related to the overall condition of hydrological, physical, chemical, and biological processes in the Plan Area.
- **Natural community.** Natural community biological goals and objectives specifically address the needs of each natural community.
- **Species.** Species-specific biological goals and objectives are designed to provide for the conservation of covered species and mitigate the adverse effects of covered activities.

The biological goals and objectives were developed first at the landscape level to meet the needs of the broadest array possible of covered natural communities and covered species. Next, each natural community was examined to determine additional conservation needed at the natural community level that could benefit multiple covered species. Lastly, the expected benefits of achieving the

landscape and natural community biological objectives for each covered species were evaluated, and species-specific biological goals and objectives were added as necessary to provide for the conservation of the species. Using this hierarchical approach, the conservation needs of many covered species are met through the landscape-level and natural community biological goals and objectives. Additional conservation needs are met by species-specific goals and objectives for covered species whose conservation needs could not be fully addressed at the landscape and natural community levels.

The reserve system will be assembled through application of the biological goals and objectives related to reserve design and acres of protection and restoration. While several parcels have been identified for acquisition[5], the JPA will create the majority of the reserve system gradually over the permit term according to the criteria described in *Conservation Measure 1, Establish Reserve System*. This implementation approach is commonly used in HCPs and NCCPs to allow for achievement of conservation goals and objectives using a willing-seller approach and with the benefits of the free market in land acquisition. The land acquisition process is described in detail in *Conservation Measure 1, Establish Reserve System*.

The factors that went into developing each of the biological objectives, including the protection and restoration acreage commitments and the reserve design objectives, are described in detail in the rationale for each objective in Section 6.3, *Biological Goals and Objectives*.

6.2.2 Planning Units

To facilitate the development of a spatially explicit conservation strategy, and to ensure that biological goals and objectives are met consistently throughout the Plan Area, the Plan Area is divided into 22 planning units (Figure 6-1, *Yolo HCP/NCCP Planning Units and Conservation Reserve Area*). The planning units were delineated to capture lands that support similar ecological, topographical, natural community, and land use conditions. These planning units identify the specific areas in which conservation actions (such as land acquisition and habitat restoration) will occur without identifying individual parcels for the actions. The planning units are sufficiently large to allow achievement of natural community objectives with protection or restoration of only a portion of the planning unit. This approach provides flexibility to allow land acquisition to occur from willing sellers, while at the same time providing certainty to the wildlife agencies—California Department of Fish and Wildlife (CDFW) and U.S. Fish and Wildlife Service (USFWS)—that the necessary conservation will occur in the Plan Area to provide for the conservation of covered species.

Planning units were identified to account for major natural geomorphic and ecological features. To make implementation practical, planning unit boundaries were delineated using clearly recognizable features such as roads and parcel boundaries that best approximated natural geomorphic and ecological boundaries.

The reserve system will be assembled primarily in the Conservation Reserve Area, which consists of planning units 5, 7, 8, and 9 and riparian areas adjacent to Putah and Cache Creeks and along the Sacramento River in planning units 12, 14, 15, and 21 (Figure 6-1, *Yolo HCP/NCCP Planning Units*

[5] Acquisition of land as used in the Yolo HCP/NCCP means the placement of conservation easements on or the fee title purchase of land parcels to protect natural communities and covered species habitat. The JPA expects the majority of acquisition will be the placement of conservation easements.

and Conservation Reserve Area). planning units 19 through 22 are generally the urban growth areas for the Cities of Davis, Woodland, West Sacramento, and Winters and therefore are not suitable for conservation commitments, with limited exceptions for rare covered species and natural communities.

Planning units 1 through 4 and 6 are in the western portion of the Plan Area. These planning units support the rugged and largely inaccessible mountains of the coast range. They also support rural parts of the County with very low-density ranches, farms, and grazing lands. These planning units provide important habitat for a number of species, but are not the primary location of habitat for covered species and include public lands where much of the natural communities and native species are protected. As a result, the JPA will focus new conservation in the Yolo Local Conservation Strategy in these planning units. With the exception of riparian areas adjacent to Putah and Cache Creeks, the Yolo HCP/NCCP does not include conservation commitments in these planning units for the following reasons.

- Many of the natural communities found only in these planning units such as serpentine grassland, mixed chaparral, and closed-cone pine-cypress have a substantial fraction of their area protected in public and private lands owned in fee title or through conservation easement by the Bureau of Land Management, U.S. Forest Service, University of California Natural Reserve System, California Audubon, and local land trusts and conservancies. Therefore, JPA acquisition of these natural communities would add little to their existing protection.
- Natural communities found only in these planning units either do not support the covered species, or do so only at densities too low to warrant conservation for that purpose (Figure 6-1, *Yolo HCP/NCCP Planning Units and Conservation Reserve Area*).
- Natural communities in these planning units were either not predicted to have impacts from covered activities, or very low impacts that could be addressed by conservation that could be consolidated in the Conservation Reserve Area.
- Natural communities in these planning units are not under threat from non-covered activities due to their rural character, restrictive County land use controls, and in some cases their rugged terrain.

6.2.2.1 Conservation Reserve Area

The Conservation Reserve Area is the area in which the JPA will focus land acquisition to create the reserve system. The JPA worked collaboratively with wildlife agency staff to evaluate available biological information and define the Conservation Reserve Area. JPA staff also consulted with the Advisory Committee and brought suggested changes to the Conservation Reserve Area back to the wildlife agencies for consideration. The Conservation Reserve Area is located primarily in the eastern part of the Plan Area but also includes riparian areas that extend further west (Figure 6-1, *Yolo HCP/NCCP Planning Units and Conservation Reserve Area*). The Conservation Reserve Area includes most of the occurrences in the Plan Area for the covered species including Swainson's hawk, giant garter snake, California tiger salamander, burrowing owl, least Bell's vireo, and other species (Figure 6-2, *Yolo HCP/NCCP Covered Species Occurrences*). This is also the area where most of the natural community and covered species habitat loss is expected to occur. Creation of the reserve system in the Conservation Reserve Area optimizes the design and cost-effectiveness of land acquisition by focusing it where the most conservation benefit can be gained.

6.2.2.2 Public and Easement Lands

Yolo County and the Cities of Davis, West Sacramento, Winters, and Woodland have worked to protect agricultural land and natural communities outside of the Yolo HCP/NCCP process for over 160 years, most significantly by directing growth to cities through adopted land use planning policies. As a result, over 88% of Yolo County's population lives within the incorporated cities. Together the cities and established towns of Yolo County house over 93 percent of the population, but account for less than 6% of the total area (Yolo County General Plan, p. LU-2). As shown in Figure 6-3, *Baseline Public and Easement Lands,* this land use planning has resulted in the protection of extensive agricultural lands on the valley floor and other areas that support natural communities and covered species habitat. While it is not possible to recreate the natural communities that existed in the Plan Area prior to the introduction of anthropogenic activities, Yolo County and the cities have minimized the impact of these activities by designing and implementing compact urban development and minimizing the development footprint of rural, or structures and infrastructure outside of urban areas.

Many of the lands in public ownership, and under private conservation and agricultural easements are located in the Conservation Reserve Area and support targeted natural communities and valuable habitat for covered species. The JPA will build the reserve system adjacent to and around these lands to expand and connect lands likely to remain in open space and support natural communities and covered species.

Lands in public ownership or under private conservation or agricultural easements that help conserve natural communities and covered species habitats are referred to as *baseline public and easement lands*. The JPA developed a baseline public and easement lands GIS dataset to identify Public and Easement Lands within the Yolo HCP/NCCP Plan Area. The JPA compiled this from various public sources. Although the boundaries depicted within the data do not in all cases represent legal boundaries, they represent the best available information and were considered to be sufficient to guide development of the conservation strategy at a landscape level. The JPA will acquire more detailed information necessary for land acquisition and other decisions during HCP/NCCP implementation.

The public dataset sources used to generate the baseline public and easement lands GIS data layer included the following:

- California Department of Fish and Game (now CDFW) Lands GIS data layer 2006;
- Conservation easement documents filed with the Yolo County Clerk Recorder between 2002 and 2014;
- City of Davis Public Lands and Easements dataset for lands within the City of Davis Planning Area (January 2014);
- Yolo County Protected Lands; and
- Yolo County Assessor's Tax Parcel data.

The JPA created the data layer by overlaying source data on County parcel boundary data. Parcels identified as baseline public and easement lands via source datasets were then attributed with the appropriate information. Based on the ownership information derived from the above sources, the data was evaluated and grouped into three resource protection-level categories based on the extent to which lands are protected and managed for natural communities and covered species. The

purpose of this categorization was to assess the level at which the lands might contribute to the Yolo HCP/NCCP conservation strategy, including meeting the biological goals and objectives of the HCP/NCCP. The JPA defined the baseline public and easement lands in 3 categories, defined in Table 6-1(a), *Baseline Public and Easement Lands.*

Category 1 lands are considered *baseline protected lands* and therefore eligible for enrollment into the reserve system as *pre-permit reserve lands,* but not eligible to count toward *newly protected lands* (Table 6-1(b), *Reserve System Land Types*). Category 2 lands are only eligible to count toward *newly protected lands* if the wildlife agencies agree a property is eligible as newly protected because it is not covered by an irrevocable conservation mandate, and if the JPA places these lands in a conservation easement and manages them. Placement of category 2 lands into conservation easements in addition to enrolling them into the reserve system has a conservation benefit above and beyond the enrollment of category 1 lands into the reserve system. Category 3 lands are eligible to count toward *newly protected lands* if placed in perpetual conservation easements. Where permanent conservation easements can be placed on these lands consistent with the HCP/NCCP, they will be elevated to category 1 and thus contribute toward achieving Yolo HCP/NCCP natural community and species habitat *newly protected lands* commitments (Table 6-2, *Newly Protected Lands Commitments*). Figure 6-3, *Baseline Public and Easement Lands in the Plan Area,* presents the distribution in the Plan Area of category 1, 2, and 3 baseline public and easement lands.

6.3 Biological Goals and Objectives

Sections 6.1 and 6.2, above, describe the purpose of the biological goals and objectives (Section 6.1.1, *Biological Goals and Objectives*), and the methods and approach used to develop the biological goals and objectives (Section 6.2.1, *Process of Developing the Biological Goals and Objectives*). This section introduces the format and organization of the biological goals and objectives (Section 6.3.1, *Structure of the Biological Goals and Objectives*), and provides all the biological goals and objectives with the rationale for each objective (Section 6.3.2, *Goal and Objective Statements*).

The biological goals and objectives describe what the conservation strategy is intended to achieve. For details as to *how* these goals and objectives will be achieved, refer to Section 6.4, *Conservation Measures.* Terms used in this section are defined in Appendix M, *Glossary*.

6.3.1 Structure of the Biological Goals and Objectives

The biological goals and objectives articulate the intended outcomes that Yolo HCP/NCCP implementation will achieve. Biological goals are broad statements of intent. Biological objectives are expressed as specific outcomes the HCP/NCCP is expected to achieve for ecosystems, natural communities, and covered species' habitat. The biological objectives are measurable to the extent possible. Although the biological objectives presented in this chapter do not specify time commitments, Chapter 7, *Implementation,* provides details on stay-ahead provisions to ensure that conservation stays ahead of natural community and covered species habitat loss.

The biological goals and objectives are organized hierarchically on the basis of the following ecological levels of organization.

- **Landscape.** The landscape-level biological goals and objectives focus on the extent, distribution, and connectivity among natural communities and improvements to the overall

condition of hydrological, physical, chemical, and biological processes in the Plan Area in support of achieving natural community and species-specific biological goals and objectives.

- **Natural community.** Natural community biological goals and objectives focus on maintaining or enhancing ecological functions and values of specific natural communities. Achieving natural community goals and objectives will also provide for the conservation of habitat of associated covered species and other native species.
- **Species.** Species-specific biological goals and objectives address stressors and habitat needs specific to individual covered species (or, in some cases, groups of species with similar needs) that are not addressed under the landscape and natural community goals and objectives.

Section 6.3.2, *Landscape-Level Biological Goals and Objectives*, lists the landscape-level goals and objectives and describes the rationale for each. Section 6.3.3, *Natural Community Biological Goals and Objectives*, addresses the conservation strategy for natural communities using a nested approach. For each natural community, the landscape-level goals and objectives that would benefit that community's conservation strategy are listed with a description of the benefit each provides. Next, the goals and objectives developed specifically for the natural community are listed with their associated rationale. Section 6.3.4, *Covered Species Biological Goals and Objectives*, uses the same nested approach for covered species: for each species, the landscape-level and natural community goals and objectives that would benefit that species are described along with their benefits, followed by goals and objectives developed for that species and their associated rationale. For the most part, the Yolo HCP/NCCP addresses conservation of covered species through goals and objectives at the landscape and natural community levels. Species-specific goals and objectives were only developed when additional factors, such as specific habitat requirements or population factors, needed to be addressed to provide for the conservation of the species in the Plan Area.

The biological goals and objectives are listed in Table 6-3, *Biological Goals and Objectives and Applicable Conservation Measures,* at the landscape, natural community, and species levels. Each biological objective will be met through implementation of one or more conservation measures, which are also listed in Table 6-3 (detailed descriptions of the conservation measures are found in Section 6.4, *Conservation Measures*).

Table 6-3. Biological Goals and Objectives and Applicable Conservation Measures[6]

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Landscape-Level Goals and Objectives	
Goal L-1: Large interconnected landscapes within the range of physical and biological attributes (e.g., slope, soils, hydrology, climate, and plant associations) in the Plan Area to support the distribution and abundance of covered species and their habitats, provide for the movement and genetic interchange among populations of covered species, and conserve native biodiversity.	
Objective L-1.1: Conserve 28,381 acres of natural communities and covered species habitats in the Conservation Reserve Area, including 20,381 acres of newly protected lands and 8,000 acres of additional pre-permit reserve lands enrolled into the reserve system. Restore or create additional acres to result in no net loss of wetlands (up to 981 acres of restoration or creation). On a case-by-case basis, lands outside the Conservation Reserve Area may be enrolled if they benefit the covered species and would be subject to review and approval by the wildlife agencies.	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities*
Objective L-1.2: Include a variety of environmental gradients (e.g., hydrology, elevation, soils, slope, and aspect) within and across a diversity of protected and restored natural communities within the Conservation Reserve Area.	Conservation Measure 1, *Establish Reserve System*
Objective L-1.3: Increase the size and connectivity of the network of protected lands in the Plan Area by acquiring newly protected lands for the reserve system adjacent to and between baseline protected lands.	Conservation Measure 1, *Establish Reserve System*
Objective L-1.4: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Cache Creek floodplain and extending the length of Cache Creek from the west boundary of planning unit 7 to the Cache Creek Settling Basin exclusive of existing and potential aggregate mining areas (Figures 6–4, *Ecological Corridors*).	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities* Conservation Measure 3, *Manage and Enhance Natural Communities*
Objective L-1.5: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Putah Creek floodplain and extending the length of Putah Creek from the west boundary of planning unit 9 to the Putah Sinks exclusive of existing and potential aggregate mining areas (Figure 6–4, *Ecological Corridors*).	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities* Conservation Measure 3, *Manage and Enhance Natural Communities*

[6] See Appendix D, *Glossary*, for terms used in the biological goals and objectives.

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Objective L-1.6: Prioritize land acquisition and restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation along the Sacramento River and Yolo Bypass in planning units 12, 14, 15, and 21 (Figure 6-4, *Ecological Corridors*).	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities* Conservation Measure 3, *Manage and Enhance Natural Communities*
Goal L-2: Ecological processes and conditions that sustain and reestablish natural communities and native species.	
Objective L-2.1: Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative plant and animal species.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Objective L-2.2: Increase the abundance of native insect pollinators that support reproduction of native plant species and long-term production of agricultural crops that support habitat for covered and other native wildlife species.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Natural Community Level Goals and Objectives	
Cultivated Lands Seminatural Community	
NC-CL1: Cultivated lands that support habitat for covered and other native wildlife species.	
Objective NC-CL1.1: Protect at least 11,810 acres of unprotected non-rice cultivated lands that provide habitat value for covered and other native species in the Conservation Reserve Area. Field borders mapped as *Semiagricultural/Incidental to Agriculture* that provide habitat for covered species will count towards this requirement. Some of these lands may be substituted for grassland habitat upon approval by the wildlife agencies.	Conservation Measure 1, *Establish Reserve System*
Objective NC-CL1.2: Protect at least 1,300 acres of unprotected rice that provides habitat value for covered and other native species in the Conservation Reserve Area. Some of these lands may be substituted for wetlands that benefit covered species, upon approval by the wildlife agencies.	Conservation Measure 1, *Establish Reserve System*
Objective NC-CL1.3: Enroll at least 2,417 acres of cultivated lands natural community on Baseline Public and Easement Lands into the reserve system as pre-permit reserve lands.	Conservation Measure 1, *Establish Reserve System*
Objective NC-CL1.4: Maintain or enhance the foraging value of the cultivated lands natural community in the reserve system for raptors.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Grasslands Natural Community	
Goal NC-G1: Large, contiguous patches of grassland, and smaller patches within a mosaic of other natural community types, to sustain and enhance the distribution and abundance of associated covered and other native species in the Conservation Reserve Area.	
Objective NC-G1.1: Protect and manage 4,500 acres of unprotected grassland in the Conservation Reserve Area, including at least 3,000 acres in the Dunnigan Hills planning unit (PU 5).	Conservation Measure 1, *Establish Reserve System*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Objective NC-G1.2: Maintain and enhance the functions of protected grassland in the reserve system as habitat for covered and other native species by increasing burrow availability for burrow-dependent species, and increasing prey abundance and accessibility for grassland-foraging species.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Valley Foothill Riparian Natural Community	
Goal NC-VFR1: Functional valley foothill riparian natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-VFR1.1: Protect and manage 1,600 acres of unprotected valley foothill riparian distributed primarily in planning units 7 and 9.	Conservation Measure 1, *Establish Reserve System*
Objective NC-VFR1.2: Restore one acre of valley foothill riparian natural community for each acre lost as a result of covered activities. Site the restoration to improve connectivity among patches of existing valley foothill riparian vegetation within the Cache Creek and Putah Creek Corridors and the Sacramento River.	Conservation Measure 2, *Restore Natural Communities*
Alkali Prairie Natural Community	
Goal NC-AS1: A reserve system that protects the habitat values of the remaining alkali prairie natural community in the Plan Area.	
Objective NC-AS1.1: Protect 33 acres of alkali prairie natural community on the Woodland Regional Park within the first five years of Yolo HCP/NCCP implementation (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).	Conservation Measure 1, *Establish Reserve System*
Objective NC-AS1.2: Incorporate the existing protected (Category 1) alkali prairie habitat at the Alkali Grasslands Preserve properties into the reserve system (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).	Conservation Measure 1, *Establish Reserve System*
Objective NC-AS1.3: Manage and enhance the functions of alkali prairie within the reserve system as habitat for covered and other native species by improving hydrologic conditions and reducing the adverse effects of nonnative plants and human activities on habitat conditions.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Fresh Emergent Wetland Natural Community	
Goal NC-FEW1: Functional fresh emergent wetland natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-FEW1.1: Protect and manage 300 acres of fresh emergent wetland in the Conservation Reserve Area.	Conservation Measure 1, *Establish Reserve System*
Objective NC-FEW1.2: Restore fresh emergent wetland natural community in the Conservation Reserve Area at a ratio of restored to each acre lost as a result of covered activities.	Conservation Measure 2, *Restore Natural Communities*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Objective NC-FEW1.3: Enhance the functions of protected fresh emergent wetland as habitat for covered species (e.g., giant garter snake) and other native species	Conservation Measure 3, *Manage and Enhance Natural Communities*
Lacustrine and Riverine Natural Community	
Goal NC-LR1: Functional lacustrine and riverine natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-LR1.1: Protect and manage 800 acres of lacustrine and riverine natural community providing habitat for covered and other native species in the Conservation Reserve Area.	Conservation Measure 1, *Establish Reserve System*
Objective NC-LR1.2: Restore or create lacustrine natural community in the Conservation Reserve Area, in kind, at a ratio of one acre of lacustrine restored to each acre lost as a result of covered activities.	Conservation Measure 2, *Restore Natural Communities*
Objective NC-LR1.3: Restore or create riverine natural community in the Conservation Reserve Area, in kind, at a ratio of one mile of riverine restored to each mile lost as a result of covered activities.	Conservation Measure 2, *Restore Natural Communities*
Species Level Goals and Objectives	
Palmate Bracted Bird's-Beak	
Goal PBBB1: Provide for the conservation of palmate-bracted bird's-beak in the Plan Area.	
Objective PBBB1.1 Maintain or increase the abundance of palmate-bracted bird's-beak in the reserve system.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Valley Elderberry Longhorn Beetle	
Goal VELB1: Provide for the conservation of valley elderberry longhorn beetle in the Plan Area.	
Objective VELB1.1: Within the 1,600 acres of protected valley foothill riparian natural community (Objective NC-VFR1.2), prioritize protection of populations of valley elderberry longhorn beetle along Lower Cache Creek and Lower Putah Creek and Sacramento River, and adjacent lands to provide for valley elderberry longhorn beetle population expansion.	Conservation Measure 1, *Establish Reserve System*
Objective VELB1.2: Within the restored valley foothill riparian natural community (Objective NC-VFR1.2), establish elderberry shrubs and associated riparian plant species, and prioritize lands adjacent to existing populations to provide for population expansion.	Conservation Measure 2, *Restore Natural Communities*
California Tiger Salamander	
Goal CTS1: Provide for the conservation of California tiger salamander in the Plan Area.	
Objective CTS1.1: Within the 3,000 acres of protected grasslands in the Dunnigan Hills planning unit (Objective NC-G1.1), include at least 1,500 acres of modeled upland habitat for California tiger salamander and prioritize protection in designated critical habitat.	Conservation Measure 1, *Establish Reserve System*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Objective CTS1.2: Within the 800 acres of protected lacustrine and riverine natural community (Objective NC-LR1.1), protect at least 50 acres of California tiger salamander aquatic habitat. Restore or create 1 acre of California tiger salamander aquatic habitat for each acre lost as a result of covered activities. Within the protected and restored aquatic habitat, include at least 5 California tiger salamander breeding pools that are each found to support all life stages of the salamander through at least all water year types.	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities* Conservation Measure 3, *Manage and Enhance Natural Communities*
Western Pond Turtle	
Goal WPT1: Provide for the conservation of the western pond turtle population in the Plan Area.	
There are no species-specific objectives for western pond turtle. Section 6.3.4.4, *Western Pond Turtle*, describes how the landscape, natural community, and other covered species objectives will meet Goal WPT1 for the western pond turtle.	
Giant Garter Snake	
Goal GGS1: Provide for the conservation of giant garter snake in the Plan Area, including the Willow Slough/Yolo Bypass subpopulation and a segment of the Colusa Basin subpopulation, and connectivity between the two subpopulations	
Objective GGS1.1: Protect and manage the 1,300 acres of protected rice land (Objective NC-CL1.2) in modeled giant garter snake habitat. Suitable emergent marsh can be substituted for rice land.	Conservation Measure 1, *Establish Reserve System*
Objective GGS1.2: Protect and manage 1,160 acres of upland natural communities (Objective L-1.1) to provide active season upland movement habitat and at least 2,315 acres to provide overwintering habitat for giant garter snake.	Conservation Measure 1, *Establish Reserve System*
Objective GGS1.3: Protect, restore, and manage the 300 acres of fresh emergent wetland natural community (Objective NC-FEW1.1), at least 420 acres of the lacustrine/riverine natural community (Objective NC-LR.11), the restored fresh emergent wetland (Objective NC-FEW1.2), and sufficient restored lacustrine and riverine natural community (Objective NC-LR1.2) to contribute to the recovery of the giant garter snake. Ensure at least 80% of the aquatic habitat is perennial, and that the remainder provides aquatic habitat for the giant garter snake during the active season at least through July of each summer.	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities*
Objective GGS1.4: In addition to the newly protected and restored giant garter snake habitat (Objectives GGS1.1, GGS1.2, and GGS1.3), enroll at least 3,583 acres of giant garter snake habitat on eligible baseline public and easement lands into the reserve system as pre-permit reserve lands.	Conservation Measure 1, *Establish Reserve System*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Swainson's Hawk	
Goal SH1: Provide for the conservation of Swainson's hawk in the Plan Area.	
Objective SH1.1: Within the 11,810 acres of protected non-rice cultivated land natural community (Objective CL1.1), maintain crop types that support Swainson's hawk foraging habitat in the Conservation Reserve Area.	Conservation Measure 1, *Establish Reserve System*
Objective SH1.2: Protect and manage the 4,500 acres of grassland natural community (Objectives NC-CL1.1) to ensure that it provides Swainson's hawk foraging habitat in the Conservation Reserve Area.	Conservation Measure 1, *Establish Reserve System*
Objective SH1.3: Protect at least 40 unprotected Swainson's hawk nest trees (active within the last 5 years at the time tree is protected) within the reserve system.	Conservation Measure 1, *Establish Reserve System*
Objective SH1.4: In addition to protection of newly protected lands (Objectives SH1.1, SH1.2, and SH1.3), enroll at least acres 2,606 acres of baseline public and easement lands into the reserve system as pre-permit reserve lands providing foraging habitat.	Conservation Measure 1, *Establish Reserve System*
Objective SH1.5: In addition to restoration of riparian natural community (Objective NC-VFR1.2), establish trees suitable for Swainson's hawk nesting (native trees at least 20 feet in height) within the cultivated lands and grassland natural community reserve system to meet a density of at least 1 tree per 10 acres (protected existing trees count toward the density requirement). Riparian restoration adjacent to these community types will also count toward nesting tree establishment.).	Conservation Measure 3, *Manage and Enhance Natural Communities*
White-tailed Kite	
Goal WTK1. Provide for the conservation of white-tailed kite in the Plan Area.	
There are no species-specific objectives for white-tailed kite. Section 6.3.4.7, *White-tailed Kite*, describes how the landscape, natural community, and other covered species objectives will meet Goal WTK1 for the white-tailed kite through the protection, management, and enhancement of foraging and nesting habitat.	
Western Yellow-billed Cuckoo	
Goal WYBC1: Provide sufficient western yellow-billed cuckoo habitat to provide opportunities for migration and breeding in the Plan Area.	
Objective WYBC1.1: Within the 1,600 acres of protected valley-foothill riparian natural community (Objectives NC-VFR1.1), site at least 240 acres in modeled yellow-billed cuckoo habitat, and design the restored valley foothill riparian (Objective NC-VFR1.2) to provide suitable habitat for this species.	Conservation Measure 1, *Establish Reserve System*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Western Burrowing Owl	
Goal WBO1: Provide for the conservation of western burrowing owl in the Plan Area.	
Objective WBO1.1: Of the 4,500 acres of protected grassland natural community (Objective NC-G1.1), site at least 3,000 acres in modeled western burrowing owl habitat.	Conservation Measure 1, *Establish Reserve System*
Objective WBO1.2: Of the 11,810 acres of protected non-rice cultivated lands (Objective NC-CL1.1), provide at least 2,200 acres of modeled western burrowing owl habitat.	Conservation Measure 1, *Establish Reserve System*
Objective WBO1.3: Protect [To be determined] western burrowing owl occurrences, each supporting at least [To be determined] breeding pairs. Protect sufficient habitat surrounding occupied burrows to sustain the breeding pairs, consistent with *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), as a subset of habitat protected under Objectives WBO1.1 and WBO1.2.	Conservation Measure 1, *Establish Reserve System*
Least Bell's Vireo	
Goal LBV1. Provide sufficient habitat area to support least Bell's vireos that migrate through the Plan Area and to support potential future reestablishment of a nesting population in the Plan Area	
Objective LBV1.1: Of the 1,600 acres of newly protected valley foothill riparian (Objective NC-VFR1.1), site at least 600 acres in modeled least Bell's vireo habitat, and design the restored valley foothill riparian (Objective NC-VFR1.2) to provide suitable habitat for this species.	Conservation Measure 1, *Establish Reserve System* Conservation Measure 2, *Restore Natural Communities*
Bank Swallow	
Goal BS1. Provide for the conservation of bank swallow in the Plan Area.	
Objective BS1.1: Protect 50 acres of unprotected bank swallow habitat on a site occupied by this species in planning unit 7 or along the Sacramento River.	Conservation Measure 1, *Establish Reserve System*
Objective BS1.2: Manage the 50 acres of protected bank swallow habitat (Objective BS1.1) to enhance bank swallow foraging habitat value by promoting open grass and wildflower vegetation, and controlling invasive plant species.	Conservation Measure 3, *Manage and Enhance Natural Communities*
Tricolored Blackbird	
Goal TRBL1: Provide for the conservation of tricolored blackbirds in the Plan Area.	
Objective TRBL1.1: Within the 300 acres of protected fresh emergent wetland natural community (Objective NC-FEW1.1), site at least 200 acres in modeled tricolored blackbird nesting habitat.	Conservation Measure 1, *Establish Reserve System*

Biological Goals and Objectives	Applicable Conservation Measures (see Section 6.4, Conservation Measures, for full descriptions of conservation measures)
Objective TRBL1.2: Enroll at least 4,698 acres of tricolored blackbird foraging habitat and 21 acres of tricolored blackbird nesting habitat on baseline public and easement lands into the reserve system as pre-permit reserve lands.	Conservation Measure 1, *Establish Reserve System*
Objective TRBL1.3: Maintain at least one tricolored blackbird nesting colony in the reserve system.	Conservation Measure 1, *Establish Reserve System*

[1] From Section 6.3, *Biological Goals and Objectives*.

6.3.2 Landscape-Level Biological Goals and Objectives

The following landscape-level goals and objectives address conditions in the reserve system, ecological processes and conditions, and landscape-level factors that affect natural communities and covered species. These goals and objectives were developed to follow the principles of conservation biology and the requirements of the NCCPA. These goals and objectives address biodiversity, ecosystem function, and the desired extent, distribution, connectivity, and ecological function of the landscape to support the habitats and life cycle requirements of many of the covered species in the Plan Area.

Landscape-level goals and objectives are listed below, followed by descriptions of the approach and rationale used to establish them. The conservation measures that will be implemented to achieve these goals and objectives are described in Section 6.4, *Conservation Measures*. Table 6-3, *Biological Goals and Objectives and Applicable Conservation Measures,* lists the conservation measures that support each biological objective.

Goal L-1 addresses the quantity and characteristics of land that will be protected in the reserve system. Goal L-2 addresses maintenance of ecological processes and conditions that sustain the natural communities and covered species in the reserve system.

Goal L-1: Large interconnected landscapes within the range of physical and biological attributes (e.g., slope, soils, hydrology, climate, and plant associations) in the Conservation Reserve Area to support the distribution and abundance of covered species and their habitats, provide for the movement and genetic interchange among populations of covered species, and conserve native biodiversity.

Objective L-1.1: Conserve 28,381 acres of natural communities and covered species habitats in the Conservation Reserve Area, including 20,381 acres of newly protected lands and 8,000 acres of additional pre-permit reserve lands enrolled into the reserve system. Restore or create additional acres to result in no net loss of wetlands (up to 981 acres of restoration or creation). On a case-by-case basis, conserve lands outside the Conservation Reserve Area if they benefit the covered species and are approved by the wildlife agencies.

Rationale: Achieving this objective is intended to protect the highest quality natural communities and covered species habitat in the Plan Area to optimize the ecological value of the reserve system for conserving covered species and native biodiversity. The commitment for total protected area amount is based on the sum of all natural community commitments. Achieving this objective is intended to protect natural communities, species-specific habitat elements, and species diversity on a landscape-level consistent with Section 2830(a)(3) of the NCCPA. Achieving this objective is also intended to conserve representative natural and seminatural landscapes to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity, consistent with Section 2820(a)(4)(A) of the NCCPA. The newly protected area amount for each natural community is provided in Table 6-2(a), *Newly Protected Lands Commitments,* the pre-permit reserve lands amount for each natural community is provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* and rationale for that commitment is provided in Section 6.3.3, Natural Community Goals and Objectives. Conservation Measure 1, *Establish Reserve System*, describes the site selection criteria that will be used to identify lands for protection to achieve this objective. Chapter 7, Section 7.5.3, *Stay-Ahead Provision,*

provides details on the stay-ahead provision to ensure that conservation stays ahead of natural community and covered species habitat loss.

Additionally, wetland natural communities will be restored to offset loss of these natural communities as a result of covered activities, to comply the federal and state regulations and policies of no net loss of wetlands. Conservation Measure 2, *Restore Natural Communities*, describes the restoration techniques and criteria for each natural community. This restoration in addition to the protection, management, and enhancement of wetlands will result in a net benefit to wetland natural communities in the Plan Area.

Objective L-1.2: Include a variety of environmental gradients (e.g., hydrology, elevation, soils, slope, and aspect) within and across a diversity of protected and restored natural communities within the Conservation Reserve Area.

Rationale: Achieving this objective will provide a range of habitat characteristics, food resources, and complexity for native species, including covered species. A variety of environmental gradients may allow shifting species distributions in response to potential future environmental changes, such as climate change, and is intended to facilitate species' responses to catastrophic events such as fire or extreme environmental fluctuations such as flood or drought. Achieving this objective will meet the requirements under Section 2820(a)(4)(D) of the NCCPA to protect a range of environmental gradients and provide for shifting distributions of species due to climate change.

Protection of a variety of environmental gradients in the reserve system is an important strategy to adapt to the expected effects of climate change (Nunez et al. 2013; Spencer et al. 2006). Changes in temperature range and precipitation patterns resulting from climate change may cause some areas of currently suitable habitat to become unsuitable for some species, while other areas of currently unsuitable habitat may become suitable. Climate change is expected to affect many habitats and species such that the temporal dynamics and spatial distributions change in unpredictable ways. Faced with large, uncertain, and dynamic responses, it is important that a broad range of habitat characteristics is available (i.e., elevation, water depth, slope, aspect) within an interconnected reserve system (Nunez et al. 2013). This is intended to ensure that, while some current habitat may be lost or altered as a result of climate change, sufficient suitable habitat will be available in response to climate change to sustain covered and other native species. Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to meet this objective.

Objective L-1.3: Increase the size and connectivity of the network of protected lands in the Plan Area by acquiring newly protected lands for the reserve system adjacent to and between baseline protected lands.

Rationale: Achieving this objective will protect and restore large blocks of connected natural communities to enhance ecosystem processes and connectivity and help increase the abundance, distribution, and diversity of covered and other native species (Spencer et al. 2006). Achieving this objective is also intended to contribute toward the maintenance of habitat areas large enough to support sustainable populations of covered species, consistent with Section 2820(a)(4)(C) of the NCCPA. Habitat loss, fragmentation, and degradation within and outside the Plan Area have disrupted the ecosystem function and large scale habitat connectivity necessary to sustain covered and other native species and maintain biodiversity. Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to meet this objective.

Objective L-1.4: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Cache Creek floodplain and extending the length of

Cache Creek from the west boundary of planning unit 7 to the Cache Creek Settling Basin exclusive of existing and potential aggregate mining areas (Figures 6–4, *Ecological Corridors*).

Rationale: The Cache Creek Corridor (Figure 6-4, *Ecological Corridors*) is designed to provide connectivity between valley communities and the upland communities, and to provide a corridor for movement of native wildlife extending across the Conservation Reserve Area. This will build off prior conservation actions that have been implemented through the Cache Creek Resources Management Plan. The Cache Creek Resources Management Plan has included land protection, riparian restoration and enhancement, and protection of the entire in-channel portion of the creek from mining activities through a zoning ordinance. The Yolo HCP/NCCP incorporates future natural community enhancement and restoration along Cache Creek, to be implemented through the Cache Creek Resources Management Plan (Section 6.4.3.7.1, *Cache Creek Resources Management Plan*).

A general conservation planning principle is to contribute to the restoration and maintenance of healthy riverine/riparian corridors, with particular attention to restoring wide *nodes* of riparian vegetation at strategic locations, maintaining and enhancing aquatic, hydrologic, and wetland connectivity, restoring natural habitat and flow conditions, and controlling exotic species (Spencer et al. 2006). Protection, restoration, management and enhancement actions within the Cache Creek corridor will be consistent with this principle. The Cache Creek corridor will not necessarily be continuous or of a uniform width; it will provide a well-placed linear sequence of "stepping stones" or a traversable mosaic of protected habitat patches with wider nodes of riparian vegetation. The corridor will contain non-riparian habitats (e.g., small interspersed grassland gaps). The width of the Cache Creek riparian corridor is limited by the width of the active floodplain and thus will vary in width. Additionally, the extent to which the Yolo HCP/NCCP can establish riparian vegetation in this corridor is limited by the natural hydrology: some reaches of the creek are *losing reaches* where there is insufficient water to support riparian vegetation. This objective, therefore, only targets establishment and maintenance of riparian vegetation where it can be sustained by natural flows. This corridor will effectively reduce habitat fragmentation. Covered and other native wildlife species that will benefit are those using primarily riparian habitats or that prefer to move through canopied habitats (e.g., deer, songbirds, and riparian-associated native snakes and amphibians) and small and medium sized native mammals (e.g., raccoon, ringtail, various small rodents). Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to protect or enroll lands into the reserve system within this corridor. Conservation Measure 2, *Restore Natural Communities*, describes riparian restoration, and Conservation Measure 3, *Manage and Enhance Natural Communities*, describes management and enhancement actions within this corridor.

Objective L-1.5: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Putah Creek floodplain and extending the length of Putah Creek from the west boundary of planning unit 9 to the Putah Sinks exclusive of existing and potential aggregate mining areas (Figure 6–4, *Ecological Corridors*).

Rationale: The Putah Creek Corridor (Figure 6-4, *Ecological Corridors*) will provide connectivity between the Conservation Reserve Area and natural communities in the South Blue Ridge planning unit. It will provide a corridor for movement of native wildlife, including wide-ranging species such as mule deer, extending to the City of Davis, where Putah Creek enters Solano County. The rationale for establishing the Putah Creek Corridor for covered and

other native species that will benefit from the corridor is the same as described for Objective L1.4. This conservation will build off of protection and enhancement actions that the Lower Putah Creek Coordinating Committee (LPCCC) has implemented in this area.

Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to meet this objective. Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to protect or enroll lands into the reserve system within this corridor. Conservation Measure 2, *Restore Natural Communities*, describes riparian restoration, and Conservation Measure 3, *Manage and Enhance Natural Communities*, describes management and enhancement actions within this corridor, including actions the LPCCC will continue to implement (Section 6.4.3.7.2, *Lower Putah Creek*).

Objective L-1.6: Prioritize land acquisition and restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation along the Sacramento River and Yolo Bypass in planning units 12, 14, 15, and 21 (Figure 6-4, *Ecological Corridors*).

Rationale: The Sacramento River and Yolo Bypass support large, contiguous riparian corridors and provide valuable habitat for covered species including western yellow-billed cuckoo, bank swallow, least Bell's vireo, and valley elderberry longhorn beetle,

Goal L-2: Ecological processes and conditions that sustain and reestablish natural communities and native species.

Objective L-2.1: Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative plant and animal species.

Rationale: Achieving this objective will provide for the protection of species diversity consistent with Section 2820(a)(3) of the NCCPA. This objective is intended to provide for the increase of native species diversity to promote natural community resilience and resistance to disturbances such as drought and flooding (Fischer et al. 2006). Additionally, vegetation biodiversity in riparian and other natural communities provides the structural and ecological diversity necessary to provide suitable habitat for many wildlife species. Increasing the relative cover of native plant species also reduces potential negative effects of nonnative plants. The importance of native species diversity and reduction of invasive species is further discussed for natural communities in Section 6.3.3, *Natural Communities Biological Goals and Objectives*, and for covered species in Section 6.3.4, *Covered Species Biological Goals and Objectives*. Conservation Measure 3, *Manage and Enhance Natural Communities*, describes the habitat enhancement techniques and invasive species control program the JPA will apply to the reserve system and some additional riparian areas outside the reserve system, to meet this objective.

Objective L-2.2: Increase the abundance of native insect pollinators that support reproduction of native plant species and long-term production of agricultural crops that support habitat for covered and other native wildlife species.

Rationale: Current scientific evidence indicates that native insect pollinators, particularly bees, may be in decline in North America (Cane and Tepedino 2001). Native insect pollinators support the reproduction of many of the native plant species that comprise natural communities in the Plan Area and the continued viability of crop types that support habitat for agricultural-associated covered, local concern, and other native wildlife species in the Plan Area (Appendix J). The Pollinator Conservation Strategy (Appendix J) identifies conservation actions designed to maintain and increase the abundance of native insects that are pollinators of cultivated crops and native plants in the Plan Area. Implementation of these conservation actions will also support conservation of the Yolo HCP/NCCP natural communities and covered and other native wildlife species. For example, maintenance and establishment of

patches of natural vegetation along field margins support production of food for native insectivorous and seed eating birds, provide habitat for the production of rodents and other small mammals that are prey for native raptors and other carnivores, provide nesting habitat for ground nesting birds, and escape cover for native rodents and other small mammals. Conservation Measure 3, *Manage and Enhance Natural Communities*, describes the measures the JPA will implement to meet this objective.

6.3.3 Natural Community Biological Goals and Objectives

This section describes the goals and objectives that guide the Yolo HCP/NCCP conservation strategies for natural communities. For each natural community, this section lists applicable landscape-level goals and objectives that would benefit the natural community, and describes these benefits. Then natural community goals and objectives are listed, followed by a description of the rationale for establishing each natural community objective. Conservation measures designed to meet all objectives are found in Section 6.4, *Conservation Measures*. The extent of conserved natural communities expected with full implementation of the Yolo HCP/NCCP is shown in Table 6-2(a), *Newly Protected Lands Commitments,* and Table 6-2(b), *Pre-permit Reserve Lands Commitments*.

6.3.3.1 Cultivated Lands

6.3.3.1.1 How Achieving the Landscape Objectives Will Benefit the Cultivated Lands Seminatural Community

Achieving Objective L-1.3 will provide for a large, interconnected reserve system. While connectivity is not of critical importance to highly mobile covered species that are able to traverse unsuitable terrain, such as Swainson's hawks and white-tailed kites, connectivity is an important factor for species such as giant garter snake and western pond turtle. As described in Conservation Measure 1, *Establish Reserve System*, the JPA will prioritize acquisition of rice lands providing habitat for giant garter snake and western pond turtle in areas adjacent to and between baseline protected conservation lands.

6.3.3.1.2 Cultivated Lands Seminatural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the cultivated land semi-natural community within the Plan Area. The goal and objectives below address additional needs specific to this seminatural community that will not otherwise be met at the landscape level.

Goal NC-CL1: Cultivated lands that support high quality habitat for covered and other native wildlife species.

Objective NC-CL1.1: Protect at least 11,810 acres of unprotected non-rice cultivated lands that provide habitat value for covered and other native species in the Conservation Reserve Area. Field borders mapped as *Semiagricultural/Incidental to Agriculture* that provide habitat for covered species will count towards this requirement. Some of these lands may be substituted for grassland habitat upon approval by the wildlife agencies.

Rationale: Cultivated landscapes are highly dynamic and subject to seasonal and annual changes in overall crop patterns and vegetation type and structure. Wildlife species that use these habitats have learned to exploit those elements within this landscape that provide them with suitable and accessible food or other resource values.

Achieving this objective will ensure sufficient cultivated lands in the reserve system to provide for the conservation of the species in the Plan Area. Irrigated pastures, alfalfa, grazing land, and annually cultivated, irrigated cropland provide foraging habitat for covered species including Swainson's hawk, white-tailed kite, western burrowing owl, and tricolored blackbird. Alfalfa and pasture crop types provide high-value Swainson's hawk and tricolored blackbird foraging habitat. Grain and corn fields provide foraging habitats for waterfowl, wading birds, and shorebirds. Field borders and hedgerows provide uncultivated land that promote rodents, insects, and other prey species for covered raptors.

In determining the areal extent and spatial configuration of non-rice cultivated lands to be conserved, the following factors were considered: spatial and functional needs of covered species; current extent of protected non-rice cultivated lands in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for covered species that rely on cultivated lands; and the amount of non-rice cultivated lands available that can reasonably be protected in targeted conservation areas. The cultivated lands will be protected in the Conservation Reserve Area, where most of the habitat for covered species associated with cultivated lands is found. Covered activities will result in the permanent loss of 9,806 acres of non-rice cultivated lands. With 11, 810 acres of newly protected non-rice cultivated lands, a total of 16,404 acres of non-rice cultivated lands will be protected in conservation easements in the Plan Area (8% of the Plan Area). The JPA will meet this objective through establishment of conservation easements as described in Conservation Measure 1, *Establish Reserve System.*

Objective NC-CL1.2: Protect at least 1,300 acres of unprotected rice cultivated lands that provides habitat value for covered and other native species in the Conservation Reserve Area. Some of these lands may be substituted for wetlands that benefit covered species, upon approval by the wildlife agencies.

Rationale: Flooded rice fields provide habitat for numerous aquatic and wetland wildlife species. Rice provides aquatic habitat for giant garter snake and western pond turtle. It also provides important foraging habitat for waterfowl, wading birds, and shorebirds. In the winter, it provides valuable foraging habitat for white-tailed kite and tricolored blackbird. A wide variety of waterfowl and other birds migrating along the Pacific Flyway use rice fields in the Plan Area when they are inundated (Sterling and Buttner 2011). Irrigation ditches and field borders associated with rice fields provide aquatic, overwintering, and movement habitat for giant garter snake, tri-colored blackbird, and aquatic and nesting habitat for western pond turtle. This objective will be met through establishment of conservation easements as described in Conservation Measure 1, *Establish Reserve System.*

Objective NC-CL1.3: Enroll at least 2,417 acres of cultivated lands natural community on Baseline Public and Easement Lands into the reserve system as pre-permit reserve lands.

Rationale: Baseline public and easement lands in the Plan Area currently support cultivated lands that provide habitat for covered species. But many of these lands are not managed for the covered species or monitored effectively to ensure management actions are working. By enrolling these lands into the reserve system as pre-permit reserve lands, they will be monitored and adaptively managed consistent with the Yolo HCP/NCCP conservation strategy. This enhanced management and monitoring will increase their conservation value for several covered species and will help to meet many of the HCP/NCCP biological goals and objectives. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective NC-CL1.4: Maintain or enhance the foraging value of the cultivated lands natural community in the reserve system for raptors.

Rationale: A number of practices on the cultivated lands natural community in the reserve system will enhance the value of these lands for foraging raptors, including covered raptors (Swainson's hawk, white-tailed kite, and western burrowing owl). For example, the establishment of hedgerows consisting of uncultivated strips adjacent to cultivated fields provides a stable source of rodent species such as California vole, a valuable prey species for Swainson's hawk. This and other practices to enhance habitat value for foraging raptors on cultivated lands are described in Conservation Measure 3, *Manage and Enhance the Reserve System*.

6.3.3.2 Grassland Natural Community

6.3.3.2.1 How Achieving the Landscape-Level Objectives Will Benefit the Grassland Natural Community

Achieving Objective L-1.2 will provide a variety of environmental gradients in the reserve system, thus increasing opportunities for protecting a diversity of grassland species dependent upon specific microclimates or conditions. Protecting a range of conditions is likely to capture species richness, genetic variation, and other elements of biodiversity that are poorly known or surveyed (Spencer et al. 2006).

Achieving Objective L-1.3 will increase the size and connectivity of protected grasslands and will eliminate grassland fragmentation in the reserve system. Grassland fragmentation limits movement of widely ranging wildlife, and limits dispersal of covered species such as California tiger salamander. It also limits dispersal of some grassland insects (Collinge and Palmer 2002) and grassland plant species with wind-dispersed seeds (Soons et al. 2005).

Achieving Objective L-2.1 in grasslands will increase diversity and relative cover of native plant species, and decrease abundance of undesirable non-native plant species. Nonnative grass species such as wild oats (*Avena* spp.) and bromes (*Bromus* spp.) are so well established in California grasslands that they are considered naturalized, and are unlikely to ever be eradicated (Reiner 1999). There are some invasive species, however, such as yellow star thistle, which can dominate grassland and severely limit its habitat value for native species. Management practices such as controlled livestock grazing can reduce nonnative species in favor of native species, and grassland management is necessary to reduce or eradicate aggressive nonnatives that provide unfavorable habitat conditions for native wildlife (Reiner 1999). Additionally, bullfrogs and nonnative predatory fishes will be controlled in stock ponds and seasonal wetlands associated with grasslands to improve native aquatic wildlife biodiversity. Conservation Measure 3, *Manage and Enhance Natural Communities*, describes grassland management and enhancement measures to achieve this objective.

6.3.3.2.2 Grassland Natural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of the grassland natural community within the reserve system. The goal and objectives below address additional needs specific to this natural community that will not otherwise be met at the landscape level.

Goal NC-G1: Large, contiguous patches of grassland, and smaller patches within a mosaic of other natural community types, to sustain and enhance the distribution and abundance of associated covered and other native species in the Conservation Reserve Area.

Objective NC-G1.1: Protect and manage 4,500 acres of unprotected grassland in the Conservation Reserve Area, including at least 3,000 acres in the Dunnigan Hills planning unit (PU 5).

Rationale: Grasslands provide important habitat for a variety of covered species and contribute to the region's biodiversity by providing food and cover for wildlife and habitat for native grasses and forbs. Large protected patches of grassland will maintain the diversity of ecosystem functions supported by grassland in the Plan Area (e.g., production of seeds that serve as food for birds and rodents; production of insects, rodents, and other small species that serve as prey for snakes, songbirds, and raptors; and capture of surface water and groundwater that support watersheds and flow in perennial, intermittent, and ephemeral streams). Protected grassland will provide habitat for covered species that are dependent on grassland for part or all of their lifecycle, including California tiger salamander, western burrowing owl, tri-colored blackbird, and Swainson's hawk. Protected grassland will also provide habitat for other native wildlife species (e.g., grasshopper sparrow, western meadowlark, grey fox, American badger, small rodents).

In determining the areal extent and spatial configuration of grassland to be conserved, the following factors were considered: current extent of protected grasslands in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for covered grassland species; and the amount of grassland available that can reasonably be protected in targeted conservation areas. Covered activities will result in the loss of up to 2,142 acres of grasslands. With the achievement of this objective, 13% of this natural community in the Plan Area will be conserved in Categories 1 and 2 Public and Easement Lands (12,564 acres out of 80,896 acres conserved, Table 5-5, *Natural Community Benefits and Net Effects*). At least 3,000 acres of the 4,500 acres of newly protected lands will be protected in the Dunnigan Hills planning unit (PU 5), which contains the largest area of contiguous grasslands in the Conservation Reserve Area. The Dunnigan Hills planning unit supports an important population of California tiger salamander and includes the only designated critical habitat for this species in the Plan Area.

Although the majority of grassland protection and restoration will occur in planning unit 5, grassland protection will also occur elsewhere in the Conservation Reserve Area where upland habitat for giant garter snake is needed adjacent to restored fresh emergent wetland natural community, and where occupied burrowing owl habitat is targeted for acquisition.

Conservation Measure 1, *Establish Reserve* System, describes how Objective NC-G1.1 will be met through establishment of conservation easements sited consistent with reserve design criteria.

Objective NC-G1.2: Maintain and enhance the functions of protected grassland in the reserve system as habitat for covered and other native species by increasing burrow availability for burrow-dependent species, and increasing prey abundance and accessibility for grassland-foraging species.

Rationale: The habitat functions of grassland communities include providing food, cover, and nesting/seasonal habitat for a variety of vertebrate covered and other native wildlife species (e.g., California tiger salamander, rodents, grasshopper sparrow, western meadowlark, horned lark, Swainson's hawk, northern harrier, and insects, including native

pollinator species). Enhancing these functions will support the use of grassland habitats by these species and potentially increase their reproduction rate and survival. Conservation Measure 3, *Manage and Enhance Natural Communities* describes grassland management and enhancement measures to achieve this objective.

6.3.3.3 Valley Foothill Riparian Natural Community

6.3.3.3.1 How Achieving the Landscape-Level Objectives Will Benefit the Valley Foothill Riparian Natural Community

Achieving Objective L-1.3 will provide reserve system connectivity. Many wildlife species use riparian corridors for dispersal and migration: the Yolo HCP/NCCP science advisors recommend using riparian corridors as the "backbones" to connect the reserve system (Spencer et al. 2006). It is therefore important for the Yolo HCP/NCCP to expand protected riparian areas to build a reserve system that provides connectivity in perpetuity. The Yolo HCP/NCCP will achieve this objective through prioritizing land acquisitions adjacent to and between baseline protected lands, as described in Conservation Measure 1, *Establish Reserve System.* Baseline protected lands are shown on Figure 6-3, *Baseline Public and Easement Lands in the Plan Area*.

Achieving Objectives L-1.4, L-1.5, and L-1.6 will result in the protection, management and enhancement of large, contiguous valley foothill riparian areas along Cache Creek, Putah Creek, and Sacramento River. The Science Advisors (Spencer et al. 2006) identified Cache Creek and Putah Creek as important areas in which to conserve the valley foothill riparian community and provide wildlife habitat connectivity. These corridors support some of the largest contiguous patches of valley foothill riparian natural community remaining in the Plan Area, and therefore support wildlife species that are rare or absent in other parts of the Plan Area.

Achieving Objective L-2.1 in the valley foothill riparian natural community will increase the native biodiversity and relative cover of native plant species through enhancement and management (e.g., invasive plant management) and through riparian restoration (e.g., planting a diversity of native species) as described in Conservation Measure 3, *Manage and Enhance Natural Communities.* High species diversity promotes natural community resilience, and native biodiversity in riparian systems generates structural diversity that constitutes habitat for many riparian wildlife species.

6.3.3.3.2 Valley Foothill Riparian Natural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of the valley foothill riparian natural community within the reserve system. The goal and objectives below address additional needs specific to this natural community that will not otherwise be met at the landscape level.

Goal NC-VFR1: Functional valley foothill riparian natural community that benefits covered species and promotes native biodiversity in the Plan Area.

Objective NC-VFR1.1: Protect and manage 1,600 acres of unprotected valley foothill riparian habitat distributed primarily in planning units 7 and 9.

Rationale: The valley foothill riparian natural community supports a high diversity of native wildlife species and provides essential foraging and breeding habitat for five covered species: western yellow-billed cuckoo, least Bell's vireo, Swainson's hawk, white-tailed kite,

and western pond turtle. Other native species that use valley foothill riparian include rose mallow, pallid bat, and yellow-billed magpie.

In determining the areal extent and spatial configuration of riparian natural community to be conserved, the following factors were considered: spatial and functional needs of covered and other riparian species, including genetic exchange; current extent of protected riparian natural community in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for covered riparian species; and the amount of riparian available that can reasonably be protected in targeted conservation areas. The HCP/NCCP will focus protection in the Lower Cache Creek (PU 7) and Lower Putah Creek (PU 9) planning units. With the achievement of this objective 39% of the valley foothill riparian natural community in the Plan Area will be conserved in categories 1 and 2 public and easement lands (3,630 acres conserved out of 12,442 acres in the Plan Area: Table 5-5, *Natural Community Benefits and Net Effects*). Conservation Measure 1, *Establish Reserve* System, describes how the HCP/NCCP will achieve this objective through land acquisitions based on reserve design criteria.

Objective NC-VFR1.2: Restore one acre of valley foothill riparian natural community for each acre lost as a result of covered activities to ensure no net loss of habitat amount and function for multiple covered species. Site the restoration to improve connectivity among patches of existing valley foothill riparian vegetation within the Cache Creek and Putah Creek Corridors and the Sacramento River.

Rationale: Restoring valley foothill riparian provides a spatial and temporal framework for ensuring that life history requisites for associated covered and other native species are maintained and that connectivity among patches of valley foothill riparian is maintained and improved. Restoration of valley foothill riparian along Cache Creek and Putah Creek and the Sacramento River will contribute towards achieving the establishment of habitat corridors under Objectives L-1.4, L-1.5, and L-1.6. The HCP/NCCP will achieve this objective by applying restoration techniques and criteria described in Conservation Measure 2, *Restore Natural Communities.*

6.3.3.4 Alkali Prairie Natural Community

6.3.3.4.1 How Achieving the Landscape Objectives Will Benefit the Alkali Prairie Natural Community

Achieving Objective L-1.3 will increase the size and connectivity of the reserve system by acquiring lands adjacent to Category 1 Public and Easement Lands, also known as baseline protected lands. The manner in which this objective will be achieved specifically for the alkali prairie natural community is described under Objective NC-AS1.1.

Achieving Objective L-2.1 will maintain or increase native biodiversity in alkali seasonal wetlands, and minimize adverse effects of invasive plants. Increasing the cover of native alkali prairie plants relative to invasive species will minimize competition posed by invasive plants to native plant species, and improve overall habitat suitability for native plants. Invasive species can alter important ecological processes in wetlands such as nutrient cycling, hydrological cycles, sediment deposition, and erosion. Invasive species will be managed in the alkali prairie natural community through implementation of Conservation Measure 3, *Manage and Enhance Natural Communities*.

6.3.3.4.2 Alkali Prairie Natural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of the alkali prairie natural community within the reserve system. The goal and objectives below address additional needs specific to this natural community that will not otherwise be met at the landscape level.

Goal NC-AS1: A reserve system that protects the habitat values of the remaining alkali prairie natural community in the Plan Area.

Objective NC-AS1.1: Protect 33 acres of alkali prairie natural community on the Woodland Regional Park within the first five years of Yolo HCP/NCCP implementation (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).

Objective NC-AS1.2: Incorporate the existing protected (Category 1) alkali prairie habitat at the Alkali Grasslands Preserve properties into the reserve system (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).

Rationale: The alkali prairie natural community was once common in the Central Valley and in portions of the Plan Area. However, conversion of land to agriculture, livestock grazing, commercial uses, and urban uses has reduced the extent and degraded the condition of this community throughout much of its historical range. In addition, the alkali prairie natural community has been subject to fragmentation, hydrologic alteration, and invasion by nonnative species. The decline in the extent, distribution, and condition of this community has reduced the diversity of native plant species uniquely associated with alkali soils and lowered the habitat functions for native wildlife. The small proportion of the historical extent of alkali prairie remaining in the Plan Area has been substantially degraded in its ecological function as habitat for native species and covered species adapted to alkali conditions. Remaining alkali prairie with the highest ecological function is found on only two small sites in the Plan Area: Alkali Grasslands Preserve (baseline public and easement lands category 1) and the Woodland Regional Park. Both sites support the only known occurrences of palmate-bracted bird's-beak in the Plan Area. The sites also support additional rare plant species including Heckard's peppergrass, brittlescale, San Joaquin spearscale, and alkali milk-vetch. Achieving this objective will ensure coordinated management in perpetuity of the highest functioning remaining alkali prairie in the Plan Area, thus helping to ensure the continued existence of this community (and palmate-bracted bird's-beak) in the Plan Area. The HCP/NCCP will achieve this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective NC-AS1.3: Manage and enhance the functions of alkali prairie within the reserve system as habitat for covered and other native species by improving hydrologic conditions and reducing the adverse effects of nonnative plants and human activities on habitat conditions.

Rationale: Enhancement of habitat for palmate-bracted bird's beak and other rare plants in the alkali prairie natural community will help to ensure the long-term survival of their populations in the Plan Area. Landscape-level processes such as the construction of Monticello Dam and flood protection channels have permanently altered the hydrological regimes that once supported the alkali prairie natural community. Development immediately adjacent to sites where remaining alkali prairie is found, such as storm water detention ponds, have negatively affected local hydrological processes that support alkali prairie. Additionally, all of the sites where alkali prairie currently exists have been altered by agricultural development to some degree. An important management action for alkali prairie is the control of invasive plant species such as Italian ryegrass and perennial pepperweed. Control and, if feasible, elimination of these invasive species will significantly improve the function and quality of protected alkali prairie as habitat for covered and other

native species. The HCP/NCCP will achieve this objective as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.3.5 Fresh Emergent Wetland Natural Community

6.3.3.5.1 How Achieving the Landscape Objectives Will Benefit the Fresh Emergent Wetland Natural Community

Achieving Objective L-2.1 will reduce the introduction and proliferation of nonnative species in the fresh emergent wetland natural community. Consistent with this objective, nonnative invasive plants and wildlife will be managed and controlled as needed to sustain native biodiversity and protect covered species. Nonnative fish and other invasive predators will be reduced as needed to protect populations of native amphibians and aquatic reptiles. The HCP/NCCP will achieve this objective through management of invasive species in fresh emergent wetland as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.3.5.2 Fresh Emergent Wetland Natural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the fresh emergent wetland natural community within the reserve system. The goal and objectives below address additional needs specific to this natural community that will not otherwise be met at the landscape level.

Goal NC-FEW1: Functional fresh emergent wetland natural community that benefits covered species and promotes native biodiversity in the Plan Area.

Objective NC-FEW1.1: Protect and manage 300 acres of freshwater emergent wetland in the Conservation Reserve Area.

Rationale: The fresh emergent wetland natural community provides essential foraging and breeding habitat for covered species, including tricolored blackbird, western pond turtle, and giant garter snake. In determining the areal extent and spatial configuration of fresh emergent wetland to be conserved, the following factors were considered: spatial and functional needs of covered and other fresh emergent wetland species, including genetic exchange; current extent of protected fresh emergent wetlands in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for covered fresh emergent wetland species; and the amount of fresh emergent wetland available that can reasonably be protected in targeted conservation areas. Covered activities will result in the permanent loss of up to 91 acres of fresh emergent wetland natural community. With the achievement of this objective, 58% of the fresh emergent wetland in the Plan Area will be conserved under categories 1 and 2 public and easement lands (Table 5-5, *Natural Community Benefits and Net Effects*). Conservation Measure 1, *Establish Reserve* System, describes how the HCP/NCCP will achieve this objective through land acquisitions based on reserve design criteria.

Objective NC-FEW1.2: Restore fresh emergent wetland natural community in the Conservation Reserve Area at a ratio of one acre restored to each acre lost as a result of covered activities.

Rationale: In addition to the protection, management, and enhancement of this natural community provided under Objectives NC-FEW1.1 and NC-FEW1.2, the JPA will restore this natural community to replace fresh emergent wetlands removed by the covered activities.

Objective NC-FEW1.3: Enhance the functions of protected fresh emergent wetland as habitat for covered and other native species.

Rationale: Habitat functions of fresh emergent wetland include providing food, thermoregulation, and cover from predators and nesting/seasonal habitat for a variety of vertebrate and invertebrate covered and native wildlife species (e.g., waterfowl, herons, rails, marsh wren, song sparrow, red-winged blackbird). The vegetation composition and functions of fresh emergent wetland are maintained by hydrologic conditions that support saturated soil and ponded water conditions. Maintaining hydrologic conditions that support protected fresh emergent wetland will ensure the maintenance of their functions as habitat for covered and other native species. The HCP/NCCP will achieve this objective through management of hydrologic conditions in fresh emergent wetland as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.3.6 Lacustrine and Riverine Natural Community

6.3.3.6.1 How Achieving the Landscape Objectives Will Benefit the Lacustrine and Riverine Natural Community

Landscape-level biological goals and objectives integral to the conservation strategy for the lacustrine and riverine natural community are stated below.

Achieving Objectives L-1.4 and L-1.5 will protect the Cache Creek and Putah Creek riverine systems and associated vegetation to provide an intact and functioning ecosystem for western pond turtle and other native aquatic and semiaquatic species.

Achieving Objective L-2.1 will increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species. Consistent with this objective, nonnative invasive plants and wildlife will be managed and controlled as needed to sustain native biodiversity and protect covered species in the lacustrine and riverine natural community. Nonnative fish and other invasive predators will be reduced as needed to protect populations of native amphibians and aquatic reptiles. The HCP/NCCP will achieve this objective through management of invasive species in the lacustrine and riverine natural community as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.3.6.2 Lacustrine and Riverine Natural Community Goals and Objectives

The landscape-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of the lacustrine and riverine natural community within the reserve system. The goal and objectives below address additional needs specific to this natural community that will not otherwise be met at the landscape level.

Goal NC-LR1: Functional lacustrine and riverine natural community that benefits covered species and promotes native biodiversity in the Plan Area.

Objective NC-LR1.1: Protect and manage 800 acres of lacustrine and riverine natural community providing habitat for covered and other native species in the Conservation Reserve Area.

Rationale: The lacustrine and riverine natural community includes ponds that provide aquatic habitat for California tiger salamander, and streams and other open water areas that provide habitat for western pond turtle and giant garter snake. In determining the areal extent and spatial configuration of lacustrine and riverine natural community to be

conserved, the following factors were considered: spatial and functional needs of covered and other lacustrine and riverine species, including genetic exchange; current extent of protected lacustrine and riverine natural community in the Plan Area; mitigation and conservation needs for covered lacustrine and riverine species; and the amount of lacustrine and riverine natural community available that can reasonably be protected in targeted conservation areas. Covered activities will result in the loss of 248 acres of the lacustrine and riverine natural community. With the achievement of this objective, 18% of the lacustrine and riverine natural communities in the Plan Area will be conserved in categories 1 and 2 public and easement lands (2,341 acres conserved out of 13,203 acres in the Plan Area; Table 5-5, *Natural Community Benefits and Net Effects*). The species-specific objectives for California tiger salamander and giant garter snake provide additional specificity as to the location and types of lacustrine and riverine natural community to be protected. Conservation Measure 1, *Establish Reserve* System, describes how the HCP/NCCP will achieve this objective through land acquisitions based on reserve design criteria.

Objective NC-LR1.2: Restore lacustrine and riverine natural communities in the Conservation Reserve Area at a ratio of one acre restored to each acre lost, respectively, as a result of covered activities.

Rationale: Objective NC-LR1.2 will ensure covered activities do not result in a net loss of lacustrine and riverine natural communities. However, covered activities will avoid removal of these water bodies consistent with Chapter 4. Conservation Measure 2, *Restore Natural Communities*, describes how the HCP/NCCP will meet these objectives.

6.3.4 Covered Species Biological Goals and Objectives

This section describes the biological goals and objectives that guide the Yolo HCP/NCCP conservation strategies for covered species. For each covered species, this section first lists landscape-level and natural community goals and objectives that will benefit the species, with descriptions of how achieving the objectives would benefit the species. It then lists species-specific biological goals and objectives, followed by descriptions of the rationale with which they were established. Conservation measures designed to meet all objectives are found in Section 6.4, *Conservation Measures*.

For a complete description of status, range, life history, threats, and modeled habitat for each covered species, see Appendix A, *Covered Species Accounts*.

6.3.4.1 Palmate-Bracted Bird's Beak

6.3.4.1.1 How Achieving the Landscape Objectives Will Benefit Palmate-Bracted Bird's Beak

Achieving Objective L-1.3 will increase the size and connectivity of the reserve system by acquiring lands adjacent to baseline protected lands. The manner in which this objective will be achieved specifically for palmate-bracted bird's beak is described in Section 6.3.3.4.2, *Alkali Prairie Natural Community Goals and Objectives,* for Objective NC-AS1.1.

Achieving Objective L-2.1 will maintain or increase native biodiversity in palmate-bracted bird's beak habitat, and minimize adverse effects of invasive plants. This will minimize competition for resources with palmate-bracted bird's beak, and improve overall habitat suitability for the species. Invasive species will be managed in palmate-bracted bird's beak habitat through implementation of

Conservation Measure 3, *Manage and Enhance Natural Communities*. Other management will occur to enhance palmate-bracted bird's beak populations.

6.3.4.1.2 How Achieving the Natural Community Objectives Will Benefit Palmate-Bracted Bird's Beak

Achieving Objectives NC-AS1.1 and NC-AS1.2 will result in the protection of palmate-bracted bird's beak habitat at the Woodland Regional Park in a perpetual conservation easement, and the enrollment of baseline protected habitat at Alkali Grasslands Preserve into the reserve system as pre-permit reserve lands. These are the only sites with known occurrences of palmate-bracted bird's beak in the Plan Area. The alkali prairie natural community, which is habitat for palmate bracted bird's-beak, was once common in the Central Valley and in portions of the Plan Area. However, conversion of land to agriculture, livestock grazing, commercial uses, and urban uses has reduced the extent and degraded the condition of this community throughout much of its historical range. Protection of suitable habitat at Woodland Regional Park will ensure long-term protection and management of the remaining habitat. This habitat protection will complement and expand on the existing protected palmate-bracted bird's-beak habitat at Alkali Grasslands Preserve. This complex of adjacent reserve lands specifically managed for palmate-bracted bird's-beak offers the best chance for long-term survival of the species in the Plan Area.

Achieving Objective NC-AS1.2 will result in the management and enhancement of habitat functions for palmate-bracted bird's beak on lands incorporated into the reserve system. The major stressors of palmate-bracted bird's beak in the Plan Area have been habitat fragmentation, hydrologic alteration, and invasion by nonnative species. Enhancing the habitat to reduce or offset these stressors is expected to increase the abundance of palmate-bracted bird's-beak in the reserve system.

6.3.4.1.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of palmate-bracted bird's beak. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape or natural community levels.

Goal PBBB1: Provide for the conservation of palmate-bracted bird's beak in the Plan Area.

> **Objective PBBB1.1:** Maintain or increase the abundance of palmate-bracted bird's beak in the reserve system relative to the baseline range of abundance.
>
> **Rationale:** The size of the palmate-bracted bird's beak population in the Plan Area varies annually from a few plants to over 2,000 plants, most likely in response to annual variation in rainfall (U.S. Fish and Wildlife Service 2009). Portions of the population on the Woodland Regional Park and Alkali Grasslands Preserve have increased in recent years due to habitat alterations. Increasing the abundance of palmate-bracted bird's-beak in protected habitat areas will help stabilize the population and ensure the species' ongoing existence in the Plan Area in the face of future changes in environmental conditions (e.g., climate change). Currently, its relatively small population size leaves the species vulnerable to stochastic (chance environmental) events such as a prolonged drought or a reproductive failure when the population is low and cannot replenish itself from the seed bank. Increasing its abundance will also decrease the likelihood of its extirpation in the Plan Area from such stochastic events.

[**note to reader:** In preparation of the public review draft, we will be coordinating with the Center for Natural Lands Management to further refine this strategy and look for opportunities to enhance the population in the Plan Area.]

6.3.4.2 Valley Elderberry Longhorn Beetle

6.3.4.2.1 How Achieving the Landscape Objectives Will Benefit the Valley Elderberry Longhorn Beetle

Achieving Objective L-1.3 will provide for reserve system connectivity. The valley elderberry longhorn beetle has a limited ability to disperse through unsuitable habitat (Collinge et al. 2001), therefore habitat connectivity is vital for this species.

Achieving Objectives L-1.4, L-1.5, and L-1.6 will provide contiguous blocks of riparian natural community along Cache and Putah Creeks and/or along the Sacramento River. This species has distinct, relatively isolated populations in individual drainages, likely due to the beetle's limited dispersal capability (Collinge et al. 2001). The species is unlikely to colonize unoccupied drainages, even if suitable habitat is present. It is therefore important to protect habitat in drainages where the species is known to occur, such as along the Putah and Cache Creek drainages.

Achieving Objective L-2.1 in riparian areas will reduce the risk of invasive plants outcompeting elderberry shrubs, which are necessary for the valley elderberry longhorn beetle's survival. This objective will be achieved through riparian management as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.4.2.2 How Achieving the Natural Community Objectives Will Benefit the Valley Elderberry Longhorn Beetle

Achieving Objectives NC-VFR1.1 and NC-VFR1.2 will result in the protection of 1,600 acres of unprotected valley foothill riparian natural community, primarily in the Cache Creek and Putah Creek planning units, and additional riparian restoration at a ratio of one acre restored for each acre lost as a result of covered activities. Valley elderberry longhorn beetle occurs primarily in the valley foothill riparian natural community, and the Cache Creek and Putah Creek planning units are known to support valley elderberry longhorn beetle populations. As described above, this species has distinct, relatively isolated populations in individual drainages, and the species is unlikely to colonize unoccupied drainages, even if suitable habitat is present (Collinge et al. 2001). Protection of habitat in occupied drainages is therefore vital. Only those portions of valley foothill riparian natural community that include elderberry shrubs, however, are capable of supporting the valley elderberry longhorn beetle. Therefore, it is necessary to include species-specific objectives (Objective VELB-1.1 and Objective VELB-1.2) to ensure that the protected and restored valley foothill riparian natural community provides suitable habitat for valley elderberry longhorn beetle.

6.3.4.2.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, as well as the associated conservation measures in Section 3.4, *Conservation Measures,* are expected to contribute to the conservation of the valley elderberry longhorn beetle. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape or natural community level.

Goal VELB-1: Provide for the conservation of valley elderberry longhorn beetle in the Plan Area.

Objective VELB-1.1: Within the 1,600 acres of protected valley foothill riparian natural community (Objective NC-VFR-1.1), prioritize protection of valley elderberry longhorn beetle populations along Lower Cache Creek and Lower Putah Creek and the Sacramento River, and adjacent lands to provide for valley elderberry longhorn beetle population expansion.

Rationale: Cache and Putah Creeks and the Sacramento River are known to support populations of valley elderberry longhorn beetle. Although the landscape and natural community objectives provide for protection of valley foothill riparian natural community along these two drainages, only those portions of the valley foothill natural community that support elderberry shrubs are capable of supporting this species. Furthermore, due to the species' limited dispersal capability, it has a low likelihood of occupying areas far from existing populations. It is therefore important to protect occupied habitat, and lands adjacent to occupied habitat, to provide for population expansion. Yolo County's implementation of the Cache Creek Resources Management Plan has resulted in the establishment of thousands of elderberry shrubs along the Cache Creek corridor. The Yolo HCP/NCCP will build on this effort to provide large, contiguous patches of valley elderberry longhorn beetle habitat in this area as well as other areas.

Objective VELB-1.2: Within the restored valley foothill riparian natural community (Objective NC-VFR1.2), establish elderberry shrubs and associated riparian plant species, and prioritize lands adjacent to existing populations to provide for population expansion.

Rationale: Restoring valley foothill riparian forest with the beetle's elderberry host plant will expand the availability of suitable habitat for valley elderberry longhorn beetle. This net increase in beetle habitat is expected to result in a net population increase in valley elderberry longhorn beetle. Since the riparian natural community will be restored to fill in gaps between existing riparian areas, this restoration will result in a wider and less fragmented distribution of the species if valley elderberry longhorn beetles colonize these restored areas.

6.3.4.3 California Tiger Salamander

6.3.4.3.1 How Achieving the Landscape Objectives Will Benefit the California Tiger Salamander

Landscape-level biological goals and objectives integral to the conservation strategy for California tiger salamander are stated below.

Achieving Objective L-1.3 will provide for reserve system connectivity. An interconnected reserve system is important to allow for dispersal and genetic exchange within the California tiger salamander population in the Plan Area.

Achieving Objective L-2.1 will increase native species diversity and relative cover in California tiger salamander habitat. Increasing native vegetative cover has been shown to increase pond hydroperiod (Marty 2005), thus making aquatic habitat more suitable for California tiger salamander breeding. Additionally, consistent with this objective, the introduction and proliferation of nonnative bullfrogs and other nonnative aquatic wildlife that prey on California tiger salamanders will be reduced. Bullfrogs and predatory fish are a primary source of mortality for this species (Fisher and Shaffer 1996). As described in Conservation Measure 3, *Manage and Enhance Natural Communities*, nonnative aquatic predators that threaten California tiger salamander populations will

be removed from ponds and other aquatic habitat, as needed, to sustain the California tiger salamander population in the reserve system.

6.3.4.3.2 How Achieving the Natural Community Objectives Will Benefit the California Tiger Salamander

Natural community biological goals and objectives integral to the conservation strategy for the California tiger salamander are stated below.

Achieving Objective NC-G1.1 will result in the protection of at least 3,000 acres of grassland in the Dunnigan Hills planning unit. This planning unit provides the most California tiger salamander habitat in the Plan Area, and includes a known population and critical habitat for this species.

Achieving Objective NC-G1.2 will increase the value of grasslands for California tiger salamander by increasing the abundance of native rodents and reducing the relative cover of invasive plants that reduce habitat value for this species. California tiger salamanders use rodent burrows for cover, and a targeted reduction of invasive plants will increase the species' ability to move through the landscape. This objective will be met through measures described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.4.3.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, and associated conservation measures, discussed above, are expected to contribute to the conservation of California tiger salamander. The goal and objectives below address additional needs, specific to this species, that would not otherwise be met at the landscape and natural community levels

Goal CTS1: Provide for the conservation of California tiger salamander in the Plan Area.

> **Objective CTS1.1:** Within the 3,000 acres of protected grasslands in the Dunnigan Hills planning unit (Objective NC-G1.1), include at least 1,500 acres of modeled upland habitat for California tiger salamander and prioritize protection in designated critical habitat.
>
> **Rationale:** Modeled upland habitat for California tiger salamander consists of grasslands within 1.3 miles of modeled aquatic breeding habitat. In determining the areal extent of California tiger salamander habitat to be conserved, the following factors were considered: spatial and functional needs of the species, including genetic exchange; current extent of protected habitat in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for the species; and the amount of habitat available that can reasonably be protected in targeted conservation areas. Based on the proportion of modeled upland habitat within grasslands in the Dunnigan Hills planning unit, it is reasonable to expect that at least 1,500 acres out of the 5,000 acres protected can be sited within 1.3 miles of modeled California tiger salamander aquatic breeding habitat. Covered activities will result in the loss of 361 acres of upland habitat for this species. Protection of at least 1,500 acres of high quality upland habitat will therefore exceed typical mitigation standards (often 3:1 for upland habitat) and will provide for the conservation of the species in the Plan Area. With this protection, 8% of the modeled California tiger salamander upland habitat in the Plan Area will be protected, and the protected lands will be concentrated in the most valuable habitat area for the species, including designated critical habitat.
>
> **Objective CTS1.2:** Within the 800 acres of protected lacustrine and riverine natural community (Objective NC-LR1.1), protect at least 50 acres of aquatic habitat and restore or

create 1 acre of aquatic habitat for California tiger salamander for each acre lost as a result of covered activities (Objective NC-LR1.2). Within the protected and restored aquatic habitat, include at least five California tiger salamander breeding pools that are found to support all life stages of the salamander through at least all water year types..

Rationale: Protection of aquatic breeding habitat is necessary to ensure the ongoing reproduction of California tiger salamander in currently occupied habitat and that sufficient unoccupied aquatic breeding habitat is protected to accommodate any future expansions in its distribution and abundance. Up to 12 acres of aquatic California tiger salamander habitat may be lost as a result of covered activities: the restoration or creation of 1 acre for each acre lost will result in no net loss of aquatic habitat. Additionally, protection of 50 acres of aquatic habitat within the dispersal range of occupied ponds will exceed the standard 3:1 mitigation ratio and will provide for the conservation of California tiger salamander in the Plan Area.

The HCP/NCCP may achieve the occupancy standard for this objective either by protecting occupied breeding pools or protecting unoccupied breeding pool habitat that later becomes occupied. For protected unoccupied habitat, the JPA will undertake habitat enhancement actions designed to encourage use by breeding California tiger salamander (e.g., controlling nonnative predators, improving hydrologic conditions).

Conservation Measure 1, *Establish Reserve System*, describes how the JPA will design the reserve system to achieve the protection component of this objective. Conservation Measure 2, *Restore Natural Communities*, describes how the JPA will restore or create ponds for California tiger salamander. Conservation Measure 3, *Manage and Enhance Natural Communities*, describes habitat enhancement measures to encourage occupation by California tiger salamander.

6.3.4.4 Western Pond Turtle

6.3.4.4.1 How Achieving the Landscape Objectives Will Benefit the Western Pond Turtle

Achieving Objective L-1.3 will provide for reserve system connectivity. An interconnected reserve system is important to allow for dispersal and genetic exchange within the western pond turtle population in the Plan Area.

Achieving Objectives L-1.4 and L-1.5 will provide contiguous riparian areas along Cache and Putah Creeks. This will provide aquatic and upland habitat for western pond turtle, and will allow for dispersal and genetic exchange along the Cache Creek and Putah Creek corridors.

6.3.4.4.2 How Achieving the Natural Community Objectives Will Benefit the Western Pond Turtle

Achieving Objective NC-CL1.2 will result in protection of at least 1,300 acres of rice. Rice provides aquatic habitat for western pond turtle.

Achieving Objective NC- G1.1 will result in protection of at least 4,500 acres of unprotected grassland in the Conservation Reserve Area. Some of this natural community will be adjacent to aquatic western pond turtle habitat and will provide upland habitat for the species.

Achieving Objective NC-VFR1.1 will result in protection of at least 1,600 acres of valley foothill riparian. Protection of these acres will provide upland habitat for western pond turtle.

Achieving Objectives NC-FEW1.1 and NC-FEW1.2 will result in protection of 300 acres of freshwater emergent wetland, and additional restoration of this natural community to achieve no net loss. These actions will provide aquatic habitat for western pond turtle.

Achieving Objectives NC-LR1.1 and NC-LR1.2 will result in protection of 800 acres of lacustrine and riverine natural community, and additional restoration of this natural community to achieve no net loss. These actions will provide aquatic habitat for western pond turtle. Some of the lacustrine habitat protected for California tiger salamander will also benefit western pond turtle.

6.3.4.4.3 Species-Specific Goals and Objectives

No species-specific objectives are necessary for the western pond turtle because the landscape and natural community-level objectives are sufficient to conserve this species. Assuming all the protected rice and fresh emergent wetland habitat, and 750 acres of the protected lacustrine and riverine habitat (not including the 50 acres of California tiger salamander aquatic habitat) will provide aquatic habitat for western pond turtle, achieving the natural community objectives will provide an estimated 2,290 acres of newly protected western pond turtle habitat in the reserve system. Covered activities will result in the loss of 394 acres of aquatic habitat for the western pond turtle: the protection of 2,290 acres of aquatic habitat will exceed typical mitigation for this species and will further provide for the conservation of western pond turtle in the Plan Area. Additionally, the protection of upland natural communities will result in the protection of an estimated 6,000 acres of upland habitat for western pond turtle (based on the proportion of upland habitat present in these natural communities in the Plan Area): this will mitigate the loss of 2,247 acres of upland habitat for western pond turtle, and will further provide for the species' conservation in the Plan Area.

6.3.4.5 Giant Garter Snake

6.3.4.5.1 How Achieving the Landscape Objectives Will Benefit the Giant Garter Snake

Achieving Objective L-1.3 will result in a large, interconnected reserve system. Habitat connectivity is vital to sustain populations of giant garter snake, for the purposes of genetic exchange, dispersal, and daily movement.

Achieving Objective L-2.1 will increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species. While nonnative aquatic plants such as water primrose provide cover for the giant garter snake, they can impede snake movement if they become too dense. Nonnative wildlife species such as bullfrog and largemouth bass prey on young giant garter snakes and may threaten local populations. Consistent with this objective, nonnative invasive plant species that degrade giant garter snake habitat or nonnative wildlife species that prey on the giant garter snake will be controlled if monitoring determines that giant garter snake populations in the reserve system are threatened by these factors. Reduction of the introduction and proliferation of nonnative species potentially harmful to giant garter snake and its habitat will be achieved through implementation of management and enhancement actions described in Conservation Measure 3, *Manage and Enhance Natural Communities*.

6.3.4.5.2 How Achieving the Natural Community Objectives Will Benefit the Giant Garter Snake

Achieving Objective NC-CL1.2 will result in the protection of 1,300 acres of rice that provides habitat value for covered and other native species in the Conservation Reserve Area. This will provide aquatic habitat for the giant garter snake, as well as rice checks and field borders providing adjacent upland movement and overwintering habitat.

Achieving Objective NC-G1.1 will result in the protection of 4,500 acres of grassland in the Conservation Reserve Area. A portion of this is expected to provide upland habitat for the giant garter snake.

Achieving Objective NC-G1.2 will enhance the functions of protected grasslands in the reserve system. This will include enhancement to increase the abundance of burrowing rodents, thus providing burrows for giant garter snakes to seek cover and overwinter. Enhancement actions to encourage burrowing rodents and improve giant garter snake upland habitat are described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

Achieving Objectives NC-FEW1.1 and NC-FEW1.2 will result in protection of 300 acres of freshwater emergent wetland and additional restoration of this natural community. This will provide aquatic habitat for giant garter snake.

Achieving Objectives NC-LR1.1 and NC-LR1.2 will result in protection of 800 acres of lacustrine and riverine natural community, and additional restoration of this natural community to achieve no net loss as a result of covered activities. A portion of this will provide aquatic habitat for giant garter snake.

6.3.4.5.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, as well as associated conservation measures discussed above, will provide for the conservation of giant garter snake in the Plan Area. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community levels.

Goal GGS1: Provide for the conservation of giant garter snake in the Plan Area, including the Willow Slough/Yolo Bypass subpopulation and a segment of the Colusa Basin subpopulation, and connectivity between the two subpopulations.

> **Objective GGS1.1:** Protect and manage the 1,300 acres of protected rice land (Objective NC-CL1.2) in modeled giant garter snake habitat. Suitable emergent marsh can be substituted for rice land.
>
> **Rationale:** This objective ensures the entire 1,300 acres of conserved rice lands will provide habitat for giant garter snake. In determining the areal extent of rice to be conserved for giant garter snake, the following factors were considered: spatial and functional needs of the giant garter snake, including genetic exchange; current extent of protected habitat in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for this species; and the amount of rice land available that can reasonably be protected in targeted conservation areas. Covered activities will result in the removal of 87 acres of rice habitat for giant garter snake: protection of 1,300 acres of rice will mitigate this effect and further provide for the conservation of the species in the Plan Area. The 1,300 acres of rice lands can be substituted for appropriate wetlands, subject to

the wildlife agencies review and approval. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System.*

Objective GGS1.2: Protect and manage 1,160 acres of upland natural communities (Objective L-1.1) to provide active season upland movement habitat and at least 2,315 acres to provide overwintering habitat for giant garter snake.

Rationale: This objective provides for the protection of uplands necessary for the giant garter snakes to move between sites, bask, and seek refuge in terrestrial burrows during the active season, and to seek refuge in burrows during their dormant period in the winter.

Objective GGS1.3: Protect, restore, and manage the 300 acres of fresh emergent wetland natural community (Objective NC-FEW1.1), at least 420 acres of the lacustrine/riverine natural community (Objective NC-LR.11), the restored fresh emergent wetland (Objective NC-FEW1.2), and sufficient restored lacustrine and riverine natural community (Objective NC-LR1.2) to contribute to the recovery of the giant garter snake. Ensure at least 80% of the aquatic habitat is perennial, and the remainder provides aquatic habitat for the giant garter snake during the active season at least through July of each summer.

Rationale: This objective is necessary to ensure the protected fresh emergent wetland provides suitable habitat for giant garter snake. In determining the areal extent of fresh emergent wetland to be protected for the giant garter snake, the following factors were considered: spatial and functional needs of the giant garter snake, including genetic exchange; current extent of protected habitat in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for this species; and the amount of fresh emergent wetlands available that can reasonably be protected in targeted conservation areas.

Achieving objectives GGS1.1 through GGS1.3 will result in the protection of 1,300 of rice, 420 acres of aquatic habitat, 300 acres of fresh emergent wetland, and 1,160 acres of active upland season movement habitat (i.e., uplands within 200 feet of rice, aquatic, and fresh emergent wetland habitat). The USFWS typically treats rice, aquatic, and fresh emergent wetland habitats as *aquatic* habitat for giant garter snake, and treats all uplands within 200 feet of giant garter snake aquatic habitat as upland habitat for this species. USFWS typically applies a standard mitigation ratio of 3:1 for *aquatic* habitat and uplands within 200 feet of *aquatic* habitat. Covered activities will result in the loss of 722 acres of giant garter snake habitat that is typically mitigated at a 3:1 ratio (723 acres X 3 = 2,169 acres)[7]. The Yolo HCP/NCCP will protect at least 3,180 acres of this habitat, which will exceed the typical mitigation standard and further contribute to the conservation of giant garter snake. Additionally, the JPA will restore an estimated 112 acres of aquatic and 76 acres of fresh emergent wetland habitat for giant garter snake..

Objective GGS1.4: In addition to the newly protected and restored giant garter snake habitat (Objectives GGS1.1, GGS1.2, and GGS1.3), enroll at least 3,583 acres of giant garter snake habitat on eligible baseline public and easement lands into the reserve system as pre-permit reserve lands.

Rationale: Baseline public and easement lands in the Plan Area (Section 5.2.2.2, *Public and Easement Lands*) currently support giant garter snake habitat. By enrolling these lands into the reserve system as pre-permit reserve lands, their management and monitoring for this species will be improved and raised to the standards of the Yolo HCP/NCCP conservation strategy. This will increase their conservation value to giant garter snake by helping to meet

[7] The species model also includes lands that are greater than 200 feet from aquatic habitat (termed *overwintering habitat*). While the 723 acres includes uplands *within* 200 feet of aquatic habitat (termed *active season upland habitat*), it does not include overwintering habitat.

the HCP/NCCP biological goals and objectives. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

6.3.4.6 Swainson's Hawk

6.3.4.6.1 How Achieving the Landscape Objectives Will Benefit the Swainson's Hawk

Achieving Objective L-1.3 will result in a large, interconnected reserve system. While the Swainson's hawk is a mobile species and not severely affected by habitat fragmentation, there are energetic costs associated with traveling across unsuitable areas to nesting or foraging habitat that could diminish the species' reproductive success. An interconnected reserve system is therefore likely to benefit this species.

6.3.4.6.2 How Achieving the Natural Community Objectives Will Benefit the Swainson's Hawk

Achieving Objective NC-CL1.1 and NC-G1.1 will result in protection of at least 16,310 acres of non-rice cultivated lands and grasslands. Objective SH1.1 and SH1.2 will ensure that these lands provide foraging habitat for the Swainson's hawk.

Achieving Objective NC-CL1.2 will result in the enrollment of 2,417 acres of baseline public and easement lands supporting cultivated lands into the reserve system as pre-permit reserve lands. Objective SW1.4 will ensure that this provides habitat for the Swainson's hawk.

Achieving Objectives NC-CL1.4 and NC-G1.2 will result in the maintenance and enhancement of Swainson's hawk habitat in the reserve system to maintain or increase the abundance of their native rodent species that provide prey for this species. The HCP/NCCP will meet this objective through implementation of Conservation Measure 3, *Manage and Enhance the Reserve System*.

Achieving Objectives NC-VFR1.1 and NC-VFR1.2 will result in protection of 1,600 acres of valley foothill riparian natural community, and additional restoration of this natural community to provide no net loss of acres as a result of covered activities. This natural community will provide nesting habitat for Swainson's hawk. The areas targeted for riparian protection along Cache and Putah Creeks and along the Sacramento River are in close proximity to surrounding foraging habitat and they support Swainson's hawk nest trees.

6.3.4.6.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the Swainson's hawk. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community level.

Goal SH1: Provide for the conservation of Swainson's hawk in the Plan Area.

Objective SH1.1: Within the 11,810 acres of protected cultivated land natural community (Objective NC-CL1.1), maintain crop types that support Swainson's hawk foraging habitat in the Conservation Reserve Area.

Rationale: Swainson's hawk crops include alfalfa and other hay crops, tomatoes, and wheat (Estep 2014). These crops support relatively high densities of rodent prey and are generally

low growing, providing good accessibility to foraging Swainson's hawk. Corn, safflower, and sunflower have low value for Swainson's hawk foraging because they are tall and dense ,which reduces prey accessibility. Additionally, planting and harvesting times for these crops are unfavorable for Swainson's hawk foraging. Orchards and vineyards have very low to no habitat value for Swainson's hawks, since prey is inaccessible, and bare ground conditions are unfavorable for supporting prey. The extensive use of pesticides and fungicides in orchards and vineyards further reduces their suitability to support prey.

Urban development and conversion to unsuitable crop types have been important factors diminishing Swainson's hawk availability in the Central Valley. Conversion from an annually-rotated agricultural matrix to one dominated by orchards and vineyards removes foraging habitat for long periods. A secondary effect of orchard conversion is removal of nesting habitat: nest trees that are within or border newly converted orchards are removed at a greater frequency than those associated with hay, row, and grain crops. Crop conversion to orchards may be the single-most important factor reducing Swainson's hawk nesting and foraging throughout the species' Central Valley range (Estep 2014).

Conservation easements on Swainson's hawk habitat in the reserve system will protect valuable habitat for Swainson's hawk and eliminate the primary threats to the species on these lands by prohibiting development or conversion to unsuitable or very low value crops such as orchards, vineyards, rice, cotton, or nursery crops. Corn, safflower, and sunflower (low value crops) will be allowed on only a limited basis as part of normal rotation practices. The protection of 11,810 acres of Swainson's hawk cultivated lands foraging habitat will mitigate the loss of 9,203 acres of cultivated lands habitat for this species resulting from covered activities, and will further provide for the conservation of the species in the Plan Area. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective SH1.2: Site the 4,500 acres of grassland natural community protection (Objectives NC-CL1.1) to ensure it provides modeled Swainson's hawk foraging habitat in the Conservation Reserve Area.

Rationale: The inclusion of 4,500 acres of grassland foraging habitat for Swainson's hawk in the reserve system will further provide for the conservation of this species. The protection of cultivated lands and grasslands combined will provide 16,310 acres of Swainson's hawk foraging habitat in the reserve system. This will mitigate the loss of 10,972 acres of total foraging habitat resulting from covered activities, and will further provide for the conservation of the species in the Plan Area. In determining the areal extent of Swainson's hawk foraging habitat to be conserved, the following factors were considered: spatial and functional needs of the species; current extent of protected habitat in the Plan Area and conservation gaps in ecologically important areas; mitigation and conservation needs for the species; and the amount of habitat available that can reasonably be protected in targeted conservation areas. With full HCP/NCCP implementation, 13% of the Swainson's hawk agricultural foraging habitat and 34% of the Swainson's hawk natural foraging habitat in the Plan Area will be protected and managed. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System.*

Objective SH1.3: Protect within the reserve system at least 40 unprotected Swainson's hawk nest trees that have been active within the last five years.

Rationale: The number of nest trees targeted for conservation is based upon the density of nest trees in suitable habitat in the Plan Area, and the acres of Swainson's hawk habitat targeted for conservation. This will ensure the density of nest trees protected in the reserve system is representative of the Plan Area. There are 530 recently active Swainson's hawk nest sites recorded in 278,114 acres of habitat, representing a density of

0.0019 nest site per acre. Protection of 17,910 acres of Swainson's hawk habitat at a representative density of nest sites will result in the protection of 34 nest sites (17,910 X 0.0019). Protection of 40 nest sites will require the JPA to protect Swainson's hawk habitat with a density of nest sites higher than the average density of nest trees in Swainson's hawk habitat in the Plan Area.

Objective SH1.4: In addition to protection of newly protected lands (Objectives SH1.1, SH1.2, and SH1.3), enroll at least 2,606 acres of baseline public and easement lands into the reserve system as pre-permit reserve lands providing foraging habitat.

Rationale: Baseline public and easement lands in the Plan Area currently support Swainson's hawk habitat. By enrolling these lands into the reserve system as pre-permit reserve lands, their management and monitoring for this species will be improved and raised to the standards of the Yolo HCP/NCCP conservation strategy. This will increase their conservation value to Swainson's hawk by helping to meet the HCP/NCCP biological goals and objectives. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective SH1.5: In addition to restoration of riparian natural community (Objective NC-VFR1.2), ensure a minimum density of 1 tree suitable for Swainson's hawk nesting (native trees at least 20 feet in height) per 10 acres in cultivated lands in the reserve system. Where existing protected trees do not meet that minimum requirement, plant suitable nest trees to meet this density requirement.

Rationale: This objective will ensure that suitable nesting habitat is provided throughout the Swainson's hawk foraging habitat in the reserve system.

6.3.4.7 White-Tailed Kite

6.3.4.7.1 How Achieving the Landscape Objectives Will Benefit the White-Tailed Kite

Achieving Objective L-1.3 will result in a large, interconnected reserve system. While the white-tailed kite is a mobile species and not severely affected by habitat fragmentation, there are energetic costs associated with traveling across unsuitable areas to nesting or foraging habitat that could diminish the species' reproductive success. An interconnected reserve system is therefore likely to benefit this species.

6.3.4.7.2 How Achieving the Natural Community Objectives Will Benefit the White-Tailed Kite

Achieving Objective NC-CL1.1 and NC-G1.1 will result in protection of at least 16,310 acres of non-rice cultivated lands and grasslands. This will provide foraging habitat for the white-tailed kite. Additionally, achieving Objectives NC-CL1.4 and NC-G1.2 will result in the maintenance and enhancement of white-tailed kite foraging habitat in the reserve system to maintain or increase the abundance of the native rodent species that provide prey for this species.

Achieving Objectives NC-VFR1.1 and NC-VFR1.2 will result in protection of 1,600 acres of valley foothill riparian natural community, and additional restoration of this natural community to provide no net loss of acres as a result of covered activities. This natural community will provide nesting habitat for white-tailed kite.

6.3.4.7.3 Species-Specific Goals and Objectives

Goal WTK1: Provide for the conservation of white-tailed kite in the Plan Area.

No species-specific objectives are necessary for white-tailed kite because the landscape and natural community-level objectives are sufficient to conserve this species. They will result in the protection, management, and enhancement of 16,310 acres of foraging habitat and 1,600 acres of nesting habitat for this species. This will mitigate the loss of 12,052 acres of foraging habitat and 1,078 acres of nesting habitat for white-tailed kite, and will provide for the conservation of the species in the Plan Area.

6.3.4.8 Western Yellow-Billed Cuckoo

6.3.4.8.1 How Achieving the Landscape Objectives Will Benefit the Western Yellow-Billed Cuckoo

Achieving Objectives L-1.4 and L-1.5 will provide habitat corridors supporting valley riparian natural community along the Cache Creek and Putah Creek Corridors. Contiguous habitat is important for the western yellow-billed cuckoo, which nests in patches greater than 25 acres in size (Gaines 1974).

Achieving Objective L-2.1 will increase native biodiversity and reduce invasive nonnative plant species in the riparian natural community. The western yellow-billed cuckoo requires structural diversity in its breeding habitat. Large, monotypic stands of invasive plants can diminish this structural diversity and render habitat unsuitable for the western yellow-billed cuckoo. The nonnative invasive Himalayan blackberry, for example, often invades riparian restoration sites and does not provide the same habitat structural complexity as other riparian plant species: this invasive species may inhibit establishment of other understory species that form important structural components of western yellow-billed cuckoo habitat (Hammond 2011). Reserve management will seek to control invasive plants such as Himalayan blackberry (Conservation Measure 3, *Manage and Enhance Natural Communities*).

6.3.4.8.2 How Achieving the Natural Community Objectives Will Benefit the Western Yellow-Billed Cuckoo

Achieving Objectives NC-VFR1.1 and NC-VFR1.2 will result in the protection of 1,600 acres of valley foothill riparian natural community, and additional restoration to result in no net loss of this natural community as a result of covered activities. The western yellow-billed cuckoo is a riparian obligate species (requires riparian habitat), and is therefore expected to benefit from the protection of existing valley riparian natural community. Only limited areas in the Plan Area, however, provide potentially suitable breeding habitat for this species. The yellow-billed cuckoo prefers large patches of mature, gallery forests[8], often associated with open water and oxbows (Greco, pers. comm., 2014). These conditions are present in the Cache Creek Settling Basin and Putah Creek sink (in Yolo Basin), as well as the Sacramento River, all of which are proposed for protection under Objective NC-

[8] Gallery forests are forests that form as corridors along rivers or wetlands and project into landscapes that are otherwise only sparsely treed such as grasslands. Gallery forests are able to exist where the surrounding landscape does not support forests.

VFR1.1. Substantial restoration, however, is likely necessary to establish a breeding population in the Plan Area (Greco, pers. comm., 2014).

Conservation Measure 1, *Establish Reserve System*, describes how the HCP/NCCP will meet this objective. It includes a minimum 25-acre patch size for valley foothill riparian protection: this will increase the potential for valley foothill riparian natural community in the reserve system to support western yellow-billed cuckoo.

6.3.4.8.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, as well as associated conservation measures discussed above, are expected to provide for the conservation of the western yellow-billed cuckoo in the Plan Area. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community level.

Goal WYBC1: Western yellow-billed cuckoo habitat sufficient to provide opportunities for migration and breeding in the Plan Area.

> **Objective WYBC1.1:** Within the 1,600 acres of protected valley-foothill riparian natural community (Objectives NC-VFR1.1), site as least 240 acres in modeled western yellow-billed cuckoo habitat, and design the restored valley foothill riparian (Objective NC-VFR1.2) to provide suitable habitat for this species.
>
> **Rationale:** In 2013, the USFWS proposed to list the western distinct population segment of western yellow-billed cuckoo as a threatened species. The listing proposal cites threats from loss of riparian habitat and habitat fragmentation as a key factor in the decline of the western yellow-billed cuckoo (78 FR 61622: October 13, 2013). As a result, it currently breeds in scattered locations where fragmented suitable habitat remains. Protecting western yellow-billed cuckoo habitat will help ensure the availability of foraging habitat necessary to support migrant western yellow-billed cuckoo using the Plan Area. This will also provide nesting habitat to accommodate the potential reestablishment of a breeding population in the Plan Area.
>
> An estimated 8% (953/ 12,442 acres) of the riparian natural community in the Plan Area consists of modeled western yellow-billed cuckoo habitat. The JPA will focus on protection of large, interconnected patches of riparian natural community when siting the 1,600 acres to be protected, therefore the proportion of protected riparian natural community supporting western yellow-billed cuckoo habitat is expected to be greater than 8%. Protection of at least 240 acres of western yellow-billed cuckoo habitat will ensure that at least 15% of the protected riparian natural community provides habitat for this species. Covered activities will result in the loss of 116 acres of modeled habitat for western yellow-billed cuckoo. The protection of 240 acres, in addition to restoration to achieve no net loss, will mitigate this loss and further provide for the conservation of western yellow-billed cuckoo.

6.3.4.9 Western Burrowing Owl

6.3.4.9.1 How Achieving the Landscape Objectives Will Benefit the Western Burrowing Owl

Achieving Objective L-1.3 will result in a large, interconnected reserve system. This will provide large areas consisting of both nesting and foraging habitat for the species.

6.3.4.9.2 How Achieving the Natural Community Objectives Will Benefit the Western Burrowing Owl

Natural community biological goals and objectives integral to the conservation strategy for western burrowing owl are stated below.

Achieving Objective NC-CL1.1 will result in the protection of at least 11,810 acres of non-rice within the cultivated lands natural community that provide habitat value for covered and other native species in the Conservation Reserve Area. Objective WBO1.2 will ensure that at least 3,000 acres of the protected cultivated lands is suitable for western burrowing owl. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Achieving Objective NC-CL1.3 will increase the conservation value of at least 2,417 acres of cultivated lands natural community on baseline public and easement lands through enrolling these lands into the reserve system as pre-permit reserve lands. By enrolling baseline public and easement lands supporting western burrowing owl into the reserve system as pre-permit reserve lands, the lands will be monitored and adaptively managed consistent with the Yolo HCP/NCCP conservation strategy to increase their conservation value for western burrowing owl by meeting the HCP/NCCP biological goals and objectives. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Achieving Objective NC-G1.1 will result in protection of at least 4,500 acres of grassland in the Conservation Reserve Area. Objective WBO1.1 ensures that at least 3,000 acres of this will consist of existing occupied western burrowing owl habitat. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Achieving Objectives NC-CL1.4 and NC-G1.2 will increase the functions of the cultivated lands and grassland natural communities in the reserve system to maintain or increase the abundance of the native rodent species that provide prey and burrows for western burrowing owl. The HCP/NCCP will meet this objective as described in Conservation Measure 3, *Manage and Enhance Natural Communities*.

6.3.4.9.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, as well as associated conservation measures discussed above, are expected to provide for the conservation of the western burrowing owl. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community scaleslevel.

Goal WBO1: Provide for the conservation of western burrowing owl in the Plan Area.

> **Objective WBO1.1:** Of the 4,500 acres of protected grassland natural community (Objective NC-G1.1), site at least 3,000 acres in modeled western burrowing owl habitat.
>
> **Rationale:** Grasslands provide primary habitat for western burrowing owl. Protecting modeled western burrowing owl primary habitat will help maintain or increase western burrowing owl nesting success by maintaining nesting habitat and prey availability necessary to rear and fledge young. Out of 80,896 acres of grasslands in the Plan Area, 37,690 acres (47%) provide primary habitat for western burrowing owl. By ensuring that at least 3,000 acres of protected grasslands provide suitable habitat for burrowing owl, grassland protection will be focused in areas suitable for western burrowing owl. Covered activities will result in the loss of 1,205 acres of western burrowing owl primary habitat.

Protection of 3,000 acres of primary burrowing owl habitat will mitigate this loss and further provide for the conservation of the species in the Plan Area. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective WBO1.2: Of the 11,810 acres of protected non-rice cultivated lands (Objective NC-CL1.1), provide at least 2,500 acres of modeled western burrowing owl habitat.

Rationale: This commitment is based on the amount of secondary burrowing owl habitat (primarily cultivated lands, defined in Appendix A, *Species Accounts*) that can reasonably be expected to occur in the cultivated lands targeted for protection. This objective along with Objective WBO1.1 will collectively provide 5,500 acres of newly protected modeled burrowing owl habitat. The protection, management, and enhancement of this habitat will mitigate the loss of 3,725 acres (1,430 acres of primary habitat and 2,249 acres of secondary habitat) that will result from covered activities, and to further provide for the conservation of western burrowing owl in the Plan Area. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective WBO1.3: Protect [To be determined] western burrowing owl occurrences, each supporting at least [To be determined] breeding pairs. Protect sufficient habitat surrounding occupied burrows to sustain the breeding pairs, consistent with *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), as a subset of habitat protected under Objectives WBO1.1 and WBO1.2.

Rationale: This objective will ensure that occupied western burrowing owl habitat will be protected under the Yolo HCP/NCCP. Protecting occupied western burrowing owl nesting burrows will help ensure continued production and survival of western burrowing owl in the Plan Area. *Staff Report on Burrowing Owl Mitigation* (CDFG 2012) does not provide a specific acreage of land to be protected around occupied burrows, but recommends site-specific analysis to account for wide variation in natal area, home range, foraging area, and other factors influencing burrowing owl persistence in a particular area. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

[**note to reader:** we need to conduct additional research and coordinate with species experts to come up with a reasonable conservation commitment for occupied burrows.]

6.3.4.10 Least Bell's Vireo

6.3.4.10.1 How Achieving the Landscape Objectives Will Benefit the Least Bell's Vireo

Achieving Objectives L-1.4 and L-1.5 will provide habitat corridors supporting valley riparian natural community along the Cache Creek and Putah Creek Corridors. Connected riparian corridors will increase the opportunity for breeding least Bell's vireos to become established in these areas.

Achieving Objective L-2.1 will increase native biodiversity and reduce invasive nonnative plant species in the riparian natural community. The least Bell's vireo requires structural diversity in its breeding habitat. Large, monotypic stands of invasive plants can diminish this structural diversity and render habitat unsuitable for the species. Invasive nonnative species that diminish structural diversity and degrade least Bell's vireo habitat conditions include giant reed (*Arundo donax*) and tamarisk (*Tamarix chinensis*) (Riparian Habitat Joint Venture 2004). Invasive plants such as these will be controlled as part of Conservation Measure 3, *Manage and Enhance Natural Communities*. Control of invasive species and maintenance of native vegetation diversity will maintain and enhance least Bell's vireo habitat.

This objective also addresses the potential need to control nonnative brown-headed cowbird populations. Brown-headed cowbirds are nest parasites that lays their eggs in the nests of least Bell's vireos and have been a major factor contributing to the species' decline. As described in Conservation Measure 3, *Manage and Enhance Natural Communities*, the JPA will implement a cowbird control program if monitoring determines that a breeding population of least Bell's vireo has become established in the Plan Area, but is being adversely affected by cowbird parasitism.

6.3.4.10.2 How Achieving the Natural Community Objectives Will Benefit the Least Bell's Vireo

Achieving Objectives NC-VFR1.1 and NC-VFR1.2 will result in the protection of 1,600 acres of valley foothill riparian natural community, and additional restoration to result in no net loss of this natural community as a result of covered activities. The least Bell's vireo is a riparian obligate species, and will therefore benefit from these objectives.

6.3.4.10.3 Species-Specific Goals and Objectives

The landscape and natural community biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the least Bell's vireo. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community level.

Goal LBV1: Provide sufficient habitat area to support least Bell's vireos that migrate through the Plan Area and to support potential future reestablishment of a nesting population in the Plan Area.

> **Objective LBV1.1:** Of the 1,600 acres of newly protected valley foothill riparian (Objective NC-VFR1.1), site at least 600 acres in modeled least Bell's vireo habitat, and design the restored valley foothill riparian (Objective NC-VFR1.2) to provide suitable habitat for this species.
>
> **Rationale:** The least Bell's vireo is an obligate riparian breeder that typically inhabits structurally diverse woodlands containing dense cover within three to six feet of the ground for nesting, and a dense stratified canopy for foraging. The least Bell's vireo has been extirpated from the Plan Area as a nesting species; however, it is expanding its nesting range northward and has recently been observed in the Plan Area during the breeding season (although there are no documented breeding records yet). Protecting and restoring least Bell's vireo habitat will help ensure the availability of foraging habitat necessary to support migrant least Bell's vireo using the Plan Area and the availability of nesting habitat to accommodate the potential reestablishment of breeding in the Plan Area.

6.3.4.11 Bank Swallow

6.3.4.11.1 How Achieving the Landscape Objectives Will Benefit the Bank Swallow

Achieving Objective L-1.4 will provide a corridor along Cache Creek, which will include the floodplain and support natural erosional and fluvial process. These erosional and fluvial processes are necessary to sustain bank swallow nesting habitat.

Achieving Objective L-2.1 will increase diversity and relative cover of native plant species in grasslands. Bank swallows forage over open grasslands, and the Bank Swallow Technical Advisory Committee recommends control of invasive plants in grasslands as one of the enhancement

techniques for this species (Bank Swallow Technical Advisory Committee 2013). The HCP/NCCP will achieve this objective through grassland management as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.4.11.2 How Achieving the Natural Community Objectives Will Benefit the Bank Swallow

Achieving Objective NC-G1.1 will result in protection of at least 4,500 acres of grassland in the Conservation Reserve Area. Only those grasslands along the floodplains, however, are expected to provide foraging habitat for bank swallow.

6.3.4.11.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the bank swallow. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape and natural community levels.

Goal BS1. Provide for the conservation of bank swallow in the Plan Area.

> **Objective BS1.1:** Protect 50 acres of unprotected bank swallow habitat on a site occupied by this species in planning unit 7.

Rationale: Bank swallows depend on actively eroding, steep cut-bank habitats for nest cavity construction. Protecting channel banks from anthropogenic alterations (predominantly bank stabilization and rip-rapping) ensures that natural processes of bank habitat creation continue and bank swallow nesting habitat is maintained. Habitat formation and degradation is a natural process of stream bank cutting and channel erosion and deposition. Including channel banks that support suitable bank swallow nesting substrate and channel banks that are actively eroding within the reserve system will help ensure the continued availability of nesting habitat to support the existing breeding population. Covered activities will avoid bank swallow nests. The protection of 50 acres of bank swallow habitat, including existing occupied colonies will mitigate the temporary loss of up to 37 acres of bank swallow habitat resulting from Cache Creek Resources Management Plan operations and maintenance activities, and further provide for conservation of the species in the Plan Area.

Objective BS1.2: Manage the 50 acres of protected bank swallow habitat (Objective BS1.1) to enhance bank swallow foraging habitat values by promoting open grass and wildflower vegetation, and controlling invasive plant species.

Rationale: Achieving the objective will improve bank swallow foraging habitat on the Cache Creek floodplain. The Bank Swallow Technical Advisory Committee recommends management of floodplains supporting bank swallow to promote open grass and wildflower vegetation, including management actions that stimulate new plant growth and reduce invasive plant species to enhance production of insects that provide high-value food for bank swallows (Bank Swallow Technical Advisory Committee 2013). The HCP/NCCP may achieve this objective within the 50 acres of habitat protected under Objective BS1.1, and outside the reserve system through Cache Creek Resources Management Plan activities. The HCP/NCCP will achieve this objective as described in Conservation Measure 3, *Manage and Enhance Natural Communities.*

6.3.4.12 Tricolored Blackbird

6.3.4.12.1 How Achieving the Landscape Objectives Will Benefit the Tricolored Blackbird

Achieving Objective L-1.3 will result in a large, interconnected reserve system. This will minimize tricolored blackbird habitat fragmentation and provide for the maintenance of habitat areas large enough to support sustainable populations of tricolored blackbird, including the provision of nesting habitat adjacent to foraging habitat. Conservation Measure 1, *Establish Reserve System*, describes reserve design principles and criteria the JPA will apply to meet this objective.

6.3.4.12.2 How Achieving the Natural Community Objectives Will Benefit the Tricolored Blackbird

Achieving Objectives NC-CL1.1 and NC-CL1.2 will result in the protection of 13,110 acres of cultivated lands. Tricolored blackbirds forage in areas that provide abundant insects, including pastures, dry seasonal pools, agricultural fields such as alfalfa and rice, feedlots, and dairies. Protecting suitable foraging habitat will help ensure the availability of foraging habitat necessary to support wintering and breeding tricolored blackbirds using the Plan Area.

Achieving Objective NC-FEW1.1 will result in the protection of 300 acres of fresh emergent wetland, and Objective NC-FEW1.2 will result in the restoration of additional fresh emergent wetland to provide no net loss of this natural community. The HCP/NCCP will meet this objective as described in Conservation Measure 2, *Restore Natural Communities*.

6.3.4.12.3 Species-Specific Goals and Objectives

The landscape and natural community-level biological goals and objectives, and associated conservation measures, discussed above, are expected to provide for the conservation of the tricolored blackbird. The goal and objectives below address additional needs specific to this species that will not otherwise be met at the landscape level.

Goal TRBL1: Provide for the conservation of tricolored blackbird in the Plan Area.

> **Objective TRBL1.1:** Within the 300 acres of protected fresh emergent wetland natural community (Objective NC-FEW1.1), site at least 200 acres in modeled tricolored blackbird nesting habitat.
>
> **Rationale:** Tricolored blackbirds are well adapted to rapidly changing environments where the locations of secure nesting habitat and rich insect food supplies fluctuates (Orians 1961; Collier 1968; Payne 1969). The primary stressor for tricolored blackbirds is the loss of suitable breeding sites that provide the required combination of tall emergent vegetation above standing water connected to highly productive foraging areas with high densities of arthropods. Protecting a sufficient amount of habitat to support tricolored blackbird will ensure that nesting colonies and their surrounding foraging habitat will be protected across a wide portion of the Plan Area and across fluctuating foraging conditions from year to year. Covered activities will result in the loss of 86 acres of tricolored blackbird nesting habitat. The protection of 200 acres of suitable habitat for this species will mitigate this loss and further provide for the conservation of tricolored blackbird in the Plan Area.
>
> **Objective TRBL1.2:** Enroll at least 4,698 acres of tricolored blackbird foraging habitat and 21 acres of tricolored blackbird nesting habitat on baseline public and easement lands into the reserve system as pre-permit reserve lands.

Rationale: By enrolling these baseline public and easement lands that support tricolored blackbird habitat into the reserve system as pre-permit reserve lands, they will be monitored and adaptively managed consistent with the Yolo HCP/NCCP conservation strategy to increase their conservation value by meeting the HCP/NCCP biological goals and objectives. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

Objective TRBL1.3: Maintain at least one tricolored blackbird nesting colony in the reserve system.

Rationale: Protecting a tricolored blackbird nesting colony will ensure the availability of habitat necessary to maintain occupancy of established nesting colonies in future years. The species shows annual site fidelity (Beedy and Hamilton 1997), which may be the result of adequate site availability or protected habitat resources. The HCP/NCCP will meet this objective as described in Conservation Measure 1, *Establish Reserve System*.

6.4 Conservation Measures

This section describes the conservation actions that the JPA will implement or cause to have implemented to meet the biological goals and objectives described in Section 6.3, *Biological Goals and Objectives*. These conservation actions are grouped into three conservation measures, as follows.

- Conservation Measure 1, Establish Reserve System. This conservation measure provides conservation actions related to reserve design, land acquisition, and enrollment of baseline public and easement lands into the reserve system as pre-permit reserve lands to create the reserve system for the Yolo HCP/NCCP.
- Conservation Measure 2, Restore Natural Communities. This conservation measure provides conservation actions related to the restoration of three natural communities and their covered species habitat. The measure includes restoration siting and design measures, and restoration techniques.
- Conservation Measure 3, Manage and Enhance Natural Communities. This conservation measure provides conservation actions related to managing and enhancing the reserve system consistent with reserve management plans. The measure also provides for specific management and enhancement actions that will be implemented outside the reserve system[9] to support the Yolo HCP/NCCP.

The purpose of these conservation measures is to achieve the biological goals and objectives. Each conservation measure includes a table that describes how the conservation measure will meet or helps to meet the relevant biological goals and objectives.

[9] The Reserve System only includes lands that Yolo HCP/NCCP acquires through fee title or easement, or lands with conservation easements that Yolo HCP/NCCP enrolls into the reserve system as pre-permit reserve lands. Yolo HCP/NCCP implementation will include some management and enhancement actions that occur outside the reserve system.

6.4.1 Conservation Measure 1: Establish Reserve System

6.4.1.1 Introduction

This conservation measure describes how the Yolo HCP/NCCP reserve system will be established to benefit the covered species, natural communities, and ecosystem of the Plan Area. Reserve system assembly is described in terms of land acquisition procedures, land acquisition methods, and land selection criteria. These components, applied as described in this measure, will ensure the reserve system meets applicable biological goals and objectives related to the acreage, configuration, and quality of lands. The reserve system will include all lands the JPA places under a conservation easement or protects in fee title, in perpetuity, to meet the biological goals and objectives. The reserve system will also include baseline public and easement lands the JPA enrolls into the reserve system as pre-permit reserve lands, to be monitored and adaptively managed consistent with the Yolo HCP/NCCP conservation strategy. The reserve system will be assembled over the term of the Yolo HCP/NCCP permits on a schedule that is consistent with the stay-ahead provision described in Section 7.5.3, *Stay-Ahead Provision*, to meet the conservation commitments provided in Tables 5-2a, *Newly Protected Lands Commitments* and 5-3b, *Pre-permit Reserve Lands Commitments*.

- Section 6.4.1.2, *Purpose*, describes the purpose of this conservation measure, and provides a table indicating how the conservation measure will achieve each of the relevant biological goals and objectives.
- Section 6.4.1.3, *Land Protection Mechanisms,* describes the mechanisms by which the JPA will protect lands for the reserve system.
- Section 6.4.1.4, *Reserve System Assembly,* provides the broad reserve design assembly principles the JPA will apply when establishing the reserve system, and provides specific siting and reserve design criteria that the JPA will apply to land acquisitions.
- Section 6.4.1.5, *Land Acquisition Requirements*, describes specific reserve system design requirements for meeting the biological goals and objectives.
- Section 6.4.1.6, *Preaquisition Surveys and Evaluations,* describes the preacquisition surveys and evaluations the JPA will conduct to determine whether lands targeted for potential acquisition meet the reserve design assembly principles and siting and design criteria.
- Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands.* describes the criteria that baseline public and easement lands must meet for the JPA to enroll them into the reserve system as pre-permit reserve lands.

6.4.1.2 Purpose

This conservation measure provides guidance for meeting the biological objectives presented in Section 6.1, *Biological Goals and Objectives* as they relate to establishment of the reserve system. Table 6-4 lists the biological goals and objectives relevant to this conservation measure, and describes how this conservation measure will contribute toward each relevant biological objective.

Table 6-4. Biological Goals and Objectives Associated with Conservation Measure 1

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
Landscape-level Biological Goals and Objectives	
Goal L-1: Large interconnected landscapes within the range of physical and biological attributes (e.g., slope, soils, hydrology, climate, and plant associations) in the Plan Area to support the distribution and abundance of covered species and their habitats, provide for the movement and genetic interchange among populations of covered species, and conserve native biodiversity.	
Objective L-1.1: Conserve 28,381 acres of natural communities and covered species habitats in the Conservation Reserve Area, including 20,381 acres of newly protected lands and 8,000 acres of additional baseline public and easement lands enrolled into the reserve system as pre-permit reserve lands. Restore or create additional acres to result in no net loss of wetlands (up to 981 acres of restoration or creation). On a case-by-case basis, lands outside the Conservation Reserve Area may be enrolled if they benefit the covered species and would be subject to review and approval by the wildlife agencies.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 5-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective L-1.2: Include a variety of environmental gradients (e.g., hydrology, elevation, soils, slope, and aspect) within and across a diversity of protected and restored natural communities within the Conservation Reserve Area.	CM1 includes reserve design concepts to achieve this objective (Section 6.4.1.4, *Reserve System Assembly*).
Objective L-1.3: Increase the size and connectivity of the network of protected lands in the Plan Area by acquiring newly protected lands for the reserve system adjacent to and between baseline protected lands.	CM1 includes reserve design concepts to achieve this objective (Section 6.4.1.4, *Reserve System Assembly*).
Objective L-1.4: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Cache Creek floodplain and extending the length of Cache Creek from the west boundary of planning unit 7 to the Cache Creek Settling Basin exclusive of existing and potential aggregate mining areas (Figure 6–4, *Ecological Corridors*).	CM1 includes reserve design requirements to achieve this objective (Sections 6.4.1.4, *Reserve System Assembly*, and 6.4.1.5, *Land Acquisition Requirements*).
Objective L-1.5: Prioritize land acquisition and restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation within the Putah Creek floodplain extending the length of Putah Creek in planning units 8 and 9 (Figure 6-4, *Ecological Corridors*).	CM1 includes reserve design requirements to achieve this objective (Section 6.4.1.5, *Land Acquisition Requirements*).
Objective L-1.6: Prioritize land acquisition and restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation along the Sacramento River and Yolo Bypass in planning units 12, 14, 15, and 21 (Figure 6-4, *Ecological Corridors*).	CM1 includes reserve design requirements to achieve this objective (Section 6.4.1.5, *Land Acquisition Requirements*).
Natural Community Level Biological Goals and Objectives	
Cultivated Land Seminatural Community	
NC-CL1: Cultivated lands that support habitat for covered and other native wildlife species.	
Objective NC-CL1.1: Protect at least 11,810 acres of non-rice that provides habitat value for covered and other native	CM1 will achieve this objective by meeting the conservation commitments provided in

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
species in the Conservation Reserve Area. Field borders mapped as *Semiagricultural/Incidental to Agriculture* that provide habitat for covered species will count towards this requirement. Some of these lands may be substituted for grassland habitat upon approval by the wildlife agencies.	Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective NC-CL1.2: Protect at least 1,300 acres of unprotected rice that provides habitat value for covered and other native species in the Conservation Reserve Area. This acreage can be substituted for wetlands that provide habitat for the covered species.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective NC-CL1.3: Enroll at least 2,417 acres of cultivated lands natural community on Baseline Public and Easement Lands into the reserve system as pre-permit reserve lands.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* through baseline public and easement lands enrollment as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.
Grassland Natural Community	
Goal NC-G1: Large, contiguous patches of grassland, and smaller patches within a mosaic of other natural community types, to sustain and enhance the distribution and abundance of associated covered and other native species in the Conservation Reserve Area.	
Objective NC-G1.1: Protect 4,500 acres of unprotected grassland in the Conservation Reserve Area, including at least 3,000 acres in the Dunnigan Hills planning unit (PU 5).	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Valley Foothill Riparian Natural Community	
Goal NC-VFR1: Functional valley foothill riparian natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-VFR1.1: Protect and manage 1,600 acres of unprotected valley foothill riparian distributed primarily in planning units 7 and 9.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective NC-VFR1.2: Restore one acre of valley foothill riparian natural community for each acre lost as a result of covered activities. Site the restoration to improve connectivity among patches of existing valley foothill riparian vegetation within the Cache Creek and Putah Creek Corridors and the Sacramento River.	

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
Alkali Prairie Natural Community	
Goal NC-AS1: A reserve system that protects the habitat values of the remaining alkali prairie natural community in the Plan Area.	
Objective NC-AS1.1: Protect 33 acres of alkali prairie natural community on the Woodland Regional Park within the first five years of Yolo HCP/NCCP implementation (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments*.
Objective NC-AS1.2: Incorporate the existing protected (Category 1) alkali prairie habitat at the Alkali Grasslands Preserve properties into the reserve system (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*).	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* through baseline public and easement lands enrollment as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.
Fresh Emergent Wetland Natural Community	
Goal NC-FEW1: Functional fresh emergent wetland natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-FEW1.1: Protect 300 acres of fresh emergent wetland in the Conservation Reserve Area.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Lacustrine and Riverine Natural Community	
Goal NC-LR1: Functional lacustrine and riverine natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-LR1.1: Protect and manage 800 acres of lacustrine and riverine natural community providing habitat for covered and other native species in the Conservation Reserve Area.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Covered Species Biological Goals and Objectives	
Valley Elderberry Longhorn Beetle	
Goal VELB1: Provide for the conservation of elderberry longhorn beetle in the Plan Area.	
Objective VELB1.1: Within the 1,600 acres of protected valley foothill riparian natural community (Objective NC-VFR1.2), prioritize protection of populations of valley elderberry longhorn beetle along Lower Cache Creek, Lower Putah Creek, and Sacramento River and adjacent lands to provide for population expansion.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
California Tiger Salamander	
Goal CTS1: Provide for the conservation of California tiger salamander in the Plan Area.	
Objective CTS1.1: Within the 3,000 acres of protected grasslands in the Dunnigan Hills planning unit (Objective NC-G1.1), include at least 1 acres of modeled upland habitat for California tiger salamander and prioritize protection in designated critical habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective CTS1.2: Within the 800 acres of protected lacustrine and riverine natural community (Objective NC-LR1.1), protect at least 50 acres of California tiger salamander aquatic habitat. Restore or create 1 acre of California tiger salamander aquatic habitat for each acre lost as a result of covered activities. Within the protected and restored aquatic habitat, include at least 5 California tiger salamander breeding pools that are found to support all life stages of the salamander through at least all water year types.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Giant Garter Snake	
Goal GGS1: Provide for the conservation of giant garter snake in the Plan Area, including the Willow Slough/Yolo Bypass subpopulation and a segment of the Colusa Basin subpopulation, and connectivity between the two subpopulations	
Objective GGS1.1: Locate the 1,300 acres of protected rice land (Objective NC-CL1.2) in modeled giant garter snake habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments*, through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective GGS1.2: Locate the protection of at least 1,160 acres of upland natural communities (Objective L-1.1) to provide active season upland movement habitat and at least 2,315 acres to provide overwintering habitat for giant garter snake.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective GGS1.3: Protect, restore, and manage the 300 acres of fresh emergent wetland natural community (Objective NC-FEW1.1), at least 420 acres of the lacustrine/riverine natural community (Objective NC-LR.11), the restored fresh emergent wetland (Objective NC-FEW1.2), and sufficient restored lacustrine and riverine natural community (Objective NC-LR1.2) to contribute to the recovery of the giant garter snake. Ensure at least 80% of the aquatic habitat is perennial, and that the remainder provides aquatic habitat for the giant garter snake during the active season at least through July of each summer.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
Objective GGS1.4: In addition to the newly protected and restored giant garter snake habitat (Objectives GGS1.1, GGS1.2, and GGS1.3), enroll at least 3,583 acres of giant garter snake habitat on eligible baseline public and easement lands into the reserve system as pre-permit reserve lands.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* through Public and Easement Lands enrollment as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.
Swainson's Hawk	
Goal SH1: Provide for the conservation of Swainson's hawk in the Plan Area.	
Objective SH1.1: Within the 11,810 acres of protected non-rice cultivated land natural community (Objective CL1.1), maintain crop types that support Swainson's hawk foraging habitat in the Conservation Reserve Area.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.7. CM3, *Manage and Enhance Natural Communities*, describes crop restrictions.
Objective SH1.2: Protect and manage the 4,500 acres of grassland natural community (Objectives NC-CL1.1) to ensure that it provides modeled Swainson's hawk foraging habitat in the Conservation Reserve Area.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective SH1.3: Protect at least 40 unprotected Swainson's hawk nest trees (active within the last 5 years at the time tree is protected) within the reserve system	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective SH1.4: In addition to newly protected unprotected lands (Objectives SH1.1, SH1.2, and SH1.3), enroll at least 2,606 acres of baseline public and easement lands into the reserve system as pre-permit reserve lands as foraging habitat.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* through baseline public and easement lands enrollment as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.
Western Yellow-Billed Cuckoo	
Goal WYBC1: Provide sufficient western yellow-billed cuckoo habitat to provide opportunities for migration and breeding in the Plan Area.	
Objective WYBC1.1: Of the 1,600 acres of protected valley-foothill riparian natural community (Objectives NC-VFR1.1), site as least 240 acres in modelled yellow-billed cuckoo habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
Western Burrowing Owl	
Goal SPEC15: Provide for the conservation of western burrowing owl in the Plan Area.	
Objective WBO1.1: Of the 4,500 acres of protected grassland natural community (Objective NC-G1.1), site at least 3,000 acres in modeled western burrowing owl habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective WBO1.2: Of the 11,800 acres of protected non-rice cultivated lands (Objective NC-CL1.1), provide at least 2,200 acres of western burrowing owl habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Objective WBO1.3: Protect [To be determined] western burrowing owl occurrences, each supporting at least [To be determined] breeding pairs. Protect sufficient habitat surrounding occupied burrows to sustain the breeding pairs, consistent with *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), as a subset of habitat protected under Objectives WBO1.1 and WBO1.2.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*, and Section 6.4.1.8.1, *Western Burrowing Owl.*
Least Bell's Vireo	
Goal LBV1. Provide sufficient habitat area to support least Bell's vireo that migrate through the Plan Area and to support potential future reestablishment of nesting populations in the Plan Area.	
Objective LBV1.1: Of the 1,600 acres of newly protected valley foothill riparian (Objective NC-VFR1.1), site at least 600 acres in modeled least Bell's vireo habitat, and design the restored valley foothill riparian (Objective NC-VFR1.2) to provide suitable habitat for this species..	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Bank Swallow	
Goal BS1. Provide for the conservation of bank swallow in the Plan Area.	
Objective BS1.1: Protect 50 acres of unprotected modeled bank swallow nesting habitat in planning unit 7 or along the Sacramento River.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.
Tricolored Blackbird	
Goal TRBL1: Provide for the conservation of tricolored blackbird in the Plan Area.	
Objective TRBL1.1: Within the 300 acres of protected fresh emergent wetland natural community (Objective NC-FEW1.1), site at least 200 acres in modeled tricolored blackbird nesting habitat.	CM1 will achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3, *Land Protection Mechanisms*.

Biological Goal or Objective	How CM1 Helps to Achieve a Biological Objective
Objective TRBL1.2: Enroll at least 4,698 acres of tricolored blackbird foraging habitat and 21 acres of tricolored blackbird nesting habitat on baseline public and easement lands into the reserve system as pre-permit reserve lands.	CM1 will achieve the protection component of this objective by meeting the conservation commitments provided in Table 6-2(b), *Pre-permit Reserve Lands Commitments,* through baseline public and easement lands enrollment as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.
Objective TRBL1.3: Maintain at least one tricolored blackbird nesting colony in the reserve system.	CM1 may achieve this objective by meeting the conservation commitments provided in Table 6-2(a), *Newly Protected Lands Commitments,* through land protection mechanisms described in Section 6.4.1.3. Alternatively, CM1 may achieve this objective by enrolling baseline public and easement lands supporting a tricolored blackbird nesting colony into the reserve system as pre-permit reserve lands, as described in Section 6.4.1.7, *Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands*.

The NCCPA requires that a system of habitat reserves or equivalent conservation be described in an NCCP:

> The plan provides for the protection of habitat, natural communities, and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species appropriate for land, aquatic, and marine habitats within the plan area. [Section 2820(3)]

The purpose of this conservation measure is to define the process that JPA will apply to build the Yolo HCP/NCCP reserve system consistent with NCCPA requirements.

6.4.1.3 Land Protection Mechanisms

Lands may be acquired for the purpose of achieving the conservation acreages provided in Table 6-2(a), *Newly Protected Lands Commitments,* through the following mechanisms.

- Purchase in fee title by the JPA or a Permittee and put under a conservation easement consistent with the requirements in this Plan (see Section 7.5.5, *Conservation Easements*).
- Acquisition of conservation easements on private lands by the JPA, a Permittee, or a state or federal agency, that meet Yolo HCP/NCCP habitat protection requirements (see Section 7.5.5, *Conservation Easements*).
- Conservation easement and/or fee title acquisition by conservation organizations (e.g., land conservancies and land trusts) that protect and manage lands in conformance with Yolo HCP/NCCP requirements.

- Purchase of mitigation credits from private mitigation or conservation banks approved by USFWS and CDFW, within the Plan Area, and meeting the protection and management requirements of the Yolo HCP/NCCP.

The JPA will also use mitigation receiving sites for assembling the reserve system. A mitigation receiving site is property encumbered by a conservation easement for the purpose of providing mitigation credits to offset the impacts of future development. Section 7.5.11, *Use of Mitigation Receiving Sites*, describes how the JPA will use these sites during Yolo HCP/NCCP implementation.

The JPA is expected to use conservation easements[10] more frequently than other acquisition methods to protect the working landscape of agricultural lands and natural lands in the Plan Area. In general, lands the JPA acquires through fee title will be lands intended for substantial changes in land use for habitat improvement, such as habitat restoration, or that have significant habitat value and purchase of an easement is not possible. Use of conservation easements is the preferred habitat protection method for cultivated lands on which the ongoing agricultural use supports achieving the Yolo HCP/NCCP biological goals and objectives.

Procedures and requirements for conservation easements are described in Section 7.5.5, *Conservation Easements*. Section 7.5.10, *Use of Mitigation Banks* and 7.5.11, *Use of Mitigation Receiving Sites*, describes how and when the JPA, other Permittee, or project proponent may use a mitigation bank or mitigation receiving site in lieu of acquiring land or conservation easements. The JPA may acquire reserve system lands in partnership with other government entities or conservation organizations, or through grants of land from participating or other entities where such lands will serve to achieve the Yolo HCP/NCCP biological goals and objectives.

6.4.1.4 Reserve System Assembly

The JPA and its implementation partners will assemble the Yolo HCP/NCCP reserve system during the permit term. Table 6-2(a*), Newly Protected Lands Commitments,* provides the quantitative requirements for each natural community to establish the reserve system. The schedule for this assembly is based on the stay-ahead provision described in Section 7.5.3, *Stay Ahead Provision.*

The NCCPA describes the following findings related to the assembly of reserve system lands that must be made by CDFW before approving an NCCP:

- The plan provides for the protection of habitat, natural communities, and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species appropriate for land, aquatic, and marine habitats within the plan area.
- The development of reserve systems and conservation measures in the Plan Area provides all of the following:
  a. Conserving, restoring, and managing representative natural and semi-natural landscapes to maintain the ecological integrity of large habitat blocks, ecosystem function, and biological diversity.

[10] See Appendix D, *Glossary*, for the definition of the term "conservation easement" as it is used in this document and Section 7.9, *Conservation Easement Requirements*, for a description of the minimum requirements for conservation easements under the NHP.

b. Establishing one or more reserves or other measures that provide equivalent conservation of covered species within the plan area and linkages between them and adjacent habitat areas outside of the plan area.

c. Protecting and maintaining habitat areas which are large enough to support sustainable populations of covered species.

d. Incorporating a range of environmental gradients (such as slope, elevation, aspect, and coastal or inland characteristics) and promoting high habitat diversity to provide for shifting species distributions due to changed circumstances.

e. Sustaining the effective movement and interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the habitat areas within the plan area.[11]

The Yolo HCP/NCCP reserve system assembly principles described below are consistent with and designed to ensure the assembled reserve system achieves these required NCCPA criteria.

6.4.1.4.1 Reserve System Design Criteria

The JPA will use the following reserve system design criteria to guide decisions regarding the acquisition of reserve lands. Over the course of implementing the Yolo HCP/NCCP, the JPA may revise these assembly priority principles, consistent with new scientific information and in coordination with USFWS and CDFW, to improve their effectiveness in achieving the Yolo HCP/NCCP biological goals and objectives.

Contribution to Biological Goals and Objectives

- Select lands that contribute to the biological goals and objectives described in Section 6.3, *Biological Goals and Objectives*.
- Prioritize lands with ecological functions that will serve to achieve multiple biological objectives (e.g., lands that support habitat for multiple covered species).

Presence of Occupied or Suitable Habitat

- Prioritize lands known to be occupied by covered species or that support suitable habitat that is contiguous with occupied habitat.

Information on known occurrences is particularly important in selecting reserve system lands for species whose occupied habitats are not easily predicted by existing habitat suitability models, such as the valley elderberry longhorn beetle, western burrowing owl, and California tiger salamander. Lands currently known to be occupied by covered species are described in Appendix A, *Covered Species Accounts*, but the JPA will use the most current CNDDB database and other applicable data, as well as pre-acquisition surveys (Section 6.4.1.6, *Pre-Acquisition Surveys and Evaluations*) to identify lands occupied by covered species. Over the term of the Yolo HCP/NCCP, new information on species occurrences will guide land conservation decisions. All lands to be acquired for acquisition will be reviewed and approved by the wildlife agencies.

[11] California Fish and Game Code § 2820(a).

Ecological Gradients

- Design reserves to include a range of contiguous ecological gradients such as such as slope, elevation, or aspect.
- Design reserves to include high habitat diversity.

NCCPs are required to incorporate a range of environmental gradients and high habitat diversity to provide for shifting species distributions due to changed circumstances (California Fish and Game Code 2820(a)(4)(D)). The JPA will assemble the reserve system to encompass lands with continuous connections across elevation ranges to capture the diversity of natural communities and habitats that result from differences in rainfall and temperature, as well as effects of topographic relief, soil conditions, and other factors, to the extent that these factors vary within the Conservation Reserve Area. Ensuring a broad array of elevation ranges within the reserve system is more likely to support future upslope migration of communities and species in response to climate change.

Protection of natural habitat diversity contributes to maintaining the abundance and distribution of associated covered and other native species. Actively selecting reserve system lands that protect, or contribute to the protection of a high diversity of natural communities, habitats, vegetation types, and species confers the conservation benefit of a diverse mosaic of physical and vegetative structure and composition that protects biodiversity. For example, the presence of riparian or lacustrine and riverine natural communities (either existing or sites suitable for restoration or creation), which enhances the value of adjacent uplands for many species and contributes to overall habitat diversity, will be given high consideration in selecting reserve system lands.

Connectivity

- Provide connectivity between natural communities inside and outside the Plan Area.
- Maximize connections between HCP/NCCP reserve system lands and with other Public and Easement Lands (particularly Categories 1 and 2) in and adjacent to the Plan Area.
- Provide connectivity between habitat types that support different life history functions for covered species (e.g., acquire Swainson's hawk riparian nesting habitat that is located within the foraging flight distance of Swainson's hawk to foraging habitat areas).
- Prioritize acquisition of lands within the dispersal distance of occupied covered species habitat.

Size

- Design reserves of sufficient size to ensure the intended conservation benefits for the target covered species.
- Design reserves of sufficient size and configuration to ensure that they can be effectively managed given site constraints.
- Where feasible, build on baseline protected lands and management systems to increase management efficiency, connectivity, and patch size.

Protecting land in large units contributes to achieving a variety of conservation goals and objectives. Larger land areas provide for species with more extensive home range sizes (tens to hundreds of acres, depending on the species), such as large mammals and raptors, and also tend to protect a diverse array of species habitats at varied elevations. Selection of larger land areas also provides more interior land area that protects conservation resources from potential detrimental effects of

adjacent land uses, minimizing potential conflicts between conservation management activities and other uses on adjacent lands. The JPA will use minimum covered species habitat patch size requirements for covered species listed in Table 6-5, *Covered Species Habitat Acquisition Patch Size, Configuration, and Habitat Connectivity Considerations*, to guide acquisition of reserve system lands. Adjacent protected lands will count toward the total patch size for meeting minimum patch sizes.

Natural communities within the Conservation Reserve Area are either remnants of natural communities that existed before large-scale agricultural conversion altered the landscape, or areas that were restored back to natural communities. Protecting the largest examples of these remnant habitats is important to maximize species diversity and the population sizes of species. Larger land units in this landscape unit may retain more varied ecological conditions and associated diversity, including enhanced ecological functions such as pollination, than smaller areas. Large units are often more buffered from adjacent land use disturbance (for example, developed uses) and can be managed more efficiently and effectively. Notwithstanding the importance of protecting larger units, many key natural communities and habitats in the Conservation Reserve Area consist mainly of smaller units, such as remnant alkali prairie natural community that supports palmate-bracted bird's beak.

Value

- Protect the highest-value natural communities and covered species habitats available.
- Include lands that support smaller patches of remnant habitats important for maintaining the abundance and distribution of dependent native species (e.g., patches of natural lands on cultivated land properties).

Efforts to conserve lands in the Plan Area will emphasize those areas with greatest overall value to covered species and natural communities, with priority given to occupied habitat. High value lands are those with the highest densities and productivities for covered and other native species, and are therefore most likely to contribute to long-term conservation. High value lands include lands with (1) the highest current habitat value for covered species and/or (2) the highest potential for enhancement of habitat values for the covered and other native species associated with the natural communities.

The species habitat models (Appendix A, *Covered Species Accounts*) identify lands with highest values for covered species, based on known species occupancy and modeled distribution of each species' habitat. The JPA will use these models, along with other tools the JPA may develop, to help identify potential reserve system lands during HCP/NCCP implementation. The JPA will, however, base selection of reserve system lands for acquisition on site-specific ecological evaluations (Section 6.4.1.6, *Pre-Acquisition Surveys and Evaluations*) to ensure that the lands under consideration are suitable for achieving the biological goals and objectives. Areas the JPA identifies as priority reserve system lands will include those that support the rarest covered species, combined occurrences of covered species, or larger areas of relatively high value habitat.

Hydrology

Select lands that support the most reliable hydrology for maintaining protected natural communities and habitats into the future (i.e., lands that protect wetlands, ponds, and streams and their supporting watersheds).

Table 6-5. Covered Species Habitat Acquisition Patch Size, Configuration, and Habitat Connectivity Considerations

Covered Species[1]	Minimum Patch Size/Configuration Considerations[2]	Habitat Connectivity Considerations[3]
Invertebrates		
Valley elderberry longhorn beetle	Minimum habitat patch size for a beetle is a single shrub. USFWS guidelines for replacing habitat for a single removed elderberry shrub require 1,800 square feet of area for restoration (USFWS 1999).	Focus preservation on areas that provide a gradient of habitat conditions that support elderberry extending from woody riparian to adjacent oak savanna.
Amphibians		
California tiger salamander	Minimum patch size is 100 acres (unless contiguous with other suitable preserved habitat) of open grassland with vernal pools or ponds, which corresponds with the minimum conservation patch size identified by Trenham (2009). Configuration should follow typographical features (i.e., draws) that are more likely to be used as movement corridors.	Habitat lands must include both breeding ponds and suitable and adjacent upland grassland habitat and should be contiguous with other protected lands to allow for dispersal and other possible movement corridors.
Reptiles		
Western pond turtle	Minimum patch size is 2.5 acres. Average home range size for adult male is 2.5 acres (Bury 1972). Average nesting distance from water is approximately 100 feet and average distance to upland refugia is 164 feet (Rathbun et al. 2002). Minimum patch size should be 2.5 acres of suitable aquatic habitat (perennial streams, large water conveyance canals, or large ponds) with a minimum 200-foot buffer of upland grassland or other uncultivated habitats around the perimeter.	· Reserve system lands along stream courses should have sustainable permanent water flows and be free of significant upstream disturbances including toxins, streamside development, and other sources of potential upstream habitat degradation. · Pond or lake reserve system lands should be contiguous with open grassland or other natural land habitats to facilitate dispersal.
Giant garter snake	Minimum patch size is 320 acres. Wylie et al. (2002) reported home ranges ranging from 17 to 234 acres in Colusa County. E. Hansen in: ICF Jones & Stokes (2008) reports annual movements of between 0.42 to 0.78 miles along canals in the Natomas Basin. For this species, home range size is less relevant than connectivity of suitable aquatic habitat, which is essential. Minimum patch size should be 320 acres (using a movement distance of 0.5 miles (0.5 miles squared = 320 acres) and should include suitable linear aquatic habitat with connectivity throughout the larger region and adjacent suitable habitat, particularly rice fields.	· Connectivity of aquatic habitats (e.g., streams or canals) is essential to sustaining populations. · Suitable upland over-wintering habitat is required immediately adjacent to aquatic habitat (banks, levees, edges, or open uncultivated lands). Adjacency with rice lands or wetlands is needed.

Covered Species[1]	Minimum Patch Size/Configuration Considerations[2]	Habitat Connectivity Considerations[3]
Birds		
Swainson's hawk	A contiguous area of 830 acres represents the smallest home range size of recorded home ranges in the Sacramento Valley (Estep 1989). However, Swainson's hawks will use, for foraging, patches that are smaller in size within the agricultural matrix as long as they are not permanently fragmented by unsuitable land uses. A minimum patch size of 80 acres (unless contiguous with other Swainson's hawk preserves) of suitable habitat for foraging is recommended to account for rotational crop patterns within preserves. Swainson's hawks will use a variety of nesting conditions from dense riparian forest to a single isolated tree. Therefore, there is no minimum patch size recommended for Swainson's hawk nesting habitat.	· Give priority to foraging habitat areas that are within 1 mile of nesting habitat. This roughly corresponds to the minimum home range size (830 acres). However, Swainson's hawks regularly travel to more distant foraging habitats depending on seasonal changes in prey availability and accessibility (Estep 1989). · Reserve system lands should be contiguous with other suitable agricultural lands at a minimum of 2,760 acres, the mean home range size of Swainson's hawks in the Sacramento Valley (Estep 1989). · Focus on preserving lands that include potential nesting habitat (e.g., woodland patches, riparian, tree rows, isolated trees) or have potential for enhancement of both nesting and foraging values.
White-tailed kite	Minimum patch size of 80 acres, (unless contiguous with other preserves) of suitable foraging habitat (seasonally or annually rotated cropland, hay crops, irrigated or dry pastures, seasonal wetlands, and grasslands. This roughly corresponds to average territory size (Dunk 1995).	· Prioritize preservation of foraging habitat that includes or is adjacent to riparian nesting habitat, followed by areas located within 0.5 mile of nesting habitat. · Reserve system lands should be contiguous with other suitable agricultural lands, grasslands, or seasonal wetland habitats at a minimum of 300 acres to correspond with larger territory sizes (Henry 1983) and to accommodate multiple pairs.
Western yellow-billed cuckoo	Minimum patch size is at least 25 acres (Gaines 1974) of mature cottonwood/willow riparian forest in a linear configuration along drainages, unless contiguous with other suitable preserved riparian forest. Habitat patches should be at least 330 feet wide and at least 990 feet long (Gaines 1974), with preservation priority given to patches greater than 50 acres and with widths over 660 feet (defined as suitable habitat by Laymon and Halterman [1989]).	Protected habitat should be located within drainages that generally provide continuous canopy cover along its length to promote movement. Does not require continuous breeding habitat, but at least cover and roosting habitat.

Covered Species[1]	Minimum Patch Size/Configuration Considerations[2]	Habitat Connectivity Considerations[3]
Western burrowing owl	No minimum patch size. See Section 6.4.1.8.1, *Western Burrowing Owl.*	Give priority to occupied habitats and grassland habitats that support healthy ground squirrel populations. Protect burrowing owl habitats adjacent to existing habitat areas.
Least Bell's vireo	Minimum patch size is 1.5 acres of dense and structurally diverse riparian forest unless contiguous with other suitable preserved riparian habitat. This corresponds with the average territory size of least Bell's vireo, which is between 1.5 and 2.5 acres (USFWS 1998).	Give priority to riparian habitats with significant willow (*Salix* sp.) or low strata dense herbaceous component. Protected sites should be contiguous with other protected riparian habitats and occur within a grassland/wetland or agricultural landscape; and not near developed areas.
Bank swallow	At least 17 feet of open, vertical, and erodible channel bank supporting soils that provide suitable nesting substrate (Garrison 1989).	Focus preservation within channel reaches that currently or historically supported nesting colonies and that continue to support suitable habitat condition to provide for the ongoing replacement of existing nesting habitat that is lost as channels meander and erode.
Tricolored blackbird	Patches of emergent wetland including tule/cattail or riparian scrub (e.g., blackberry brambles) of at least 0.5 acre in size (Beedy 1989).	Protect habitat areas within 75 feet of a water source and 0.5 mile of wetland, irrigated pasture, alfalfa, or other land cover types that produce large numbers of insects.

[1] Palmate-bracted bird's beak is not included in this table because its mapped habitat is extremely limited and highly fragmented within the Plan Area, and all mapped habitat except that to be lost due to covered activities will be protected under the HCP/NCCP. Consequently, patch size, configuration, and habitat connectivity considerations do not apply to this species.

[2] Minimum patch size/shape that should be preserved to provide meaningful habitat value for the species.

[3] Connectivity requirements such as proximity to other patches of species habitat, proximity to other patches of specific land cover types, movement corridors.

6.4.1.4.2 Reserve System Prioritization Guidelines

The JPA developed the following reserve system prioritization guidelines to most effectively meet conservation objectives and the habitat needs of all covered species. The JPA intends to use these guidelines to guide the process of landowner participation in the reserve system by prioritizing the acquisition process based on habitat quality, connectivity, location, acreage objectives, and other site-specific and landscape attributes in order to maximize value, enhance management, and facilitate active communication and cooperation with the agricultural community within the Plan Area to meet HCP/NCCP goals and objectives. The JPA intends for these guidelines to be flexible through time to provide for a changing landscape and so that the JPA and wildlife agencies can explore opportunities for acquisition that may appear to be inconsistent with the priority criteria but that otherwise meet conservation objectives. All land acquisition is subject to wildlife agency approval.

Newly protected lands will have **all** the following attributes:

1. The property is not currently in a protected land status (exclude Categories 1 and 2 protected lands)
2. The property is within the Conservation Reserve Area, unless the land is adjacent to the Conservation Reserve Area and approved by the wildlife agencies.
3. The property is outside of urban planning units 19, 20, 21, and 22

The JPA will prioritize land acquisitions consistent with the following guidelines. With wildlife agency approval, the JPA my prioritize lands that do not meet the following guidelines as necessary to meet the specific acquisition criteria for Swainson's hawk (Section 6.4.1.4.4) and giant garter snake (Section 6.4.1.5), or as determined on a case-by-case basis for other lands having a high acquisition priority based on the HCP/NCCP's conservation commitments and biological goals and objectives.

Priority 1 lands have the following attributes:

1.1 Two or more of the following:

- Swainson's hawk habitat in conservation zones 10, 11, 13, 15, and 16
- Giant garter snake habitat
- California tiger salamander habitat in conservation zone 5
- Western burrowing owl occurrences
- Valley foothill riparian in conservation zones 7 or 9

- AND -

Is adjacent to Category 1 or Category 2 protected lands.

-OR-

1.2 Swainson's hawk habitat in conservation zones 11 and 13, and adjacent to Category 1 or Category 2 protected lands.

-OR-

1.3 Grasslands or lacustrine/riverine within the California tiger salamander critical habitat unit.

-OR-

1.4 Palmate bird's beak habitat in Conservation Zone 11

-OR-

1.5 GGS habitat in Planning Units 11, 12, 13, 17, 18, and is adjacent to Category 1 or Category 2 protected lands.

-OR-

1.6 Contain valley foothill riparian in Conservation Zones 7 and 9

-OR-

1.7. Include portions of "GGS Potential Reserve Design Corridor"

Priority 2 lands are lands outside but adjacent to Priority 1 lands, with the following attributes:

2.1 Two or more of the following:

- Swainson's hawk habitat in conservation zones 10, 11, 13, 15, and 16
- Giant garter snake habitat
- California tiger salamander habitat in conservation zone 5
- Western burrowing owl occurrences
- Valley foothill riparian in conservation zones 7 or 9

-OR-

2.2 GGS habitat in Planning Units 11, 12, 13, 17, 18

-OR-

2.3 Swainson's hawk habitat in Planning Units 11 and 13.

6.4.1.4.3 Species-specific Evaluation Criteria

In addition to meeting the prioritization guidelines above, the STAC will also evaluate each prospective preserve based on species-specific criteria. These criteria include habitat suitability (including patch size), landscape, and land management attributes (Appendix TBD – this will be the STAC evaluation criteria, for the public review draft). The STAC will evaluate and score each property based on the evaluation criteria. The STAC will then make a recommendation to the JPA based on the site evaluation and the extent to which the property is consistent with meeting conservation objectives.

6.4.1.4.4 Reserve System Lands Distribution for Swainson's Hawk

In addition to the acquisition prioritization and species-specific evaluations described above, the JPA will also consider the distribution of reserve system lands in the Plan Area to ensure that reserves meet the habitat needs of Covered Species that are wide ranging across the Plan Area landscape, and are not highly dependent on habitat connectivity, such as Swainson's hawk and white-tailed kite. Swainson's hawk foraging habitat should be strategically placed within the Plan Area to provide moderate to high value habitat preserves integrated into the agricultural matrix throughout the portion of the conservation reserve area that supports the bulk of the nesting population. For example, dividing the 16,310 newly protected acres into 300 acre blocks, there are 54 individual reserves that can be placed strategically throughout the agricultural landscape. These newly protected reserves can be consolidated and form larger contiguous blocks or can be a series of separate, smaller reserves scattered throughout each Planning Unit. Acquisition of newly protected reserves for the Swainson's hawk should focus on planning units 10, 11,13, 15, and 16, but can include others as determined by the STAC. Table 6-6 shows an example of how 54 300-acre reserves could be distributed among the planning units based on their size and the distribution and abundance of Swainson's hawk nesting territories.

Table 6-6. Example Distribution of 54 Reserves among 5 Planning Units

Planning Unit	Reserves
11	18 (5,400 acres)
13	16 (4,800 acres)
15	8 (2,400 acres)
16	6 (1,800 acres)
10	6 (1,800 acres)

Because the majority of the nesting population and available nesting habitat occurs within these planning units, strategically placing reserves as described will also maintain or enhance habitats nearest the majority of nesting habitats in the plan area.

Modeled habitat for other covered species present on these reserve system lands will count toward the total modeled habitat acre commitments for those species.

6.4.1.4.5 Giant Garter Snake Reserve System Design

Based on information from species experts and in accordance with Wylie et al. (2010), Yolo HCP/NCCP will prioritize protection and restoration of giant garter snake habitat that contributes toward achievement of the following reserve design. Baseline public and easement lands, newly protected lands, pre-permit reserve lands, and lands protected and restored through mechanisms other than the Yolo HCP/NCCP will all count toward completing this reserve design. JPA's acre commitments will contribute toward achieving this reserve design, but the acre commitments will not increase beyond those specified in the biological goals and objectives.

- Habitat for giant garter snake should be provided (i.e., protected and/or restored) in multiples of two paired patches of habitat. Each patch should consist of one 593 acre (240 hectare) patch of contiguous buffered perennial wetland habitat (restored or enhanced) and one 1,578 acres (639 hectare) patch of contiguous active ricelands separated by no more than 8 kilometers. If ricelands are not available, the pair of patches could also consist of two 593 acre patches of buffered perennial wetlands. In addition, the pairs of habitat patches should not be separated by more than 8 kilometers.
- These pairs of habitat patches of contiguous perennial wetlands and ricelands should be buffered by 0.5 kilometer of compatible habitat and the two areas should be connected by a corridor of aquatic and upland habitat with a 0.8 kilometer width. All pairs of habitat patches should be connected with the other pairs of habitat patches within by corridors of suitable habitat.
- In the Yolo Basin, 5 pairs of habitat patches should be spread out spatially from north to south over the basin. Areas with high flooding flows in the Yolo Bypass should be avoided.
- Two pairs of habitat patches should be provided in the Colusa Basin portion of the Plan Area.

Modeled habitat for covered species other than giant garter snake that may be present on reserve system lands will count toward the total modeled habitat acre commitments for those species.

6.4.1.4.6 California Tiger Salamander Reserve System Design

Yolo HCP/NCCP will prioritize protection and restoration of California tiger salamander habitat that contributes toward achievement of the following reserve design. Baseline public and easement lands, newly protected lands, pre-permit reserve lands, and lands protected and restored through mechanisms other than the Yolo HCP/NCCP will all count toward completing this reserve design. JPA's acre commitments will contribute toward achieving this reserve design, but the acre commitments will not increase beyond those specified in the biological goals and objectives.

- Protection of 13,592 acres of California tiger salamander habitat in the Dunnigan Hills area.
- Within the 13,592 acres, include three or four preserves, each at least 3,398 acres in size.
- In each preserve, include at least four ponds.
- If a preserve includes four to nine ponds, each pond must be at least 0.9 acre in size. If a preserve includes ten or more ponds, each pond must be at least .09 acre in size.

Modeled habitat for covered species other than California tiger salamander that may be present on reserve system lands will count toward the total modeled habitat acre commitments for those species.

6.4.1.5 Land Acquisition Requirements

In addition to applying the reserve design principles and concepts described above to build the reserve system, the JPA will meet the following requirements for the reserve system.

- Protect and enroll lands at the required acreages and locations provided in Table 6-2(a), *Newly Protected Lands Commitments,* and 6-3(b), *Pre-permit Reserve Land Commitments*
- Contribute to the establishment of a corridor comprised of patches of woody and herbaceous riparian vegetation within the Putah Creek floodplain extending the length of Putah Creek in planning units 8 and 9 (Figure 6-4, *Ecological Corridors*). Prioritize acquisition of riparian areas with high vegetative structural diversity.
- Contribute to the establishment of a corridor comprised of patches of woody and herbaceous riparian vegetation within the Cache Creek floodplain and extending the length of Cache Creek from the west boundary of planning unit 7 to the Cache Creek Settling Basin exclusive of existing and potential aggregate mining areas (Figures 6–4, *Ecological Corridors*). Prioritize acquisition of riparian areas with high vegetative structural diversity.
- Contribute to the establishment of a corridor comprised of patches of woody and herbaceous riparian vegetation along the Sacramento River (Figures 6–4, *Ecological Corridors*). Prioritize acquisition of riparian areas with high vegetative structural diversity.
- Within the 1,600 acres of protected valley foothill riparian natural community (Objective NC-VFR1.2), prioritize protection of populations of valley elderberry longhorn beetle along Lower Cache Creek and Lower Putah Creek, and adjacent lands to provide for population expansion.
- Protection of fresh emergent wetlands, foothill riparian natural community, and ponds must ensure sufficient watershed lands are present to support hydrologic requirements.

- Protection of rice land, restored fresh emergent wetland, and protected and restored giant garter snake habitat must include securing (e.g., via water rights and/or contracts) the artificial water sources supporting these habitats.

6.4.1.6 Pre-Acquisition Surveys and Evaluations

The JPA will develop and implement protocols for assessing physical and biological resources and infrastructure present on lands the JPA is considering for acquisition to determine the degree to which they are suitable for achieving the Yolo HCP/NCCP biological goals and objectives, and consistent with the reserve design principles, concepts, and requirements described above. For potential reserves supporting Swainson's hawk, the JPA will incorporate its existing Science and Technical Advisory Committee (STAC) evaluation process into these protocols. Qualified biologists (Section 4.3.6.1, *Qualified Biologist*) will conduct pre-acquisition surveys. Surveys will assess relevant physical and biological attributes of the lands consistent with the reserve system assembly criteria (Section 6.4.1.4, *Reserve System Assembly*) and reserve design requirements (Section 6.4.1.5, *Land Acquisition Requirements*).

6.4.1.7 Enrolling Baseline Public and Easement Lands into the Reserve System as Pre-permit Reserve Lands

In addition to protection of currently unprotected lands to meet the conservation acreage requirements provided in Table 6-2(a), *Newly Protected Lands Commitments,* the JPA will enroll baseline public and easement lands into the reserve system to meet the acreage requirements provided in Table 6-3(b), *Pre-permit Reserve Lands Commitments*. Baseline public and easement lands are defined in Table 6-1(a), *Baseline Public and Easement Lands*; they include lands in public ownership and other lands that are protected under existing conservation easements. Table 6-7, *Pre-permit Reserve Lands, Enrollment Requirements*, describes the enrollment requirements for different types of pre-permit reserve lands.

The JPA may enroll Categories 2 and 3 baseline public and easement lands (as defined in Table 6-1(a), *Baseline Public and Easement Lands*) into the reserve system if it contributes to the biological goals and objectives of the Yolo HCP/NCCP**.** Once enrolled, these lands become *pre-permit reserve lands.* Pre-permit reserve lands must conduct their management and monitoring according to the requirements and guidelines outlined in this chapter, or in a manner that is consistent with the HCP/NCCP biological goals and objectives as agreed upon by the Wildlife Agencies. Monitoring and managing pre-permit reserve lands consistent with this chapter will standardize management and monitoring to provide a cohesive reserve system throughout the Plan Area, and ensure consistent management and monitoring in perpetuity. This upgrade and standardization of management and monitoring on existing open space therefore constitutes an important part of this conservation strategy that will benefit the covered species.

The JPA may enroll Category 1 baseline public and easement lands as defined in Table 6-1(a), *Baseline Public and Easement Lands*, also known as baseline protected lands, into the reserve system if the land contributes to the conservation strategy consistent with the biological goals and objectives, includes CDFW and/or USFWS as a third party beneficiary in the conservation easement, and is managed to conserve Yolo HCP/NCCP natural communities and covered species.

To enroll baseline public and easement lands into the reserve system as pre-permit reserve lands, the JPA will undertake the following actions.

- The JPA will coordinate and may enter into agreements (e.g., memoranda of agreement, memoranda of understanding, and cooperative management agreements) with federal and state agencies, land trusts, and other organizations and individuals that manage baseline public and easement lands that meet the criteria provided above to implement additional or adjust existing management actions, if needed, to maintain or benefit these resources.
- The JPA will coordinate with and enter into agreements with Permittees (e.g., City and County agencies) to manage the proposed pre-permit reserve lands under their jurisdiction to similarly benefit these resources.
- Preparatory to entering into agreements, the JPA will coordinate with entities having jurisdiction over the proposed pre-permit reserve lands to (a) gather relevant available information and, if appropriate, conduct surveys necessary to determine the presence and status of the covered species resources listed above on baseline public and easement lands, and (b) gather information necessary to describe the range of land management practices that are permissible on these lands.
- Based on information collected, the JPA in coordination with the landowner/land manager will identify the need for adjustments in land management practices to maintain or improve the covered species resources listed above and, if needed, identify new or revised management actions the JPA will work with the landowner/land manager to implement.
- For lands that are protected under existing conservation easements and for which the JPA proposes modifications to existing land use practices, the JPA will coordinate with the easement holders and the landowners to seek modifications to the conservation easements necessary to implement any changes in land use practices.
- In certain instances the JPA may provide funding necessary to implement prescribed management actions on the pre-permit reserve lands.

Table 6-7. Pre-permit Reserve Lands, Enrollment Requirements

Pre-permit Reserve Lands	Enrollment Requirements
Swainson's hawk easements	One management plan will be prepared for all of these properties. The plan will be subject to wildlife agency approval prior to completion.
Mitigation banks	Entities operating mitigation banks will send the JPA annual monitoring reports. Only acres sold prior to HCP/NCCP approval will count toward the pre-permit reserve lands commitment. Credits sold after the HCP/NCCP is in place to fulfil HCP/NCCP commitments will count toward the newly protected lands commitment (as mitigation lands).
Conaway Ranch conservation easements[1] (excluding the 4,000 acre Conaway flood easement)	The management plan will stipulate that these lands will be managed for HCP/NCCP covered species occurring on these lands.
Other Category 1 and 2 baseline public and easement lands	The JPA will coordinate with the wildlife agencies during implementation to enroll these lands consistent with conservation strategy criteria.
Yolo Wildlife Area	[Note to reader – the pre-permit lands conservation commitments in this administrative draft do not assume Yolo Wildlife Area lands will be included as pre-permit reserve lands. CDFW will assess management and monitoring goals on Yolo Wildlife Area and Yolo HCP/NCCP goals and objectives, to determine whether they are compatible: if so, these lands may be added as pre-permit reserve lands for the Public Review Draft.]

[1] These lands are not covered by an endowment at the time of this writing. The JPA and wildlife agencies have agreed that ongoing management is the responsibility of Conaway and the associated agencies and will not be a cost attributable to the JPA.

6.4.1.8 Species-specific Acquisition Requirements

Additional acquisition requirements that are species-specific and not addressed above are provided in this section.

6.4.1.8.1 Western Burrowing Owl

Consistent with Objective WBO1.3, the JPA will protect [To be determined] western burrowing owl occurrences, each supporting at least [To be determined] breeding pairs. The JPA will protect sufficient habitat surrounding occupied burrows to sustain the breeding pairs, consistent with *Staff Report on Burrowing Owl Mitigation* (CDFG 2012). The 2012 CDFG report recommends determining the acreage needed around burrowing owl burrows to sustain breeding pairs based on site specific conditions and information on the species' natural history. Gervais et al. (2003) suggests that burrowing owls concentrate foraging efforts within 600 meters of a nest burrow. Based on this information, protected burrowing owl occurrences should include 600 meters of foraging habitat surrounding the nesting burrows. A different configuration may be protected, however, if the Science and Technical Advisory Committee determines, based on site-specific information and the best available scientific information on the species, that sufficient habitat is protected surrounding the burrows to sustain the breeding pairs of western burrowing owl.

6.4.2 Conservation Measure 2: Restore Natural Communities

6.4.2.1 Introduction

This conservation measure describes the natural community restoration and creation actions that the JPA will apply to ensure the Yolo HCP/NCCP reserve system meets applicable biological goals and objectives related to the natural community and covered species habitat restoration and creation. The restoration will occur prior to natural community loss consistent with the stay ahead provision described in Chapter 7, Section 7.5.3, *Stay Ahead Provision,* to meet the biological objectives provided in Table 6-8.

Natural community restoration is defined as the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a site that historically supported such functions, but no longer does because of the loss of one or more required ecological factors or as a result of past disturbance. Restoration typically involves altering the soil or other substrate to improve a site's ability to support the historic land cover types, although it may also include physical manipulation to restore specific ecological function in a site where that function has been lost (e.g., removal of hardscape in a stream channel and re-vegetation with riparian plantings). In contrast to enhancement (defined in Conservation Measure 3, *Natural Communities Management and Enhancement*), restoration results in the re-establishment of ecological function, value, *and* acreage of a natural community or land cover type. For example, valley foothill riparian natural community could be restored to stream reaches that historically supported it. In the Yolo HCP/NCCP, habitat restoration is only allowed in those land cover types for which techniques are generally successful, and where restoration would substantially enhance habitat for covered species and native biological diversity. Restoration actions must also incorporate the best available science.

Natural community restoration may not restore all functions of natural communities. For example, recent studies of wetland restoration projects indicate that many of them fail to meet success criteria or lack important functions of natural reference sites (National Research Council 2001). The conservation strategy takes this uncertainty into account by relying primarily on habitat preservation and by requiring habitat restoration be completed and meet success criteria prior to project impacts. Also, uncertainty is taken into account by the adaptive management strategy (see Chapter 7 *Monitoring and Adaptive Management Program*).

Although the Yolo HCP/NCCP conservation strategy focuses on natural community restoration, it also includes limited natural community creation. *Natural community creation* is the manipulation of the physical, chemical, or biological characteristics present to develop a land cover type in an area that did not previously support it. Similar to restoration, creation results in establishment of new ecological function, value, and acreage of a natural community or land cover types. The only habitat creation proposed under the Yolo HCP/NCCP is for ponds that will be created as breeding habitat for California tiger salamander in areas that did not previously support ponds (Section 6.4.2.5.1, *Lacustine*). The JPA will prioritize restoration over creation for California tiger salamander ponds.

Table 6-8. Biological Goals and Objectives Associated with Conservation Measure 2

Biological Goal or Objective	How CM2 Advances a Biological Objective
Landscape-Level Biological Goals and Objectives	
Goal L-1: Large interconnected landscapes within the range of physical and biological attributes (e.g., slope, soils, hydrology, climate, and plant associations) in the Plan Area to support the distribution and abundance of covered species and their habitats, provide for the movement and genetic interchange among populations of covered species, and conserve native biodiversity.	
Objective L-1.1: Protect 28,381 acres of high-value natural communities and covered species habitats in the Conservation Reserve Area, and restore additional acres to result in no net loss of wetlands and riparian.	CM2 will achieve the restoration component of this objective as described throughout this conservation measure.
Valley Foothill Riparian Natural Community	
Goal NC-VFR1: Functional valley foothill riparian natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-VFR1.2: Restore one acre of valley foothill riparian natural community for each acre lost as a result of covered activities. Site the restoration to improve connectivity among patches of existing valley foothill riparian vegetation within the Cache Creek, and Putah Creek Corridors and the Sacramento River.	CM2 will achieve this objective as described in Section 6.4.2.4, *Valley Foothill Riparian Natural Community*.
Objective L-1.4: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Cache Creek floodplain and extending the length of Cache Creek from the west boundary of planning unit 7 to the Cache Creek Settling Basin exclusive of existing and potential aggregate mining areas (Figures 6–4, *Ecological Corridors*).	CM2 will achieve this objective as described in Section 6.4.2.4, *Valley Foothill Riparian Natural Community*.
Objective L-1.5: Prioritize land acquisition and natural community restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation, where it can be sustained by natural flows, within the Putah Creek floodplain and extending the length of Putah Creek from the west boundary of planning unit 9 to the Putah Sinks exclusive of existing and potential aggregate mining areas (Figure 6–4, *Ecological Corridors*).	CM2 will achieve this objective as described in Section 6.4.2.4, *Valley Foothill Riparian Natural Community*.
Objective L-1.6: Prioritize land acquisition and restoration to support a corridor comprised of patches of woody and herbaceous riparian vegetation along the Sacramento River and Yolo Bypass in planning units 12, 14, 15, and 21 (Figure 6-4, *Ecological Corridors*).	
Fresh Emergent Wetland Natural Community	
Goal NC-FEW1: Functional fresh emergent wetland natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-FEW1.2: Restore fresh emergent wetland natural community in the Conservation Reserve Area at a ratio of one acre restored to each acre lost as a result of covered activities.	CM2 will achieve this objective as described in Section 6.4.2.5, *Fresh Emergent Wetland Restoration Criteria and Techniques.*

Biological Goal or Objective	How CM2 Advances a Biological Objective
Lacustrine and Riverine Natural Community	
Goal NC-LR1: Functional lacustrine and riverine community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-LR1.2: Restore or create lacustrine natural community in the Conservation Reserve Area at a ratio of one acre restored to each acre lost as a result of covered activities.	CM2 will achieve this objective as described in Section 6.4.2.6, *Lacustrine and Riverine Restoration Criteria and Techniques*.
Objective NC-LR1.3: Restore riverine natural community in the Conservation Reserve Area at a ratio of one mile restored to each mile lost as a result of covered activities.	CM2 will achieve this objective as described in Section 6.4.2.6, *Lacustrine and Riverine Restoration Criteria and Techniques*.
Objective NC-LR1.3: Restore or create riverine natural community in the Conservation Reserve Area, in kind, at a ratio of one mile of riverine restored to each mile lost as a result of covered activities.	CM2 will achieve this objective as described in Section 6.4.2.6, *Lacustrine and Riverine Restoration Criteria and Techniques*.
Valley Elderberry Longhorn Beetle	
Goal VELB1: Provide for the conservation of valley elderberry longhorn beetle in the Plan Area.	
Objective VELB1.2: Within the restored valley foothill riparian natural community (Objective NC-VFR1.2), establish elderberry shrubs and associated riparian plant species, and prioritize lands adjacent to existing populations to provide for population expansion.	CM2 will achieve this objective as described in Section 6.4.2.4.1, *Valley Elderberry Longhorn Beetle.*
California Tiger Salamander	
Goal CTS1: Provide for the conservation of California tiger salamander in the Plan Area.	
Objective CTS1.2: Within the 800 acres of protected lacustrine and riverine natural community (Objective NC-LR1.1), protect at least 50 acres of California tiger salamander aquatic habitat. Restore or create 1 acre of California tiger salamander aquatic habitat for each acre lost as a result of covered activities. Within the protected and restored aquatic habitat, include at least 5 California tiger salamander breeding pools that are found to support all life stages of the salamander through at least all water year types.	CM2 will achieve the restoration/creation component of this objective as described in Section 6.4.2.6.1, *Lacustrine.*
Giant Garter Snake	
Goal GGS1: Provide for the conservation of giant garter snake in the Plan Area, including the Willow Slough/Yolo Bypass subpopulation and a segment of the Colusa Basin subpopulation, and connectivity between the two subpopulations	
Objective GGS1.3: Locate and design the 300 acres of protected fresh emergent wetland natural community (Objective NC-FEW1.1), at least 420 acres of the protected lacustrine/riverine natural community (Objective NC-LR.11), the restored fresh emergent wetland (Objective NC-FEW1.2), and sufficient restored lacustrine and riverine natural community (Objective NC-LR1.2) to meet no net loss of giant garter snake lacustrine and riverine habitat for this species, to provide aquatic habitat for the giant garter snake. Ensure at least 80% of the aquatic habitat is perennial, and that the remainder provides aquatic habitat for the giant garter snake during the active season at least through July of each summer.	CM2 will achieve the restoration component of this objective as described in Section 6.4.2.5, *Fresh Emergent Wetland Restoration Criteria and Techniques*.

Section 6.4.2.2 describes the purpose of this conservation measure, and provides a table indicating how the conservation measure will achieve each of the relevant biological goals and objectives. Section 6.4.2.3 describes general restoration requirements that apply to all natural communities and covered species habitats. Sections 6.4.2.4 through 6.4.2.7 provide restoration criteria and techniques for each of the natural community types to be restored or created.

6.4.2.2 Purpose

This conservation measure provides guidance for meeting the biological objectives presented in Section 6.3, *Biological Goals and Objectives,* as they relate to natural community and covered species habitat restoration. Table 6-8 lists the biological goals and objectives relevant to this conservation measure, and describes how this conservation measure will contribute toward each relevant biological objective.

6.4.2.3 General Restoration and Creation Requirements

6.4.2.3.1 Siting Restoration Projects

The JPA will identify and select potential restoration sites on the basis of their physical processes and hydrologic, geomorphic, and soil conditions to ensure successful restoration can occur and be self-sustaining. Such an approach increases the likelihood of successful restoration and reduces long-term management and maintenance costs.

The JPA will also select restoration sites on the basis of their ability to support covered species, support implementation of species-specific conservation actions, and meet species-specific biological goals and objectives. For example, sites designed to support tricolored blackbird will be located a sufficient distance away from black-crowned night-heron rookeries to minimize predation on tricolored blackbirds, and sites designed to support breeding habitat for covered amphibians must have adequate nearby upland habitat.

The JPA will only restore natural communities in areas where there is evidence that the natural community was previously present. Creation (i.e., establishment in areas where the natural community did not previously occur) is only allowed for ponds to support California tiger salamander (Section 6.4.2.6.1, *Lacustrine*).

The JPA will choose restoration and creation locations based on the reserve design principles and concepts described in CM1, *Establish Reserve System* (Section 6.4.1.4, *Reserve System Assembly*). The JPA will site and design natural community restoration projects to contribute to a variety of environmental gradients (e.g., hydrology, elevation, soils, slop, and aspect) within and across a diversity of natural communities. The JPA will permanently protect the restoration and creation sites in conservation easements as described in Section 6.4.1.3, *Land Protection Mechanisms,* including sufficient surrounding upland to support the hydrology of restored and created wetlands. The JPA will incorporate these lands into the reserve system and manage and enhance them consistent with CM2, *Manage and Enhance Natural Communities.*

6.4.2.3.2 Restoring Natural Communities Outside the Reserve System

Although the JPA will focus restoration in the reserve system, restoration on public or private lands outside the reserve system (i.e., not placed under a Yolo HCP/NCCP conservation easement) may apply toward the no net loss requirements if the following conditions are met.

- A Permittee, including the JPA, or a third party under contract with a Permittee, conducts the restoration.
- The Permittee conducts restoration consistent with the provisions in Conservation Measure 2.
- The Permittee restores the site to pre-project or ecologically improved conditions within 5 years of the end of the covered activity (if restoration occurs at covered activity site).
- There are no suitable and feasible restoration sites within the reserve system.
- The JPA or other Permittee maintains the site in perpetuity according to the terms of the Yolo HCP/NCCP. If a third party maintains the site, the third party must enter into a contract with the JPA to ensure management according to the terms of the Yolo HCP/NCCP.
- The JPA, or its designated third party, monitors the restoration site in accordance with Section 6.5, *Monitoring and Adaptive Management*.
- The JPA and wildlife agencies approve the project.

6.4.2.3.3 Restoration Plans

The JPA will prepare, or require project proponents to prepare, detailed restoration plans prior to implementing restoration projects. These will include plans and specifications, and will be developed for individual sites or stream reaches based on specific geomorphic, hydraulic, and hydrologic conditions; extent and quality of existing habitats; existing wildlife use; and the potential for adverse effects (e.g., disturbance and/or removal of existing habitat or wetlands). These plans will be consistent with the reserve unit management plan for the site[12], described in Section 6.4.3.3, *Reserve Management Plans*. Restoration plans will satisfy the requirements listed below.

- Define restoration goals and objectives, performance indicators, and success criteria.
- Collect and analyze baseline data (e.g., soil type and suitability for riparian planting, low-flow conditions, past land use history/alterations).
- Identify suitable/feasible restoration measures.
- Develop conceptual restoration designs.
- Develop detailed restoration designs (plans and specifications) that identify and describe construction methods, planting areas and methods, planting species (including collection and propagation methods), and maintenance requirements.
- Prepare an adaptive management and monitoring plan based on the guidelines in Chapter 7 that includes descriptions of responsible parties; monitoring methods and schedule; indicators (e.g., vegetative cover); success criteria (e.g., 20% cover by year 5); and adaptive management measures (e.g., replanting with different species).

6.4.2.4 Valley Foothill Riparian Natural Community

The JPA will restore at least one acre of valley foothill riparian natural community for each acre lost as a result of covered activities. The restoration will be sited to improve connectivity among patches

[12] Site restoration plans on newly protected lands may be prepared prior to or concurrent with the reserve unit management plan.

of existing valley foothill riparian vegetation in the Cache Creek and Putah Creek Corridors (planning units 7 and 9).

Activities necessary to restore the riparian natural community may involve, depending on site-specific conditions, the following actions.

- Site clearing of debris and existing vegetation
- Site grading to improve micro-habitat conditions, hydrology, and planting/seeding conditions
- Planting and seeding of native plants
- Irrigation of sufficient duration to establish riparian vegetation
- Control of weeds and herbivory of sufficient duration to establish riparian vegetation

The JPA will apply the best available scientific and technical information and guidance to riparian restoration projects. Riparian restoration handbooks and guidance used in developing and implementing riparian restoration plans may include the *California Riparian Restoration Handbook* (Riparian Habitat Joint Venture 2009) as well include additional guidelines as they become available during the term of the Yolo HCP/NCCP.

6.4.2.4.1 Valley Elderberry Longhorn Beetle

The JPA will prioritize riparian plantings on lands adjacent to existing valley elderberry longhorn beetle populations to provide for population expansion opportunities. Within the restored valley foothill riparian natural community, the JPA will establish elderberry shrubs and associated riparian plant species at an amount proportional to the amount of elderberry stems over one inch in diameter removed as a result of covered activities, and the presence of valley elderberry longhorn beetle exit holes in the affected stems. Consistent with USFWS standards (1999), each elderberry stem measuring 1.0 inch or greater in diameter at ground level that is adversely affected (transplanted or destroyed) by covered activities will be replaced with elderberry seedlings or cuttings at a ratio ranging from 1:1 to 8:1 (new plantings to affected stems). Table 6.9 provides these ratios. Stock of either seedlings or cuttings will be obtained from local sources, including but not limited to the Putah Creek Coordinating Committee's plant nursery. Cuttings may be obtained from plants to be transplanted if the affected site is in the vicinity of the restoration site.

Since studies have found that the beetle is more abundant in dense native plant communities with a mature and a mixed understory, a mix of native plants associated with the elderberry plants will be planted at ratios ranging from 1:1 to 2:1 (native tree/plant species to each elderberry seedling or cutting), consistent with Table 6-9, *Valley Elderberry Longhorn Beetle Habitat Planting Ratios*. Stock of saplings, cuttings, and seedlings will be obtained from local sources. The site will also be planted with native herbaceous species if conditions are suitable.

Tables 6-9. Valley Elderberry Longhorn Beetle Habitat Planting Ratios

Location of Affected Plants	Stems (maximum diameter at ground level)	Exit Holes on Shrub (Yes/No)[1]	Elderberry Seedling Ratio[2]	Associated Native Plant Ratio[3]
Non-riparian	Greater than or equal to 1 inch, less than 3 inches	No	1:1	1:1
		Yes	2:1	2:1
	From 3 to 5 inches	No	2:1	1:1
		Yes	4:1	2:1
	Greater than or equal to 5 inches	No	3:1	1:1
		Yes	6:1	2:1
Riparian	Greater than or equal to 1 inch, less than 3 inches	No	2:1	1:1
		Yes	4:1	2:1
	From 3 to 5 inches	No	3:1	1:1
		Yes	6:1	2:1
	Greater than or equal to 5 inches	No	4:1	1:1
		Yes	8:1	2:1

[1] Presence or absence of exit holes indicating presence of valley elderberry longhorn beetle. All stems measuring one inch or greater in diameter at ground level on a single shrub are considered occupied when exit holes are present *anywhere* on the shrub.

[2] Ratios in this column correspond to the number of cuttings or seedlings to be planted per elderberry stem (one inch or greater in diameter at ground level) affected by a covered activity.

[3] Ratios in this column correspond to the number of associated native species to be planted per elderberry seedling or cutting planted.

The restoration area will provide at least 1,800 square feet for each transplanted elderberry plant. Up to 10 plantings (i.e., elderberry cuttings or seedlings and/or associated native plants) may be planted within the 1,800 square foot area with each transplanted elderberry. An additional 1,800 square feet shall be provided for every additional 10 conservation plants. Each planting will have its own watering basin measuring approximately 3 feet in diameter. Watering basins will be constructed with a continuous berm measuring approximately 8 inches wide at the base and six inches high.

6.4.2.5 Fresh Emergent Wetland Restoration Criteria and Techniques

The JPA will restore an acre of fresh emergent wetland for each acre removed as a result of covered activities. The JPA will site and design the restored fresh emergent wetland to provide aquatic habitat for the giant garter snake.

The primary natural habitat of giant garter snake is comprised of permanent wetland,[13] which typically supports substantially higher densities of giant garter snake than rice land (Wylie et al. 2010). The JPA will restore fresh emergent wetlands to achieve the following conditions.

- Flooded from early spring through mid-fall.
- Minimum patch size of 10 acres.

[13] NHP land cover types that support giant garter snake aquatic breeding and movement habitat are described in Appendix A, *Covered Species Accounts*.

- Restored within a matrix of open water (lacustrine) and upland habitat (existing or restored) suitable for giant garter snake to create a mosaic of open water, fresh emergent wetland, and upland.
- Located in or adjacent to, and hydrologically connected to rice land or existing wetlands that are occupied by giant garter snake.
- Include or be connected, to habitat corridors that support movement among existing and restored habitat areas.
- Supported by surface streams or by surface and subsurface hydrology associated with agricultural and flood control practices that maintains ponding and soil saturation at a frequency and duration sufficient to support hydrophytic vegetation typical of permanent emergent wetlands that support giant garter snake.
- Designed to allow for rapid drawdown of water if needed to control mosquitoes or nonnative invasive species.

Giant garter snake habitat will likely be restored primarily on rice lands or managed wetlands that could be occupied by giant garter snake. To minimize the potential for injury or mortality of giant garter snake as a result of operating restoration-related equipment, the JPA will only conduct habitat restoration activities during the giant garter snake active period.

Activities necessary to restore fresh emergent wetland and giant garter snake habitat may involve, depending on site-specific conditions, the following actions.

- Site clearing of debris and existing vegetation.
- Site grading to improve micro-habitat conditions, hydrology, and planting/seeding conditions.
- Erosion control measures.
- Collection of native emergent plant species rhizomes and other propagules for establishment in restoration sites.
- Planting and seeding of native emergent wetland and aquatic plants.
- Plant protection and ground cover manipulation.
- Installation or modification of water irrigation and drainage infrastructure, including wells, pumps, water control structures and irrigation ditches.

6.4.2.6 Lacustrine and Riverine Restoration Criteria and Techniques

6.4.2.6.1 Lacustrine

The JPA will restore or create one acre of lacustrine natural community, in-kind, for each acre removed as a result of covered activities. *In-kind* is the establishment of the same wetland type as that lost to the covered activity, and that would establish the same type of ecological functions over time. For example, creating a pond with species similar to those found in a naturally occurring pond that is removed by covered activities would be in-kind creation. Creating open-water lacustrine habitat within a mosaic of fresh emergent wetland to replace loss of lacustrine natural community associated with giant garter snake habitat would also be in-kind.

The JPA will restore lacustrine areas in association with fresh emergent wetlands and uplands to replace loss of open water (lacustrine) habitat for giant garter snake or western pond turtle. Section 6.4.2.5, *Fresh Emergent Wetland Restoration Criteria and Techniques,* provides the requirements for lacustrine restoration as a component of giant garter snake habitat.

The JPA will restore or create ponds suitable for supporting California tiger salamander to replace loss of California tiger salamander aquatic habitat. Pond creation will occur in damaged or disturbed areas to minimize the loss of existing habitats by the creation of new ones. The JPA may create ponds along streams or drainages provided it does not impair the hydrologic function of the stream. The JPA may also create ponds in other appropriate areas away from streams or drainages as long as there is normally enough water, or a water source may be established (e.g., installation of a spring box or a well) to adequately maintain the necessary inundation schedule for the California tiger salamander.

The Yolo HCP/NCCP assumes that California tiger salamander ponds will be created rather than restored (i.e., development of the pond land cover type in an area that did not previously support it). If an existing or historic pond is degraded to the point that it lacks certain ecological functions that are essential to support covered species (e.g., a pond is filled with sediment and no longer holds water), then restoration of a pond may be counted toward the Yolo HCP/NCCP creation requirements for ponds.

The JPA will site new ponds to improve habitat connectivity for California tiger salamander. The JPA will identify gaps between occupied ponds that are greater than 1.3 miles (typical dispersal distance for this species) but short enough such that the creation of a pond may bridge the gap.

Where feasible, created ponds will rely on passive management (e.g., they will dry on their own periodically) to minimize the need for artificial draining. The JPA will design ponds so that they either do not retain water long enough to support establishment of bullfrogs, nonnative fish, or other predators of California tiger salamander, or can be artificially drained to deter such establishment (described in Section 6.3.2 *Landscape Conservation and Management*). Pond size will vary depending on the availability of water and site and watershed conditions. Pond depth will be sufficient to provide suitable breeding habitat for tiger salamanders and to preclude dense growth of emergent aquatic vegetation. The JPA will plant native emergent and aquatic vegetation in ponds to provide suitable breeding habitat for California tiger salamander.

6.4.2.6.2 Riverine

The JPA will restore one mile of riverine natural community (stream) for each mile removed as a result of covered activities. Unlike other natural communities for which restoration is required, streams are unique—restoration occurs within the footprint of existing streams, rather than creating new wetland footprints. Stream restoration is defined as any substantial physical alteration to stream systems to return them to natural or semi-natural conditions and to restore specific ecological function in a site where that function has been lost. For example, stream restoration includes removing hardscape features from concrete-lined or rip-rapped stream banks or restoring earthen or otherwise engineered channels to a more natural condition that allows for water infiltration, percolation, and groundwater recharge. Restoration may also include stabilizing stream banks to manage fine sediment inputs and preventing excessive erosion.

Stream restoration will be accomplished according to the level of effects on streams. One mile of stream will be restored for every mile of stream permanently affected by covered activities. Stream restoration will occur within the reserve system, or outside of the reserve system in partnership

with private and public landowners. The JPA will conduct additional site assessments during implementation to identify specific restoration project areas based on the site selection guidelines described below.

Stream restoration may entail direct restoration (reconstruction of a channel) or incremental process restoration (installation of a natural structural feature to induce change in a channel), consistent with the guidelines of the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1998). Stream restoration can also be used to restore bank stability and reduce bank erosion; such restoration may improve aquatic habitat and water quality. Stream restoration techniques may affect the local slope, length, sinuosity, and dimensions of the channel, as well as alter basic channel processes related to sediment transport, and are very useful for treating the underlying causes of habitat degradation. Stream restoration under the Yolo HCP/NCCP will only be considered as a potential solution where there are chronic anthropogenic problems. In implementation, the effects of restoration on local channel geometry will be carefully considered and proper hydraulic analysis performed (Flosi et al. 1998).

6.4.3 Conservation Measure 3: Manage and Enhance the Reserve System

6.4.3.1 Introduction

This conservation measure describes the actions the JPA will apply to ensure the Yolo HCP/NCCP reserve system meets applicable biological goals and objectives related to natural community and covered species habitat management and enhancement. The management and enhancement will occur throughout the term of the Yolo HCP/NCCP permits to meet the biological objectives provided in Table 6-10, *Biological Goals and Objectives Associated with Conservation Measure 3.*

Natural Community Management is defined as the maintenance of ecological conditions and values within a natural community to prevent its degradation. Examples of natural community management include livestock grazing to prevent further spread of invasive species and maintaining water sources supporting covered species aquatic habitat.

Natural Community Enhancement is defined as manipulation of the physical, chemical, or biological characteristics of a land cover type to heighten, intensify, or improve one or more specific existing ecological function(s). Enhancement results in the gain of selected existing ecological function(s), but may also lead to a decline in other ecological function(s). Natural community enhancement implemented in the reserve system will result in an increase or improvement in specific ecological function without a change in the amount of land cover types. Examples of ecological functions include native species richness, species diversity, native vegetative cover, and wildlife habitat. An example of natural community enhancement is a substantial reduction in the density or biomass of invasive species (including their eradication, as described in Section 6.4.3.4.1, *Invasive Species Control Program*).

Section 6.4.3.2 describes the purpose of this conservation measure, and provides a table indicating how the conservation measure will achieve each of the relevant biological goals and objectives. Section 6.4.3.3, *Reserve Management Plans,* describes the requirements for preparing reserve management plans for the reserve system. Section 6.4.3.4 describes landscape–level management and enhancement actions that will be implemented across the entire reserve system landscape, including invasive species control, maintenance and enhancement of connectivity, and

implementation of the pollinator strategy. Section 6.4.3.5 describes management actions specific to each natural community, and Section 6.4.3.6 describes species-specific management and enhancement actions not addressed at the landscape or natural community levels. Section 6.4.3.7 describes management and enhancement activities that will be implemented under the Yolo HCP/NCCP but outside the reserve system.

6.4.3.2 Purpose

This conservation measure provides guidance for meeting the biological objectives presented in Section 6.3, *Biological Goals and Objectives,* as they relate to management and enhancement. Table 6-10 lists the biological goals and objectives relevant to this conservation measure, and describes how this conservation measure will contribute toward each relevant biological objective.

Table 6-10. Biological Goals and Objectives Associated with Conservation Measure 3

Biological Goal or Objective	How CM3 Advances a Biological Objective
Landscape-Level Biological Goals and Objectives	
Goal L-2: Ecological processes and conditions that sustain and reestablish natural communities and native species.	
Objective L-2.1: Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative plant and animal species.	CM3 will meet this objective as described in Section 6.4.3.4.1, *Invasive Species Control Program;* 6.4.3.7.1, *Cache Creek Resource Management Plan,* and 6.4.3.7.2, *Lower Putah Creek*.
Objective LC-2.2: Increase the abundance of native insect pollinators that support reproduction of native plant species and long-term production of agricultural crops that support habitat for covered and other native wildlife species.	CM3 will meet this objective as described in Section 6.4.3.4.3, *Pollinator Strategy*.
Cultivated Lands Seminatural Community	
NC-CL1: Cultivated lands that support habitat for covered and other native wildlife species.	
Objective NC-CL1.4: Maintain or enhance the foraging value of the cultivated lands natural community in the reserve system for raptors.	CM3 will meet this objective as described in Section 6.4.3.5.1, *Cultivated Lands Seminatural Community*.
Grassland Natural Community	
Goal NC-G1: Large, contiguous patches of grassland, and smaller patches within a mosaic of other natural community types, to sustain and enhance the distribution and abundance of associated covered and other native species in the Conservation Reserve Area.	
Objective NC-G1.2: Maintain and enhance the functions of protected grassland in the reserve system as habitat for covered and other native species by increasing burrow availability for burrow-dependent species, and increasing prey abundance and accessibility for grassland-foraging species.	CM3 will meet this objective as described in Section 6.4.3.5.2, *Grasslands Natural Community*.
Alkali Prairie Natural Community	
Goal NC-AS1: A reserve system that protects the habitat values of the remaining alkali prairie natural community in the Plan Area.	
Objective NC-AS1.2: Manage and enhance the functions of alkali prairie within the reserve system as habitat for covered and other native species by improving hydrologic conditions and reducing the adverse effects of nonnative	CM3 will meet this objective as described in Section 6.4.3.5.4, *Alkali Prairie Natural Community*.

Biological Goal or Objective	How CM3 Advances a Biological Objective
plants and human activities on habitat conditions.	
Fresh Emergent Wetland Natural Community	
Goal NC-FEW1: Functional fresh emergent wetland natural community that benefits covered species and promotes native biodiversity in the Plan Area.	
Objective NC-FEW1.3: Enhance the functions of protected fresh emergent wetland as habitat for covered and other native species.	CM3 will meet this objective as described in Section 6.4.3.5.5, *Fresh Emergent Wetland Natural Community*.
Swainson's Hawk	
Goal SH1: Provide for the conservation of Swainson's hawk in the Plan Area.	
Objective SH1.5: In addition to restoration of riparian natural community (Objective NC-VFR1.2), establish trees suitable for Swainson's hawk nesting (native trees at least 20 feet in height) within the cultivated lands reserve system to meet a density of at least 1 tree per 10 acres (protected existing trees count toward the density requirement). Riparian restoration adjacent to these community types will also count toward nesting tree establishment.).	CM3 will meet this objective as described in Section 6.4.3.6.1, *Swainsons' hawk and White-tailed Kite*.
Bank Swallow	
Goal BS1. Provide for the conservation of bank swallow in the Plan Area.	
Objective BS1.2: Manage the 50 acres of protected bank swallow habitat (Objective BS1.1) to enhance bank swallow foraging habitat value by promoting open grass and wildflower vegetation, and controlling invasive plant species.	CM3 will meet this objective as described in Section 6.4.3.6.2, *Bank Swallow*.

6.4.3.3 Reserve Management Plans

The JPA will prepare and implement management plans for protected natural communities and covered species habitats supported by those communities in the reserve system. Management plans may address specific protected parcels or multiple protected parcels within a specified geographic area of the reserve system. Management plans will provide the information necessary to guide habitat enhancement and management actions to achieve the biological objectives established for the conserved lands addressed by each plan. Within two years of acquisition of conserved parcels, the JPA will complete baseline ecological surveys to collect the information necessary to assess the level of ecological condition and function of conserved species habitats and supporting ecosystem processes, and the functional connectivity of conserved lands within and among habitats.[14] This will be added to the data collected during preacquisition surveys. Section 6.5, *Monitoring and Adaptive Management*, provides more detail on baseline surveys. Within one year of completing the assessment of ecological conditions and function, the JPA will prepare a management plan that identifies habitat enhancement actions to be implemented to enhance habitat functions for the target covered species and any subsequent ongoing management actions that are necessary to maintain natural community and covered species habitat functions over time. The collected information will also establish the base ecological conditions from which the effectiveness of enhancement and management measures can be evaluated through subsequent effectiveness

[14] Note that pre-acquisition biological surveys are required for all properties that are brought into the reserve system, but such surveys serve a different purpose (to determine suitability for acquisition) and are not necessarily of the same type or level of detail as baseline surveys.

monitoring and the adaptive management program (Section 6.5, *Monitoring and Adaptive Management*).

Management plans will include all the information specified in the management plan template provided in Appendix G, *Management Plan Template*. Based on the assessment of existing site conditions (e.g., soils, hydrology, vegetation, occurrence of covered species) and site constraints (e.g., size, infrastructure, adjacent land uses), and depending on biological objectives of the conserved lands, management plans will specify measures for enhancing and maintaining habitat as appropriate.

The JPA will periodically update management plans to incorporate changes in maintenance, management, and monitoring requirements based on new knowledge gained through the adaptive management program over the term of the Yolo HCP/NCCP.

6.4.3.4 Landscape Level Management and Enhancement

6.4.3.4.1 Invasive Species Control Program

The JPA will develop a plan for the control of invasive animal and plant species that could substantially degrade the functions of protected natural communities as habitat for covered and other native species in the reserve system.

Nonnative invasive plant species currently of highest concern in the Plan Area include giant reed, ravenna grass, tamarisk, Himalayan blackberry, eucalyptus, perennial pepperweed, Italian ryegrass, barbed goatgrass, medusahead grass, yellow starthistle, and parrot feather. These species dominate or are a significant component of some mapped patches of grassland, riparian and wetlands, and woodlands and forest natural communities and have the potential to spread to other sites in the Plan Area. Animal species that are known to degrade the habitat functions for covered species and are of highest concern in the Plan Area include feral domesticated animals (e.g., house cats), nonnative fish and amphibians (e.g., bullfrog), European starling, house sparrow, and brown-headed cowbird. These species either prey upon or compete for ecological resources that sustain covered and other native species.

The invasive species control program will identify protocols for evaluating known and identifying new occurrences of disruptive invasive species on reserve system lands. The program will identify protocols to assess and treat invasive species that are disruptive to ecosystems and habitat values for covered species. The JPA will coordinate development and implementation of the control program with governmental agency control programs and efforts of other conservation programs. Monitoring and control requirements for specific reserve system lands will be incorporated into the management plans (Section 6.4.3.3, *Reserve Management Plans*).

Elements of the invasive species control plan will include the following.

- Protocols for periodically surveying for and assessing the abundance of nonnative predators and competitors on reserve system lands.
- Protocols for periodically surveying for and assessing the occurrence and abundance of invasive nonnative plants on reserve system lands.
- A brown-headed cowbird monitoring and control program (see discussion below).

- Methods for assessing the degree of biological effect nonnative plant and animal species have on covered and other native species within the reserve system.
- Methods for assessing the threat of non-native plant and animal species from adjacent lands becoming established on reserve lands. threats for establishment of nonnative animals and plants from areas adjacent to reserve system lands onto reserve system lands.
- Methods for assessing the threat of spread of nonnative plants and animals from reserve system lands onto adjacent lands.
- A decision-making process for determining the need for implementing management actions to control nonnative species.
- A description of potential nonnative species control methods.
- A process for developing and implementing monitoring necessary to assess the effectiveness of implemented control methods.
- Develop a set of protocols and techniques for controlling and eliminating invasive species (hand removal, depredation, etc.).

Invasive Nonnative Plants. Specific elements of the control program for invasive plant species will include the following.

- Gathering and maintaining information regarding locations of large scale infestation by nonnative vegetation types, including giant reed, tamarisk, Himalayan blackberry, and eucalyptus woodlands within the Plan Area.
- Methods for assessing degree of biological effect of nonnative plant species on covered and other native species within the reserve system to set priorities for and guide control efforts. The evaluation process should consider potential benefits provided by nonnative communities to covered species, such as the use of Himalayan blackberry stands by the tricolored blackbird for breeding and the use of eucalyptus groves by Swainson's hawk and white-tailed kite for nesting.
- Methods for assessing threats for the spread of nonnative plants from reserve system lands to adjacent lands and vice versa.
- Methods for removing invasive plant species

Nonnative Aquatic Vertebrates. Several nonnative vertebrates, including various fish species, bullfrog, and turtles may compete with or prey upon covered species in aquatic habitats, including the California tiger salamander, western pond turtle, and giant garter snake,. Control of nonnative fish and aquatic amphibians and reptiles on reserve system lands includes measures to modify habitat conditions to encourage native aquatic species and discourage nonnatives, and to directly control invasive species populations (e.g., capture and removal, temporary dewatering of impoundments).

Brown-Headed Cowbird. The brown-headed cowbird poses a threat to the conservation of least Bell's vireo and other native riparian bird species. The brown-headed cowbird is a native North American species that has expanded its range into central California in response to the conversion of the landscape to livestock grazing and agriculture over the last 150 years. The cowbird is an obligate "brood parasite" that suppresses the productivity of host species by laying its eggs in the host species' nests and the cowbird young competing with or displacing the host bird's young. The

cowbird is a primary direct cause for the near elimination of the least Bell's vireo from the Central Valley (see Appendix A, *Covered Species Accounts*).

The cowbird is nearly ubiquitous in The Plan Area, while the least Bell's vireo is highly localized and not known to be regularly established as a breeding species in the Plan Area. Therefore, it is not necessary or practical to conduct large-scale control or population reduction of the cowbird. Rather, control efforts will apply only to the immediate vicinity of known least Bell's vireo nesting localities or as adaptive management experiments at removing cowbirds from areas to encourage establishment of least Bell's vireo nesting. Measures to control brown-headed cowbird include the following.

- Cowbird surveys, cowbird habitat suitability assessments, and covered species reproductive monitoring on Yolo HCP/NCCP reserve system lands that are occupied or become occupied by the least Bell's vireo to assess risks of parasitism to covered host species.
- Localized, seasonal, brown-headed cowbird control on reserve system lands occupied by the least Bell's vireo where cowbirds may pose a threat to reproduction, using methods approved by USFWS and CDFW.
- Modification of habitat conditions that may be encouraging cowbird use on reserve system lands occupied by least Bell's vireo.

6.4.3.4.2 Management and Enhancement of Connectivity

The JPA will identify and delineate areas among lands addressed under each management plan where connectivity among existing habitats is low, and where habitat enhancement and management actions would bolster the viability of existing habitat patches supporting a metapopulation of covered species. The JPA will include provisions on managing gaps and barriers between habitat patches in management plans and will design habitat enhancement methods that support connectivity at the landscape level.

Examples of actions to enhance gap permeability include growing of vegetation (e.g., selecting restoration and enhancement sites to increase connectivity) and ceasing or reducing mowing or other vegetation management practices to increase habitat permeability for a variety of terrestrial species. Where possible, surface roads on conservation lands will be minimally maintained and will be allowed to develop vegetated shoulders and center strips to reduce their fragmenting effect on small terrestrial species (e.g., rodents, amphibians, reptiles). Other measures, such as removal of fences and barriers, ceasing bank vegetation management, and allowing revegetation of denuded or altered areas also support connectivity between habitat patches.

6.4.3.4.3 Pollinator Strategy

The Implementing Entity will undertake the following types of actions to support implementation of the recommended conservation actions identified in the Pollinator Conservation Strategy (see Appendix J, *Pollinator Conservation Strategy*).

Communicate and Coordinate with Plan Area Agricultural Programs

The JPA will maintain ongoing communications with the Natural Resources Conservation Service (NRCS), Yolo County Farm Bureau, Yolo County Agriculture Department and local landowners to identify and develop opportunities and incentives for implementation of Pollinator Conservation Strategy conservation actions within the Plan Area.

Assist Plan Area Conservation and Agricultural Programs to Secure Funding

The JPA, where consistent with Yolo HCP/NCCP conservation objectives, will coordinate with the NRCS, local, state, and federal land managers, and other entities to secure grants and other funding for implementation of Pollinator Conservation Strategy conservation actions.

Assist with Public Outreach

The JPA will coordinate with local conservation and agricultural programs to develop and disseminate information regarding the importance of native insect pollinators to Plan Area ecosystems and economy. Technical information will be disseminated, describing conservation actions that can be implemented by landowners to improve native insect pollinator habitat conditions and sources of funding to assist with their implementation.

6.4.3.5 Natural Community Management and Enhancement

6.4.3.5.1 Cultivated Lands Seminatural Community

The JPA will manage protected HCP/NCCP cultivated lands to increase the habitat functions they support for covered and other native wildlife species that use cultivated lands. Depending on site-specific conditions, appropriate management actions on permanently protected cultivated lands may include the following.

- Cultivation of crop types that provide Swainson's hawk foraging habitat, inclusive of crop types of lesser foraging value that must be grown in rotation to maintain long-term viability for cultivation of the targeted crop types.
- Planting of cover strips and hedgerows to provide rodent habitat to increase prey abundance for covered species and other raptors.
- Planting native trees and shrubs to establish habitat for covered and other native wildlife species (e.g., Swainson's hawk nesting habitat, raptor hunting perches).
- Maintaining water in canals and ditches during the active period (early spring through mid-fall) for the giant garter snake, western pond turtle, and other native wildlife species.
- Modifying ditch configurations within rice growing areas to increase basking and nursery? habitat for the giant garter snake.

Agricultural conservation easement requirements related to allowable farming practices on Yolo HCP/NCCP agricultural lands are described in Section 7.5.5, *Conservation Easements.*

[**Note to reader**: We will likely be developing more quantification to these and other management and enhancement actions as we work through the costing process, for the next draft.]

6.4.3.5.2 Grasslands Natural Community

The JPA will manage the protected grassland natural community to maintain and enhance functions for valley elderberry longhorn beetle, California tiger salamander, western pond turtle, giant garter snake, white-tailed kite, Swainson's hawk, western burrowing owl, and tricolored blackbird. The JPA will also manage grassland to benefit native species diversity and general ecosystem function.

A key goal of management of grassland will be to increase the availability of fossorial rodents, especially ground squirrels, to provide prey for covered raptors and burrows for amphibians

(including California tiger salamander) and burrowing owls. Depending on site-specific conditions, appropriate management actions may include the following.

- Prohibiting rodent control activities on conservation lands, except where required for public safety or to protect key resource values or important infrastructure.
- Creating debris piles to provide habitat for small mammals and birds.
- Managing grazing to improve the abundance of fossorial mammals.

Other habitat enhancement and management actions to improve the functions of protected grassland land cover types as habitat for covered species, depending on site-specific conditions, could include the following actions.

- Managing grazing to achieve desired habitat conditions for targeted covered species.
- Use of fire, managed grazing, or other vegetation management techniques to influence vegetation structure or composition, or increase the absolute cover and diversity of native plant species and to control undesirable nonnative plant species.
- Installation of fencing, water sources, or other livestock management improvements to improve control of livestock in key habitat areas and effects of livestock grazing across the landscape.
- Installing artificial nesting burrows for western burrowing owl to facilitate use of unoccupied areas.
- Localized application of herbicides to remove heavy infestations of nonnative plants. Herbicide use is not a covered activity under the Yolo HCP/NCCP.
- Reseeding of native plant species.

6.4.3.5.3 Valley Foothill Riparian Natural Community

The JPA will manage protected riparian habitats to maintain and enhance this natural community and habitat functions for valley elderberry longhorn beetle, western pond turtle, Swainson's hawk, white-tailed kite, western yellow-billed cuckoo, and least Bell's vireo.

Depending on site-specific conditions, appropriate management actions for protected valley foothill riparian habitats may include the following.

- Managing livestock grazing to maintain favorable habitat conditions for covered species.
- Controlling nonnative predators and invasive plant species.
- Modifying vegetation management measures along canals and sloughs to encourage development of woody and herbaceous riparian vegetation that is compatible with water management programs.
- Planting native species to improve habitat structure and species composition.

The JPA will coordinate enhancement and management of Yolo HCP/NCCP protected valley foothill riparian natural community with existing riparian habitat management and restoration programs and plans, including:

- *Lower Putah Creek Watershed Management Action Plan* (EDAW 2005);

- *Willow Slough Watershed Integrated Resources Management Plan* (Jones & Stokes Associates, Inc. 1996);
- *Revised Final Cache Creek Resources Management Plan for Lower Cache Creek* (Yolo County Planning, Resources, and Public Works Department 2002);
- *Yolo County Oak Woodland Conservation and Enhancement Plan* (Yolo County Planning, Resources, and Public Works Department 2007); and
- *Capay Valley Conservation and Restoration Manual, 2nd edition* (Yolo County Resource Conservation District 2002).

The Permittees will also manage and enhance the riparian natural community outside the reserve system (i.e., lands not placed in conservation easements), consistent with the Cache Creek Resource Management Plan and the Lower Putah Creek Watershed Management Action Plan. These conservation actions are described in Section 6.4.3.7, *Management and Enhancement Outside the Reserve System.*

6.4.3.5.4 Alkali Prairie Natural Community

The JPA will coordinate with the Center for Natural Lands Management (CNLM) to enhance and restore the alkali prairie natural community on the Alkali Grasslands Preserve, which is held in conservation easement by CNLM. The JPA will also enhance and restore the alkali prairie natural community on the Woodland Regional Park (Figure 6-5, *Alkali Prairie Natural Community and Baseline Public and Easement Lands*). Enhancement and restoration activities will have the specific goal of improving or increasing available habitat for palmate-bracted bird's-beak. The expected outcome of habitat enhancement or restoration will be a larger area of habitat occupied by palmate-bracted bird's-beak and a consistent increase in the number of plants from year to year. The JPA will prepare one management and monitoring framework for both sites. The framework will guide enhancement activities for alkali prairie natural community. It will focus specifically on controlling Italian ryegrass and other invasive species, implementing measures to restore hydrological functions of alkali prairie habitat, and maintaining adjacent habitat for pollinators. The JPA will monitor the enhanced sites to assess the effectiveness of these actions toward improving and expanding habitat for palmate-bracted bird's beak.

[**note to readers:** prior to completion of the public review draft, we will be coordinating with CNLM to further develop this section. CNLM already has a management plan for their lands – we need to integrate their management plan and develop a cohesive monitoring and adaptive management strategy for these lands that is compatible with what CNLM is doing.]

6.4.3.5.5 Fresh Emergent Wetland Natural Community/Lacustrine and Riverine Natural Community

The fresh emergent wetland natural community and the lacustrine and riverine natural community are addressed together in this section, because these natural communities co-occur and their management and enhancement needs are similar. Fresh emergent wetlands and lacustrine (open water) areas such as ponds will be managed to maintain and enhance wetland function and hydrogeomorphic processes through site-specific management practices. Covered species using these natural communities include giant garter snake, tricolored blackbird, and western pond turtle. California tiger salamanders use ponds that are typically seasonal, and are not expected to co-occur

with giant garter snake, tricolored blackbird, and western pond turtle. Many of the management and enhancement needs, however, are similar.

Depending on site-specific conditions, management practices will include the following.

- Controlling nonnative plant species and restoring native plant species.
- Increasing relative cover of native vegetation.
- Managing livestock grazing to maintain favorable habitat conditions for covered species.
- Managing water sources supporting wetlands.
- Erosion control.
- Maintaining or enhancing adjacent upland habitats to support upland transitions.
- Maintaining sufficient water levels and water quality throughout the year to support emergent vegetation, aquatic food webs, and diverse aquatic habitat structure.
- Protecting upland basking and overwinter/hibernation sites, including rodent burrows.
- Planting emergent vegetation along pond margins to increase habitat functions for breeding California tiger salamander, western pond turtle, tricolored blackbird, giant garter snake, and tricolored blackbird.
- Maintaining and improving pond water control structures and water supplies.
- Controlling nonnative predators in ponds (e.g., bullfrog).
- Increasing or decreasing ponding (duration and frequency) to improve wetland functions and to control nonnative invasive species.

The JPA will manage giant garter snake habitat to provide water over the course of the giant garter snake's active season at suitable elevations and depths. Water levels will be managed to ensure that hibernacula burrows will not be flooded during winter. The JPA will adaptively manage drawdown of water levels during winter to ensure residual habitat for prey species. In addition, the JPA will monitor bullfrog abundance in restored and protected wetlands and control them if necessary to substantively improve juvenile giant garter snake survival rates by reducing the predation loss. Habitat restoration designs will incorporate upland habitat areas that support movement and aestivation habitat. The JPA will manage uplands near protected and restored emergent wetlands to provide small mammal burrows and soil crevices located above prevailing flood elevations throughout its winter dormancy period (USFWS 2006c). Adequate burrows are typically located in sunny exposures along south and west facing slopes.

Vegetation Management

Vegetation management is a critical component of optimizing the habitat function of ponds for covered species. Vegetation management will involve several techniques, often used in concert, to achieve the species composition and habitat structure necessary to benefit covered and other native species.

Some existing ponds or wetlands and all created ponds or restored wetlands will be planted with native vegetation appropriate for the surrounding natural communities for replacement of lost ecological services and function. Planting of emergent vegetation such as bulrushes or willows in ponds that lack vegetation can improve breeding habitat and cover for western pond turtle, giant garter snake, and

California tiger salamander in the deepwater portions (i.e., greater than 1 meter deep). Further, tall emergent vegetation, such as bulrushes, can provide roost and nest sites for tricolored blackbirds where the ponds are located near foraging habitat. Ponds with adjacent grasslands will benefit from selective seeding of native forbs or grasses in the uplands surrounding the pond fringe.

Vegetation may have to be removed from ponds where little open water remains to improve conditions for western pond turtle or giant garter snake. Vegetation removal can be accomplished through grazing , selective herbicide application using label-approved application techniques and in calm winds, or mechanical means. Where feasible, prescribed burns will be used to control nonnative vegetation around ponds and wetlands and within pond or wetland complexes. Mechanical removal of vegetation would occur after the breeding season for wetland- and pond-dependent wildlife, including nesting migratory birds, to minimize impacts. In cases where covered species are dependent on nonnative vegetation (e.g., tricolored blackbirds nesting in Himalayan blackberry) the removal of nonnative vegetation will be undertaken in phases over a three to four-year period and replaced with the appropriate native vegetation.

Overgrazing by cattle can cause trampling of vegetation, soil compaction, development of "cow contours," and bank destabilization. Fencing ponds and wetlands has been shown to be a rapid, successful, and cost-effective method of enhancing some wetlands. After fencing, vegetation cover and wetland species diversity can increase substantially in stock ponds and other permanent or near-permanent freshwater wetlands that have been degraded by cattle grazing (Contra Costa Water District 2002). In this HCP/NCCP, fencing locations and specifications will depend on several factors, including site-specific conditions and the biological objectives the actions are addressing. Fencing wetlands may not be appropriate in locations where retaining open water for species such as western pond turtle and California tiger salamander is an objective. In such cases, fencing half of a pond or wetland (split fencing) may accommodate the needs of multiple covered species (U.S. Fish and Wildlife Service 2002).

Livestock grazing will be introduced or continued at some wetlands and ponds to eliminate or reduce cover of exotic plants and to maintain ponds by preventing excessive plant growth when such a technique is consistent with maintaining values for covered species. Grazing rotation and fencing can also reduce the erosive impacts described above. Ford et al. (2012) provide details about pond habitat quality for the California tiger salamander. The period of a pond's inundation is critical to habitat value as well as the livestock operation that is associated with the pond's establishment and maintenance. Ponds that draw down in the late spring or early summer can become unsuitable for livestock use due to lack of water and dangerous muddy banks.

To support successful reproduction for the California tiger salamander, its aquatic habitat must remain inundated long enough to support successful metamorphosis, which is typically December through May (U.S. Fish and Wildlife Service 2010). The California tiger salamander typically use ponds free of emergent vegetation. Aquatic vegetation can be compatible, especially submerged vegetation, but salamander breeding appears to be rare with moderate levels of emergent vegetation. Allowing limited livestock access to a pond will help maintain its usefulness as habitat for covered species by preventing excessive plant growth that can lead to rapid sedimentation of ponds (U.S. Fish and Wildlife Service 2002). Seasonally limited grazing can be effective at reducing competition for nonnative plant species in seasonal wetlands (Marty 2005).

Water and Other Management

It is assumed that many ponds in the Plan Area are in disrepair. Repairs could be made to improve water retention in ponds created as stock ponds that are not retaining water due to leaks and, as a result, not functioning properly as habitat for covered species. Additionally, pond capacity and water duration can be increased (e.g., by raising spillway elevations) to support covered species populations.

To retain the habitat quality of ponds and wetlands over time, occasional sediment removal may be needed to address the buildup of sediment that results from adjacent land use or upstream factors. Dredging will be conducted during the non-breeding periods of covered and other native species.

The JPA will also work with private landowners who own key ponds to secure funding to improve and maintain their ponds and wetlands as habitat for covered species (e.g., tricolored blackbird, California tiger salamander, giant garter snake, or western pond turtle). The JPA will help landowners apply for existing grants to enhance ponds and freshwater emergent wetlands on their land (e.g., North American Wetlands Conservation Act Small Grants Program [USFWS], or Environmental Quality Incentives Program of the Farm Bill [USDA Natural Resources Conservation Service]). The JPA will work closely with existing organizations that have strong relationships with private landowners such as the Natural Resources Conservation Service, the local Resource Conservation District, and the California Cattlemen's Association. A program could be developed in the Plan Area modeled after the successful Alameda County Conservation Partnership in Alameda County. This program provides technical assistance, funding, and permit streamlining to private landowners wishing to maintain and enhance stock ponds to benefit endangered species.

Coarse woody debris or anchored basking platforms will be installed in ponds to improve habitat for western pond turtles (Hays et al. 1999). This modification will increase the habitat value in locations with existing western pond turtles. These structures may also enhance habitat for native amphibian species.

Nonnative Wildlife Management

The JPA will work to reduce and, where possible, eradicate nonnative exotic species that adversely affect native pond and wetland species. These efforts will include prescribed methods for removal of bullfrogs, mosquitofish, and nonnative predatory fish from stock ponds and wetlands within the reserve system.

6.4.3.6 Covered Species Level Management and Enhancement

Almost all of the management and enhancement actions that benefit covered species are provided through actions described in Section 6.4.3.4, *Landscape-level Management and Enhancement,* at the landscape level and Section 6.4.3.5, *Natural Community-level Management and Enhancement,* at the natural community level. This section describes species-specific management and enhancement needs that are not provided in the proceeding sections.

6.4.3.6.1 Swainson's Hawk and White-tailed Kite

Planting of Nest Trees

The JPA will establish trees suitable for Swainson's hawk nesting (native trees at least 20 feet in height) within the cultivated lands reserve system to meet a density of at least 1 tree per 10 acres

(protected existing trees count toward the density requirement). To implement this conservation measure, the JPA will undertake the following actions.

- Evaluate existing information and conduct surveys if needed to identify specific locations where sufficient Swainson's hawk foraging habitat is available to support nesting, nest trees are lacking, and soil and hydrologic conditions are suitable for the establishment of nest trees.
- Prepare and protect nest tree establishment sites (e.g., clearing of existing vegetation, placement of herbivory protection fencing or other structures, installation of irrigation system).
- Plant seedlings/saplings of nest tree species on suitable reserve system lands. Conduct weed control, irrigation, and fence repair as needed until nest trees are established.
- Monitor tree condition, growth, and use by Swainson's hawk and other native raptors.

During HCP/NCCP implementation, the monitoring and adaptive management program will determine if newly established trees are utilized. Based on that information, improvements may be made in locating and establishing new nest tree sites.

6.4.3.6.2 Bank Swallow

The JPA will manage bank swallow foraging habitat in the reserve system, within the Cache Creek floodplain, to promote open grass and wildflower vegetation within the floodplain. The JPA will apply the best available scientific and technical information to protocols that stimulate new native plant growth and reduce invasive plant species in the floodplain, to promote insect populations that can serve as prey for bank swallows.

6.4.3.7 Management and Enhancement Outside the Reserve System

6.4.3.7.1 Cache Creek Resources Management Plan

The County of Yolo adopted the Cache Creek Resources Management Plan in 1996 and amended it in 2002. This plan eliminated in-channel commercial mining (i.e., mining inside of the Cache Creek channel) and established a program for implementing ongoing projects to improve channel stability and restore riparian habitat along Cache Creek. The Cache Creek Resources Management Plan provides a policy framework for restoration of 14.5 miles of lower Cache Creek and includes specific implementation standards. The Cache Creek Improvement Program (CCIP), the implementation plan for the Cache Creek Resources Management Plan, identifies specific categories of projects that include: bank stabilization, channel maintenance, revegetation, and habitat restoration. The CCIP provides the structure for the program and authority for a Technical Advisory Committee (TAC), the committee that defines the procedures and methodologies for stream monitoring and maintenance activities.

The Cache Creek Resources Management Plan includes site specific recommendations for various reaches along Cache Creek to remove invasive plant species and allow development of native vegetation, restore old existing in-channel mining pits, remove levees to allow natural channel processes, and encourage the use of riparian vegetation or other *soft engineering* for bank stabilization purposes. The plan calls for coordination with the Yolo County Flood Control and Water Conservation District, CDFW, USFWS, the U.S. Army Corps of Engineers, and all other appropriate agencies and organizations to ensure that habitat restoration projects proposed by these and other entities are consistent with the plan.

The Cache Creek Resources Management Plan recommends the establishment of a series of wildlife preserves to provide core areas for maximizing fish and wildlife habitat. It states that wildlife preserves should emphasize the preservation of high quality existing habitat, areas with high species diversity, areas supporting unique species or biotic communities, and habitat for rare, threatened, and endangered species.

The Cache Creek Resources Management Plan seeks to restore riparian vegetation throughout the Cache Creek Resources Management Plan plan area (Figure 6-4, *Ecological Corridors*) to create a continuous riparian and public open space corridor along the creek. This is consistent with Objective L-1.4 for Cache Creek. The Yolo HCP/NCCP incorporates the Cache Creek Resources Management Plan restoration and enhancement actions into its conservation strategy to help meet Objective L-1.4 and to benefit the valley foothill riparian natural community and covered species found in it including western yellow-billed cuckoo, least Bell's vireo, bank swallow, and valley elderberry longhorn beetle. The Yolo HCP/NCCP monitoring and adaptive management program will include monitoring to assess Cache Creek Resources Management Plan progress toward meeting Yolo HCP/NCCP biological goals and objectives and benefitting the covered species.

6.4.3.7.2 Lower Putah Creek

The Lower Putah Creek Coordinating Committee (LPCCC) was created through a settlement to resolve a civil action brought by the Putah Creek Council, a nonprofit environmental organization, against Solano County Water Agency (SCWA) and the Solano Irrigation District. The LPCCC is composed of representatives of the Putah Creek Council, several water districts including the SCWA, several cities including the City of Davis, and the campus of the University of California, Davis. The settlement requires annual expenditures by the SCWA for specified activities to protect and enhance the instream values associated with lower Putah Creek, including funding a Streamkeeper position. The LPCCC has a number of duties including the monitoring of conditions in lower Putah Creek, undertaking restoration, enhancement, and maintenance measures, seeking grant funds, and overseeing the Streamkeeper.

The LPCCC undertakes the following activities funded by SWCA on an annual basis:

- Native vegetation preservation and enhancement, including the identification of areas along the lower Putah Creek dominated by non-native species, and their removal and replacement with native trees and grasses. This work is coordinated with efforts by other individuals and entities involved in similar removal and replacement efforts.
- Monitoring of wildlife, including birds, mammals, reptiles and amphibians living in and around lower Putah Creek.
- Monitoring of native fish in lower Putah Creek.

These activities are consistent with Objective L-1.3 to create a continuous riparian corridor along Putah Creek. They are also consistent with the broad Yolo HCP/NCCP goals of protecting native species diversity, and more specific goals of conserving covered species in the Plan Area. The Yolo HCP/NCCP incorporates the Lower Putah Creek program into its conservation strategy to help meet Objective L-1.5 and to benefit the valley foothill riparian natural community and covered species found in it including western yellow-billed cuckoo, least Bell's vireo, bank swallow, Swainson's Hawk, White-tailed Kite, and valley elderberry longhorn beetle. The Yolo HCP/NCCP monitoring and adaptive management program will include monitoring to assess the program's progress toward meeting Yolo HCP/NCCP biological goals and objectives and benefitting the covered species.

6.5 Monitoring and Adaptive Management

6.5.1 Introduction

This chapter describes the monitoring and adaptive management program for the Yolo HCP/NCCP. This program will:

- ensure compliance with the Yolo HCP/NCCP requirements; assess the status of covered and other native species, natural communities, and ecosystem processes within the reserve system[15] and in certain cases outside of the reserve system; and
- measure the effectiveness of the conservation strategy in achieving the biological goals and objectives (Table 6-3, Biological Goals and Objectives and Applicable Conservation Measures).[16]

The JPA[17] will integrate adaptive management and monitoring into one cohesive program where monitoring will inform and change management actions to continually improve outcomes for covered and natural communities. An overview of the program, monitoring and management actions, and data and reporting requirements are described below.

6.5.1.1 Regulatory Context

By regulation, an HCP must incorporate monitoring of conservation measures and the response of covered species to these measures (50 CFR 17.22[b][1][iii] and 50 CFR 222.22[b][5][iii]). An adaptive management strategy is a recommended component of HCPs with data gaps that would substantively affect how the species is managed and monitored in the future (65 FR 35251). The United States Fish and Wildlife Service (USFWS) Five-Point Policy (65 FR 35241–35257) describes adaptive management as an integrated method for addressing uncertainty in natural resource management and states that management must be linked to measurable biological goals and monitoring. To that end, Tables 6.4, *Biological Goals and Objectives Associated with Conservation Measure 1,* 6.6, *Biological Goals and Objectives Associated with Conservation Measure 2,* and 6.8, *Biological Goals and Objectives Associated with Conservation Measure 3*, integrate biological goals and objectives, conservation actions, and monitoring actions to ensure the program evaluates the conservation measures and assesses the implementation of the biological goals and objectives.

An NCCP must include both a monitoring program and an adaptive management program (California Fish and Game Code Section 2820[7] and [8]). An NCCP also must integrate adaptive management strategies that are periodically reviewed and modified on the basis of the results of

[15] In general conservation actions and monitoring take place within the reserve system (i.e., lands acquired, managed, and monitored by the JPA to benefit covered species under this Plan). Monitoring for Swainson's hawk, burrowing owl, and tricolored blackbird will extend beyond the reserve system boundaries. Monitoring outside of the reserve system will still occur within the Plan Area.

[16] The biological goals and objectives conform to the guidance provided by the Five Point Policy as much as feasible, given the scope of the conservation strategy and the fact that the reserve lands have not yet been acquired. In some cases, the narrative text of the conservation strategy provides details on the indicator, location, timeframe, etc.. In other cases, the JPA will develop these details during early implementation because on-the-ground information can better inform specific management actions for specific parcels. The JPA will integrate these details into the reserve management plans.

[17] Throughout Section 5.5, *JPA* refers to the JPA or its contractors.

monitoring efforts and other sources of new information (California Fish and Game Code Section 2820[a][2]).

The monitoring and adaptive management program described in this chapter is intended to fulfill HCP and NCCP requirements to monitor covered species, natural communities, and species response to management activities. This program will continually incorporate recommendations for monitoring and adaptive management based on the most recent guidelines for regional HCPs and NCCPs provided by the USGS Biological Resources Division, CDFW, and USFWS (Atkinson et al. 2004). This program is also consistent with 2009 guidelines for federal agencies on adaptive management (see http://www.doi.gov/initiatives/AdaptiveManagement/documents.html).

6.5.1.2 Adaptive Management

Adaptive management is a decision-making process promoting flexible management such that actions can be adjusted as uncertainties become better understood or as conditions change (Figure 6-6, *Adaptive Management Process*). Monitoring the outcomes of management is the foundation of an adaptive approach, and thoughtful monitoring can both advance scientific understanding and modify management actions iteratively (Williams et al. 2007).

Adaptive management is necessary because of the degree of uncertainty and natural variability associated with ecosystems and their responses to management. Based on the best scientific information currently available, it is expected the Yolo HCP/NCCP's conservation actions will effectively achieve the biological goals and objectives described in Section 6.3, *Biological Goals and Objectives*. However, there are varying degrees of uncertainty associated with the management techniques and conditions within and outside the Plan Area. In addition, the status of covered species and natural communities may change in unexpected ways during HCP/NCCP implementation. It is possible that additional and different management measures will be identified in the future and more effectively implement the conservation strategy than those currently implemented. Results of monitoring may also indicate some management measures are less effective than anticipated. To address these uncertainties, the JPA will use an adaptive approach to inform management and design the monitoring program to support this adaptive approach.

The cornerstone of the monitoring and adaptive management program is an experimental approach in which monitoring will yield scientifically valid results that inform management decisions (Figure 6-6, *Adaptive Management Process*). The JPA will use information collected through monitoring and other experiments to manage reserve lands and protect covered and other native species habitat and natural communities. The JPA will also coordinate and share the results of monitoring and targeted studies, as appropriate, with other regional restoration and management programs and among the other Permittees and the wildlife agencies. A well-coordinated and scalable monitoring program will enable the JPA the wildlife agencies and others to measure and evaluate change in resources and threats within individual reserves, across the entire Plan Area. Such coordination requires standardization of protocols, sampling design, and training of personnel, as well as integrative data analysis.

Another important component of the adaptive management process is outside review by scientists. Science and technical advisors will evaluate the effectiveness of existing or proposed management actions (Section 6.5.6.2, *Science and Technical Advisors*). The JPA will incorporate recommendations provided by these reviews, where appropriate, and agreed to by the wildlife agencies into Yolo HCP/NCCP implementation.

Integrating adaptive management and monitoring is critical to the successful implementation of the conservation strategy. Monitoring is the foundation of an adaptive approach, and adaptive management actions are developed, in part, from the results of monitoring. In the Yolo HCP/NCCP, the two components are integrated into a single program.

The monitoring and adaptive management program will inform reserve managers and other decision makers of the status of covered and natural communities, and essential ecological processes such that management actions can be revised when necessary to meet the biological goals and objectives of the HCP/NCCP. The JPA will evaluate effectiveness of conservation efforts following the model outlined in Figure 6-7, *Flowchart of the Adaptive Management Process*. This figure illustrates how the JPA will develop indicators and success criteria and how the JPA will use monitoring to ensure the effectiveness of the Plan. The use of conceptual ecological models will also guide monitoring and adaptive management. Conceptual models will help frame questions for monitoring, and results will help guide future management and monitoring efforts while simultaneously informing updates to the models (Figure 6-8, *Adaptive Management Feedback Loop*). Figure 6-9, *Example Stress-Response Model 1* and 6-10, *Example Stress-Response Model 2,* provide examples of this from other conservation plans. Using monitoring to provide information for adaptive management actions will require a framework for measuring responses (Figure 6-11, *Continuum of Experimental Management*). In its simplest form, monitoring that happens immediately after management actions occur will inform future efforts. As Figure 6-11 illustrates, however, the JPA must develop management actions in concert with monitoring objectives such that increased certainty regarding the significance of the results can be obtained. Pilot projects will be carried out (Section 6.5.4.3, *Targeted Studies*), whereby management actions will be treated as experiments, and monitoring will be used to evaluate each action. This will allow management to proceed without complete knowledge of the needs of the species or ecological processes. All of these components are described more fully in the following sections.

In summary, adaptive management is the land manager's response to new information. Adaptive management actions will likely take place at the following junctures:

- In response to the results of targeted studies including pilot projects,
- In response to downward trends in the status of covered species or key natural-community variables,
- When new information from the literature or other relevant research indicates that a feasible and superior alternative method for achieving the biological goals and objectives exists,
- When monitoring indicates that the expected or desired result of a management action did not take place, and
- Proactively, when the JPA identifies threats through the ongoing development of conceptual models or through other monitoring efforts in the Plan Area.

Most adaptive management measures will occur when conservation actions do not produce the desired outcome or when covered species /natural-community trends decrease. In these cases, the JPA will implement new actions to try and improve the outcome for species and communities. Such actions include, but are not limited to, the following:

- Alter the timing, location, intensity or type of grazing;
- Reduce, increase or otherwise change the pattern of prescribed burning;

- Re-evaluate and, if necessary, alter avoidance and minimization measures;
- Modify age, timing, location, or type of seedling transplantation for natural-community restoration;
- Prioritize or de-emphasize one aspect of noxious weed control such as targeted pesticide use;
- Increase, decrease or desist species-specific conservation actions such as translocation of individuals based on experimental results.

The JPA can modify the conservation actions in response to new information following the principles of adaptive management.

6.5.2 Program Objectives

The overarching objective of the monitoring and adaptive management program is to ensure that the HCP/NCCP is achieving the biological goals and objectives (Table 6-3, *Biological Goals and Objectives and Applicable Conservation Measures*). This chapter presents a foundation for accomplishing this task. The JPA will submit the reserve management plans, which will include monitoring and adaptive management components, to the wildlife agencies for review and approval within 5 years of the acquisition of the first parcel of each reserve management unit. During these first 5 years the JPA will develop an interim management plan for management of these lands. These interim plans will have basic management objectives to provide necessary management for covered species and the natural community. Additional objectives of the monitoring and adaptive management program are listed below.

- Provide an organizational framework and decision-making process for evaluating monitoring, targeted studies, and other data to adjust management actions.
- Document the baseline condition of biological resources in the reserve system and other key habitat outside of the reserve system using existing data, modeling, and the results of ongoing field surveys.
- Develop conceptual models for natural communities and covered species, if applicable, that the JPA can use as a basis for collecting information, verifying hypotheses, and designing and changing management practices.
- Incorporate hypothesis testing and experimental management, including targeted studies to address key uncertainties and to improve management and monitoring efforts.
- Develop and implement scientifically valid monitoring protocols at multiple levels to ensure that data collected will inform management and integrate with other monitoring efforts.
- Ensure that monitoring data are collected, analyzed, stored, and organized so the data are accessible to the JPA and other Permittees, the wildlife agencies, scientists and, as appropriate, the public.

6.5.2.1 Program Scope

This chapter provides a framework, guidelines, and specific recommendations to help the JPA develop a detailed monitoring component for their reserve management plans. Upon permit approval, the JPA will compile information from ongoing monitoring efforts conducted by the Permittees and others throughout the Plan Area.

The JPA will develop conceptual models for covered species and initiate baseline surveys for newly acquired parcels. If restoration actions are proposed before the reserve management plan is in place, a design plan, including experimental design, monitoring actions and adaptive management, will be developed specific to that action. Table 6-10, *Biological Goals and Objectives Associated with Conservation Measure 3*, provides a summary of monitoring tasks throughout the HCP/NCCP permit and beyond. Detailed information of monitoring tasks by program phase is found in Section 6.5.5, *Program Phases*.

It is beyond the scope of this HCP/NCCP to develop a comprehensive monitoring program at this time. Rather, the goal of Section 6.5, *Monitoring and Adaptive Management,* is to provide sufficient guidance to ensure the monitoring program designed during implementation will meet regulatory standards. Since the location and condition of the reserve system, as well as all target areas for monitoring outside the reserve system are not known at this time, it would be difficult or impossible to develop detailed monitoring requirements including protocols, thresholds, triggers, and other key variables. Furthermore, some of the components of this monitoring program will be new and will therefore require extensive field testing (see Section 6.5.5.2 *Targeted Studies*, below) before the JPA can implement them on a large scale.

The scope of the monitoring and adaptive management program is limited by the assurances provided by the wildlife agencies to the Permittees and described in Chapter 7, *Plan Implementation*. These assurances include the commitment by the wildlife agencies that if unforeseen circumstances arise (as defined in Chapter 7), the Permittees will not be required to provide additional land, water, or financial compensation beyond the obligations of the HCP/NCCP.

Despite the assurances provided by the wildlife agencies, the monitoring program is designed to be somewhat flexible. Since the HCP/NCCP seeks to balance the requirements of management with the need to learn more about the ecological system through monitoring, the amount of funding allocated to monitoring can vary during the permit term. The JPA can shift funding within the HCP/NCCP to respond to the changing needs of the monitoring and adaptive management program at its discretion and with approval from the wildlife agencies. The scope of the monitoring and adaptive management program is further defined below.

6.5.2.2 Geography

The JPA will determine the geographic scope of the monitoring and adaptive management program by the lands acquired and/or managed for the reserve system and other lands managed and enhanced for the conservation benefit of covered species as described in Section 6.4, *Conservation Measures*. Since the JPA will assemble the reserve system over the course of the permit term, the exact configuration of the reserve system is unknown. The general location of acquisition priorities, however, has been defined as the Conservation Reserve Area (Figure 6-1, *Yolo HCP/NCCP Planning Units and Conservation Reserve Area*). As the reserve system grows, the monitoring program will also grow. Monitoring of streams and select covered species[18] will occur within and outside the geographic border of the reserve system. The JPA will consider the regional context of species and natural communities when designing and implementing monitoring and adaptive management.

[18] Burrowing owl and tricolored blackbird. See species-specific monitoring discussion later in this chapter.

6.5.2.3 Levels of Monitoring

Since the conservation strategy functions at multiple levels, the monitoring and adaptive management program must collect information at these multiple levels. The program described in this chapter details the framework for a three-tiered approach that consists of landscape-, natural community-, and species-level monitoring.

Landscape-level monitoring is designed to detect large-scale changes, such as changes in ecosystem processes, shifts in natural community distribution, and the integrity of landscape linkages. Community-level monitoring is designed to detect changes in the composition and function of natural communities, populations of key predator or prey populations, invasive species, and other important habitat factors for covered species. Species-level monitoring measures the effects of management actions on covered species and tracks the abundance, distribution, and other variables of covered species in the reserve system and the Plan Area.

6.5.2.4 Coordination with Other Programs

Monitoring already occurs throughout the Plan Area to varying degrees on public and private lands. Long-term monitoring and scientific experiments are conducted at several sites, for example, including locations along Cache Creek and Putah Creek. The HCP/NCCP's monitoring program will utilize these existing programs where appropriate. During the inventory phase, the JPA will consult with the proponents of these monitoring programs to learn the latest protocols and determine what aspects of their monitoring overlap with the Plan's requirements. There may also be opportunities to conduct joint monitoring efforts to meet the needs of both projects.

The JPA will also coordinate and share monitoring and other experimental results with other regional restoration and management programs. A well-coordinated and scalable monitoring program design will enable the JPA and others to measure and evaluate change in resources and threats in individual reserves, across the entire Plan area, and within the covered species range. Such coordination requires standardization of protocols, sampling design, and training of personnel, as well as integrative data analyses

6.5.2.5 Take Authorization during Monitoring

Some monitoring activities may require handling or disturbing state or federally listed species; such activities may constitute take. The monitoring method is optimal when both the quality of information and the effect on the species is assessed. The monitoring program will consider the effect on the species, particularly in cases of very low population numbers. Take of covered species during monitoring activities is authorized providing that all of the following conditions are met.

- The take occurs in association with activities described in Section 6.5 of this HCP/NCCP, or a reserve management plan approved by the wildlife agencies.
- The take occurs in the Plan Area, during the permit term, for activities conducted by the Permittees, the JPA, or any person acting under the direct guidance or authority of these entities.
- The person(s) undertaking such activities is qualified and can carry out their duties in conformance with the protocols and procedures specified in the monitoring chapter and the reserve management plan (Section 4.3.6.1, *Qualified Biologists*).
- The activity is consistent with the HCP/NCCP's monitoring and adaptive management program.

To meet federal and state requirements, monitors will report the amount and extent of take in accordance with the Permits. Monitors will report occurrences of all special status species within the reserve system to the California Natural Diversity Database (CNDDB).

6.5.3 Types of Monitoring

In addition to the levels of scale (i.e., landscape, community, and species), three main types of monitoring are specified: compliance monitoring, effectiveness monitoring, and targeted studies. A description of each of these types is provided below.

6.5.3.1 Compliance Monitoring

Compliance monitoring tracks the status of HCP/NCCP implementation and documents that the HCP/NCCP is meeting all its requirements. Compliance monitoring verifies the Permittees are carrying out the terms of the HCP/NCCP, permits, and Implementation Agreement (IA). It is also known as implementation monitoring. The JPA will track and ensure compliance monitoring internally and provide results to the wildlife agencies who will ensure that the Permittees remain in compliance with the permits, IA, and HCP/NCCP. As defined by the Yolo HCP/NCCP, compliance monitoring will be composed of the components listed below, based on templates developed for the Santa Clara HCP/NCCP.

- Tracking loss of natural communities and covered species to ensure take limits are not exceeded and to ensure compliance with the stay-ahead requirements described in Chapter 7, *Plan Implementation*.
- Tracking implementation of acquisition, restoration, and creation actions (Section 7.5.3, Stay-Ahead Provision, and Table 7-2, *Key Deadlines for HCP/NCCP Compliance*).
- Tracking implementation of other conservation actions on and off the reserve system.
- Tracking implementation of avoidance and minimization requirements (Chapter 4, *Application Process and Conditions on Covered Activities*).
- Tracking and reporting of management and monitoring activities.

6.5.3.2 Effectiveness Monitoring

Effectiveness monitoring assesses the biological success of this HCP/NCCP—specifically, it evaluates the implementation and success of the conservation strategy described in this chapter. Effectiveness monitoring includes monitoring the effects of management activities. An important component of this monitoring is determining patterns within the reserve system relative to the baseline status and trends of biological resources. The JPA will design, conduct and report on the results of effectiveness monitoring. Wildlife agencies will have approval on the proposed effectiveness monitoring and the Science and Technical Advisory Committee will have an opportunity to provide input on any proposed effectiveness monitoring and its results (Section 6.5.5, *Program Implementation*). Effectiveness monitoring includes both status and trends monitoring and effects monitoring, which are described below.

6.5.3.2.1 Status and Trends

The JPA will monitor indicators of the status and trends of covered species and natural communities to provide data regarding the increase or decrease of these resources in the Plan Area. The JPA will

first collect baseline data to provide a temporal snapshot of the status of these resources at the first year of monitoring: this is a metric against which to compare future data. Status and trends monitoring will include quantitative data on covered species (population size, distribution), land cover, and modeled habitat as well as nonnative invasive species and other known threats. Additionally, historical data on population size or distribution can be relevant to understanding the current condition. For species or natural communities that go through natural fluctuations or variations, historical trends are more important than single year surveys. Qualitative assessments of vegetative structure and/or habitat quality will also be a component of status and trends monitoring. Examples of status and trends monitoring include quantitative data on covered species numbers, acres of land cover types in the Plan Area, occurrences of invasive plant populations, and incidences of natural disturbance (e.g., fire, flood).

6.5.3.2.2 Effects of Management

Understanding the effects of management actions is a critical component of the monitoring and adaptive management program. The purpose of effects monitoring is to ascertain the success of management in achieving desired outcomes, to provide information and mechanisms for altering management if necessary, and to evaluate whether the conservation strategy described in Chapter 6 was successful.

The preliminary or initial component of effects monitoring will include the development and assessment of success criteria for management actions such as riparian restoration, pond creation, and agricultural lands improvement for covered species. Where they exist, the biological goals and objectives will determine the form that success criteria take. Once success criteria are developed, effects monitoring will include monitoring these criteria as well as assessing the effects of management on covered species. Finally, the effects of threat-abatement activities (e.g., density of nonnative invasive plants) will be evaluated to determine the effects of management. Management actions will be conducted using an experimental approach when feasible (Figure 6-11, *Continuum of Experimental Management*).

6.5.3.3 Targeted Studies

Targeted studies fulfill three major objectives:

1. Identify the best methodologies for monitoring;
2. Provide information about the efficacy of management techniques; and
3. Resolve critical uncertainties allowing for improved management of systems and covered species.

For the purposes of the Yolo HCP/NCCP, targeted studies that provide information regarding monitoring protocols are called *methods testing*. Targeted studies that test the efficacy of experimental management actions are called *pilot projects*. Targeted studies that address critical uncertainties are called *directed studies*. The JPA or its contractors will conduct methods testing. The JPA should carry out or fund directed studies, but the JPA may also utilize graduate students, university researchers, or other scientists whose project goals inform critical uncertainties and further the biological goals and objectives of the HCP/NCCP. In addition, directed studies may be funded by outside sources if the work carried out on reserve system lands furthers the JPA's understanding of covered species and natural communities.

6.5.3.3.1 Method Testing

Method testing is designed to evaluate alternative monitoring protocols and sampling designs and to select the best technique for obtaining the desired information. For example, if the objective is to enhance the palmate-bracted bird's beak population, methods testing might compare the use of different vegetation sampling techniques. The results of method testing would then be used to develop a long-term monitoring protocol.

6.5.3.3.2 Pilot Projects

Pilot projects will be used during implementation to ascertain, on a small scale, which management actions may ultimately yield the desired conservation gains prior to initiating a long-term project. Pilot projects are also a cost-effective way to test management actions. Pilot projects can and should be used during the early phases of HCP/NCCP implementation to field test different management actions (see Figure 6-11 for a continuum of experimental management).

6.5.3.3.3 Directed Studies

Critical uncertainties are key questions relating to an ecological system and how that system might be managed to better function for covered species. Since natural systems are complex and dynamic, varying degrees of uncertainty are associated with conserving and managing these systems. Typically, management proceeds absent a full understanding of the components that affect a natural community or a species. The outcome of these management actions are carefully monitored and refined in acknowledgement of the high level of uncertainty. Directed studies are used to reduce the levels of uncertainty related to achieving biological goals and objectives. These uncertainties are generally related to the factors listed below:

- The ecological requirements of covered species, and
- The likely response of covered species and natural communities to implementation of conservation actions within the reserve system.

The JPA may propose additional directed studies not identified as conservation actions. Directed studies will be carried out to gain insights into key questions identified in the conservation strategy and during HCP/NCCP implementation. The JPA will prioritize proposed directed studies during implementation, and carry them out based on their priority ranking.

Results of directed studies conducted under the HCP/NCCP will inform management and ensure attainment of the biological goals and objectives. It is expected that the JPA or consulting scientists will conduct some or all of the directed studies specifically outlined in the conservation strategy. Additional long-term directed studies, identified during HCP/NCCPP implementation, will be conducted by or in partnership with outside scientists from academic institutions, consulting firms, and nonprofit organizations. It is anticipated that funding provided by the JPA for directed studies could be matched or supplemented by other entities to increase the level of investigation and to achieve results that integrate with broader issues in the scientific community. In addition to the directed studies undertaken to answer critical uncertainties, it is expected that the JPA will develop partnerships with academic institutions (e.g., undergraduate student projects, Masters theses, Ph.D. disertations) to help address broader scientific interests within the reserve system that will nonetheless inform and improve management and monitoring techniques. Funding for this and other programs is described in more detail in Chapter 8, *Costs and Funding*.

6.5.4 Program Phases

The HCP/NCCP organizes essential elements of the monitoring and adaptive management program into three main phases: inventory, targeted studies, and long-term monitoring and adaptive management.

Key tasks in each phase are described below. In general, activities in the inventory phase will occur during the first 5 years of HCP/NCCP implementation and thereafter as parcels are added to the reserve system. For individual sites, the inventory phase will begin immediately after land acquisition. Most targeted studies will be concentrated in the first five years of HCP/NCCP implementation, but they will likely continue throughout implementation as the JPA identifies and resolves management uncertainties. Activities in the long-term monitoring phase will begin on each site after the inventory phase is complete. Since the JPA will create the reserve over several decades, there will likely be extensive overlap between activities in each phase during the first 10–20 years of HCP/NCCP implementation (Figure 6-12, *Timing of Monitoring Phases*). Also, see Table 6-10, *Biological Goals and Objectives Associated with Conservation Measure 3*, for a summary of monitoring tasks throughout the permit term.

6.5.4.1 Inventory Phase

The initial inventory phase of monitoring occurs following permit approval and continues as new parcels are acquired and added to the reserve system or new conservation actions are initiated outside the reserve system, primarily along Cache Creek and Putah Creek. Baseline information collected during the inventory phase will lay the foundation of the overarching monitoring and adaptive management program. Inventories will need to occur over multiple seasons to ensure that all species present are identified. Under normal conditions, the initial inventory at a site will take place within three years of acquisitions for each site. The JPA will inventory and assess landscapes, natural communities, and species, as appropriate, within the reserve system. This information will build largely on the data collected during pre-acquisition assessments and will be supplemented by post-acquisition monitoring.

In addition to the acquisition of baseline information, the inventory phase will focus on the identification of key relationships between species, habitats, and processes; the prioritization of project implementation and the selection of biotic and abiotic indicators for evaluating ecosystem condition. Information collected during the inventory phase will build on species information (Appendix A, *Species Accounts*) as well as other data sources (e.g., historical ecology reports).

6.5.4.1.1 Document Baseline Conditions

Baseline conditions within the reserve system need to be documented to enable management planning and to serve as a comparison point for all future monitoring. Accordingly, natural communities and covered species that occur on a site need to be documented and mapped. Documenting baseline conditions will consist of the following tasks.

- Update GIS land cover layer with existing aerial photographs, satellite imagery, and other relevant data sources at the outset of implementation.
- Inventory and document resources and improve mapping as the reserve system is assembled. The results of the assessments for land acquisition (i.e., pre-acquisition assessment) will be the

first source of baseline data. The JPA will standardize data-collection methodologies and nomenclature to facilitate sharing of information.

- Research and document historical data and trends.
- Use baseline data to validate and refine covered species habitat models as lands are surveyed and acquired (the JPA will evaluate species models periodically, no less frequently than every five years, and will update species models as needed, consistent with new survey data collected, from land cover mapping provided by project applicants, and from other relevant sources). Any modifications on these models, however, will be reviewed and approved by the wildlife agencies.
- Conduct post-acquisition biological inventories. Additional surveys will be needed to supplement data gathered in pre-acquisition assessments.
- Use aerial photos and ground surveys, as needed, to assess quality and location of local and regional landscape linkages between unprotected natural areas and adjacent protected lands.
- Collect additional baseline data needed to refine conceptual models.

6.5.4.1.2 Initiate Management Planning

Management planning will consist of the following tasks.

- Prioritize implementation of conservation actions to best achieve biological objectives.
- Develop reserve management plans (described in Section 6.4.3.3, Reserve Management Plans).
- Refine the monitoring schedule.
- Identify biotic and abiotic indicators (see section on indicators for description) for testing during the targeted studies phase.
- Select monitoring protocols and identify sampling design for status and trends and effects monitoring. Test experimental designs during the targeted studies phase, as necessary.
- Develop criteria for measuring success of enhancement, restoration, and creation efforts (see example criteria in Table 6-11, *Examples of Success Criteria for Monitoring Effectiveness of Selected Management Actions*).
- Develop criteria to assess effectiveness of conditions on covered activities (described in Chapter 4, *Conditions on Covered Activities and Application Process*).

Table 6-11. Example Success Criteria for Monitoring Effectiveness of Selected Management Actions[a]

Management Action	Performance Period[1]	Example Success Criteria	
		Example Minimum Value[3]	**Example Target Value[4]**
Enhance Wetlands	__ years following acquisition of wetlands	*Nonnative predators:* · Maintain __% of all wetlands free of nonnative bullfrogs in any given year	*Nonnative predators:* · Maintain all wetlands free of nonnative fish bullfrogs annually
		Emergent vegetation cover-margins: · Maintain native emergent vegetation along at least __% of wetland edges	*Emergent vegetation cover-margins:* · Maintain native emergent vegetation along at least __% of pond wetland edges
		Hydrology: · Maintain wetlands year-round in normal rainfall years[6]	*Hydrology:* · Maintain wetlands year-round in dry rainfall years[6]
Enhance Grassland	__ years following implementation of preserve-wide management of grasslands (and after pilot study complete)	*% native forb cover:* · Demonstrate an upward trend in __% native forb cover relative to existing conditions	*% native forb cover:* · Increase native forb cover by __% relative to condition at time of acquisition
		% native grass cover: · Demonstrate an upward trend in % native grass cover (annual or perennial) relative to condition at time of acquisition	*% native grass cover:* · Increase native grass cover by __% relative to condition at time of acquisition
		Native plant diversity: · Demonstrate an upward trend in native plant diversity	*Native plant diversity:* · Demonstrate an upward trend in native plant diversity
Increase Natural Burrow Availability and Prey Base in Grasslands	__ years following implementation of measure	*Abundance of burrows:* · Demonstrate and upward trend in burrow density and distribution within the reserve system	*Abundance of burrows:* · Increase the density of burrows by __% and total acreage of burrow complexes by __% within the reserve system
Enhance Valley Oak Woodland	Implement measures to increase oak tree establishment and densities within __ years of detecting a decline in canopy cover	*Absolute oak tree canopy cover:* · Maintain the existing __% absolute oak tree canopy cover in oak woodlands on reserve lands	*Absolute oak tree canopy cover:* · Maintain the existing __% absolute oak tree canopy cover in oak savanna and woodlands on reserve lands

Management Action	Performance Period[1]	Example Success Criteria	
		Example Minimum Value[3]	**Example Target Value[4]**
Restore Valley Oak Woodland	__ years following initial plantings of oak trees	*Extent restored:* · __ acres[5]	*Extent restored:* · __ acres[5]
		% oak-tree canopy cover: __% tree canopy cover equal to or up to __% greater than the percent canopy cover in valley oak stands removed by covered activities	*% oak- tree canopy cover:* __% tree canopy cover equal to or up to __% greater than the percent canopy cover in valley oak woodlands removed by covered activities
	__ years following initial plantings of oak trees	*Understory native plant cover:* · Develop an understory with native plant cover within __% of existing conditions	*Understory native plant cover:* · Develop an understory with native plant cover equal to or greater than that of existing conditions
		Understory native plant diversity: · Develop an understory with native plant diversity at least __% of existing conditions	*Understory native plant diversity:* · Develop an understory with native plant diversity equal to or greater than existing conditions
		Species composition: · Maintain the existing native species composition	*Species composition:* · Maintain the existing native species composition
		Species regeneration: · Demonstrate the existing species composition is maintained post-treatment	*Species regeneration:* · Demonstrate the existing species composition is maintained post-treatment
Enhance Riverine Habitat	__ years following initial treatments	*Relative native tree canopy cover:* · Demonstrate an upward trend in native plant diversity	*Relative native tree canopy cover:* · Increase the existing relative native tree canopy cover by at least __%
		Relative native shrub canopy cover: · Demonstrate an upward trend in native plant diversity	*Relative native shrub canopy cover:* · Increase the existing relative native shrub canopy cover by at least __%

Management Action	Performance Period[1]	Example Success Criteria	
		Example Minimum Value[3]	**Example Target Value[4]**
Restore riverine natural community to Compensate for Habitat Loss and to Increase Biodiversity	__ years following restoration planting	*Extent restored:* · __ acres[5]	*Extent restored:* · __ acres[5]
		Relative native tree canopy cover: · Establish a relative native tree canopy cover of at least __%	*Relative native tree canopy cover:* · Establish a relative native tree canopy cover of at least __%
		Relative native shrub canopy cover: · Establish a relative native shrub canopy cover of at least __%	*Relative native shrub canopy cover:* · Establish a relative native shrub canopy cover of at least __ acres

Notes:

[a] This table provides a framework for evaluating the success of certain conservation measures. The JPA will develop values for assessing success during the Inventory and Targeted Studies phases of implementation

[1] The estimated period following enhancement/creation/restoration of a natural community at a site during which performance standards should be achieved.

[2] Success criteria are shown in italics.

[3] The example minimum value is the minimum measured value for each success criterion that must be achieved during the performance period.

[4] The example target value represents the optimal desired value for each performance indicator and the design and management objectives for enhanced/created/restored natural communities. If performance objectives are not achieved, adaptive management actions may be triggered.

[5] Acres restored are estimates based on the impact analysis. Actual restoration performance standard/target may vary depending on actual field-verified impacts.

[6] Normal rainfall years are defined as within 1 standard deviation of the annual average rainfall as measured at the California Irrigation Management Information System (CIMIS) __ rain gauge over the hydrologic record of the gauge (October–September). Dry years are defined as less than 1 standard deviation from the annual mean.

Upon HCP/NCCP implementation, the JPA will document baseline conditions along with survey methods and monitoring schedules based on the guidelines for monitoring described below. These protocols and schedules will provide the overarching framework that the JPA will implement in each management unit. The JPA will draw from relevant and established protocols (e.g., wildlife agency and CNPS survey protocols) and will adapt them throughout the permit term to incorporate the best available scientific data.

For each reserve management plan, the JPA will develop a monitoring component that identifies protocols, indicators, monitoring schedule, and success criteria. The JPA will revise this component to include information from methods testing, pilot projects and directed studies as results become available. Before the reserve unit management plan for a given reserve is complete, monitoring on lands in the reserve system will consist of baseline inventories, pilot projects to test monitoring methods, and directed studies.

6.5.4.2 Targeted Studies Phase

The targeted studies phase of monitoring follows Permit approval and will continue as long as critical uncertainties persist (Figure 6-12, *Timing of Monitoring Phases*). Most targeted studies will take place within the first 5–10 years of HCP/NCCP implementation, such that results can inform long-term management. The JPA will develop conceptual models for key natural communities and covered species that identify critical management uncertainties; design and initiate pilot projects to test management and monitoring methods; develop and initiate experiments that resolve critical uncertainties; and begin pretreatment monitoring of sites considered for enhancement, restoration, or creation.

6.5.4.2.1 Develop Ecological Models

These models will inform the monitoring program by identifying relationships between ecosystem components and by identifying management assumptions. As the monitoring program collects additional data, these "living" models will serve as a framework for management decisions and will function as reference points for the JPA's understanding of the relationship between management and natural communities and/or covered species within the reserve system. In addition, species conceptual models that identify threats, management and monitoring for species will be developed.

6.5.4.2.2 Test and Refine Monitoring Protocols

In the targeted studies phase, the JPA will conduct methods testing (described above) to develop, test, and refine monitoring protocols. The JPA will develop monitoring protocols for natural communities, and covered species. The purpose of this testing is to identify the best and most cost-effective monitoring methodologies to derive the desired information.

In some cases there is little distinction between pilot projects and long-term monitoring. During the targeted studies phase, the JPA will implement and experimentally evaluate different management techniques. In some cases, restoration, enhancement, and monitoring methods are not known or have not been successfully reproduced on a large scale by land managers or the scientific community. Before restoration or enhancement through management can occur successfully, these methodologies need to be tested on a smaller scale. These pilot projects, designed to test the effectiveness of restoration and enhancement, are necessarily long-term (i.e., 5–10 year) endeavors; they may inform short-term management but will be included as part of the long-term management

program. Results from these early studies will guide future efforts in the reserve system. This feedback will increase the efficiency with which reserve lands can be managed and the overall success rate of management activities. Testing the use of indicators for natural communities or covered species; refining monitoring protocols; establishing control plots for long-term management; and reviewing the literature for guidance on sampling, experimental design, and management will all be a part of the targeted studies phase of implementation.

6.5.4.2.3 Develop Experiments to Resolve Critical Uncertainties

A final element of the targeted studies phase of implementation is the development of experiments that resolve critical uncertainties. The JPA will identify critical uncertainties as conceptual models are developed. In addition, the JPA will work with other individuals and organizations (e.g., local universities) to facilitate targeted studies on the reserve system and areas outside the reserve system along Cache Creek and Putah Creek that will improve management.

6.5.4.3 Long-Term Monitoring and Adaptive Management Phase

Both the inventory phase and the targeted studies phase will be followed by long-term monitoring to determine the status and trends of natural communities, and covered species, and the effectiveness of the reserve system management in achieving the HCP/NCCP biological goals and objective (Figure 6-12, *Timing of Monitoring Phases*). Monitoring that does not depend on the results of targeted studies will occur as soon as the reserve management plans have been reviewed and approved by the wildlife agencies and baseline studies are complete (inventory phase) or sooner, if appropriate. Long-term monitoring will use the framework developed during the inventory phase to carry out effectiveness monitoring and to implement adaptive management.

The long-term monitoring phase includes the following tasks.

- Update GIS land cover layer with aerial photographs, satellite imagery, and other relevant data sources at least every five years. Assess status and trends at the natural community levels.
- Monitor covered species response to enhancement, restoration, and habitat creation.
- Monitor restoration sites for success; remediate sites if initial success criteria are not being met. The reserve management plan will identify triggers for remediation.
- Monitor covered species using methodologies developed in targeted studies phase. Assess status and trends of covered species by monitoring covered species populations over time.
- Assess status and trends of palmate-bracted bird's beak that may have been partially or temporarily affected by covered activities to ensure that plant protection in the reserve system adequately offsets adverse effects.
- When enhancement and restoration projects are complete and have met final success criteria, scale back monitoring effort (i.e., frequency, extent) but continue to adaptively manage these sites.

In addition to long-term monitoring, this phase will include steps to adaptively manage the reserve system to implement the conservation strategy. Adaptive management tasks are listed below.

- Evaluate efficacy of monitoring protocols. During this phase, the JPA will evaluate the results of pilot projects and incorporate them into long-term monitoring efforts.

- Incorporate best available scientific information into management. Regular reviews of literature as well as interaction with the Science and Technical Advisory Committee and the wildlife agencies will ensure that new understanding of the species or monitoring approaches is incorporated into the monitoring and adaptive management program.
- Evaluate and refine conceptual models. The JPA will develop conceptual models for each species and for natural communities. As more information becomes available and as assumptions evolve, the models will reflect changes and continue to provide guidance for future monitoring efforts.
- Review any unexpected or unfavorable results and test hypotheses to achieve desired outcome. The JPA will examine unexpected results or results suggesting that the conservation actions will not likely meet the conservation strategy commitments described in this chapter to understand the cause or source of the result. The JPA will test hypotheses about management outcomes.
- Adjust management actions and monitor.
- Adjust success criteria and conservation actions, if necessary. The success criteria and conservation actions developed for the Plan will be adjusted if they have been determined to be inappropriate indicators of success (too high or too low, based on biological information), if more cost-effective but equally successful conservation actions are developed and agreed upon by the wildlife agencies, or if they are inadequately conserving species or communities. The magnitude of the change to the success criteria will be based on best available scientific information. New or different conservation actions may be implemented through time, as long as they fulfill the conservation strategy commitments described in this chapter. Section 6.4, *Conservation Measures*, describes conservation actions, and Table 6-11, *Example Success Criteria for Monitoring Effectiveness of Selected Management Actions*, provides example success criteria. The JPA will develop operational success criteria during the Targeted Studies phase of implementation. Changes to success criteria and conservation actions will be discussed with and not implemented until approved by the wildlife agencies. For significant changes, a permit amendment may be necessary.

6.5.5 Program Implementation

As described above, adaptive management is a critical element of the HCP/NCCP because it addresses many of the uncertainties of the Plan and provides for continual adjustment and improvement toward meeting Plan goals and objectives. Key to the success of the adaptive management program is a clear and effective structure for making decisions on the basis of new data from HCP/NCCP monitoring and information from other sources.

The JPA will solicit input regarding adaptive management from the wildlife agencies, Science and Technical Advisory Committee, other independent experts, and the public. In addition, the JPA may convene technical committees to seek focused advice on key adaptive management topics. The responsibility for determining the course of action to take in adaptive management rests with the JPA and its senior staff or senior contract biologists. The wildlife agencies have approval rights, however, on some aspects of the adaptive management program as described below.

6.5.5.1 Wildlife Agencies

A primary role of the wildlife agencies is to provide feedback to the JPA regarding changes to HCP/NCCP implementation based on the results of targeted studies and monitoring. Where possible, wildlife agency

staff will provide expertise in the biology and conservation of covered species and natural communities, management tools, monitoring program, and all other HCP/NCCP implementation.

The JPA and the wildlife agencies will strive at all times to work in good faith with each other to reach mutual agreement on key implementation tasks such as adaptive management, monitoring, and conservation actions. The primary forum in which these discussions will occur is the Science and Technical Advisory Committee described in Chapter 7, Section 7.2.4.2, *Science and Technical Advisory Committee*. Additional meetings with the wildlife agencies may be needed to discuss and resolve key issues related to adaptive management and monitoring.

6.5.5.2 Land Management Agencies

As discussed above, the JPA will share information and resources in implementing management across reserve boundaries and on a regional scale with other land management agencies and organizations in the Plan Area, such as CDFW, Yolo County Resource Conservation District, Bureau of Land Management, Solano County Water Agency, and Cache Creek Conservancy. Input from other land management agencies in the Plan Area is an important component of successful adaptive management.

6.5.5.3 Science and Technical Advisors

The JPA will consult science advisors who will provide advice on HCP/NCCP implementation. The role of the Science and Technical Advisory Committee is to provide the JPA with science-based expert opinion and recommendations, focused "white papers," peer review, and feedback regarding key scientific aspects of Plan implementation. Science advisors will be contacted by the JPA and its partners, including the wildlife agencies, as needed. They may also be convened as a group when needed to address specific topics. Science advisors will be scientists and wildlife agencies with expertise in one or more of the following areas:

- Covered species,
- Landscape ecology,
- Natural communities in the Reserve System,
- Ecological processes,
- Resource management,
- Biological monitoring,
- Statistical analysis and experimental design.
- Conceptual models,
- Species-specific surveys, and
- Species protocols.

The JPA will select the science and technical advisors with input from the wildlife agencies. The JPA may also request that the science and technical advisors review the following types of information prepared by or for the JPA.

- Proposals for directed studies to address important management questions.
- Management and monitoring reports and recommendations to the JPA provided by others.

- Monitoring priorities, sampling design, survey protocols, data analysis, and data storage.
- Proposals for experimental pilot projects to test natural community enhancement/creation/restoration or management techniques.

6.5.5.4 The Public

Members of the public will have opportunities to learn about HCP/NCCP status and provide input to the JPA on adaptive management during periodic (at least annual) public hearings and regular meetings of the Science and Technical Advisory Committee, which will be open to the public. Members of the public may offer important contributions to a successful adaptive management program, such as providing data on covered species, reviews of monitoring data, and suggestions for improved land management. Members of the public may also participate in data collection through a volunteer program supervised by the JPA or its designee.

6.5.6 Guidelines for Monitoring

Adaptive management, and the design of targeted studies, will be driven by hypotheses about key factors for the natural community, and/or covered species for which the management is applied. For example, if the goal of management is to increase populations of small mammals to serve as a prey base for certain covered species (e.g., Swainson's hawk, white-tailed kite), land managers must develop hypotheses about what controls small mammal abundance and distribution. Adaptive management actions and monitoring will be directed toward confirming or disproving those hypotheses. Directed studies will be conducted on a small scale using an experimental design that will yield statistically valid results to address critical uncertainties. Ultimately, if small mammal availability limits the abundance of covered species, increasing the prey base may increase the survival and fitness of covered species. If the prey base increases and the covered species do not respond, then other factors apparently limit their abundance.

In addition to the scientific guidelines described above, the following steps will be included in the experimental design.

1. **Define the question.** Monitoring strategies will be designed to address specific hypotheses. Conceptual, statistical, or spatially explicit models will define those hypotheses.
4. **Determine what to measure.** Establish the attributes or variables that the monitoring will measure to answer the question defined above. This step includes the development of measurable success criteria for evaluating creation, restoration and enhancement actions.
5. **Develop monitoring protocols.** Questions to be answered by the monitoring program will be at the species, natural community, and landscape level. Monitoring protocols will vary with level and with the target of the monitoring. The JPA will develop monitoring protocols in accordance with the guidelines provided below in Section 6.5.5.2.2.
6. **Use indicator species, if appropriate.** In some cases, groups of species or indicator species will streamline monitoring. Indicators are selected because they are easy to survey and provide usable information on the species or system in question. Guidelines for selecting and using indicators are described in detail below.
7. **Consider sampling design.** Sampling design needs to be a consideration prior to initiating the experiment. The experimental management approach of the HCP/NCCP requires that questions

of site selection, statistical power, and significance be incorporated, as much as possible, into the monitoring and adaptive management program. Sampling design is described in detail below.

6.5.6.1 Indicators

In cases where an indicator is used to monitor an ecosystem or natural community (health indicator species), the JPA will use conceptual models to help identify an appropriate indicator species or variable. Table 5-11, *Example Success Criteria for Monitoring Effectiveness of Selected Management Actions*, provides example performance indicators for natural community enhancement, restoration, and creation measures. Indicators, in general, are easy to monitor and demonstrate changes or trends that are quantifiable. Indicators need not be species, but may be ecological variables or structure-based characteristics such as diameter and age class of trees, interpatch distances between habitat, or key structural features of certain habitat types (e.g., snags or downed logs in forests, woody debris in rivers) (Noss 1999; Lindenmayer et al. 2000). Effective indicators (or variables) have some or all of the following characteristics (Carignan and Villard 2002; Atkinson et al. 2004).

- They are relevant to program goals and objectives and can be used to assess the program performance at the appropriate spatial and temporal levels.
- They are sensitive to changes in the ecosystem, providing early warning of response to environmental or management impacts.
- They indicate the cause of change, not just the existence of change.
- They provide a continuum of responses to a range of stressors such that the indicator will not quickly reach a minimum or maximum threshold.
- They have known statistical properties, with baseline data, references, or benchmarks available.
- They are technically feasible, easily understood, and cost effective to measure by all personnel involved in the monitoring.

The JPA will coordinate with existing programs to identify indicators or variables in use by other programs that are complementary to, and consistent with, the Yolo HCP/NCCP conservation strategy. "What" will be monitored.

- "Why" the monitoring is useful (i.e., the specific question the variable is designed to address).
- "When" will the variable be monitored and at what frequency.
- The conceptual ecological model underlying the selection of the monitoring variable.
- The geographical area where it will be monitored (e.g., transect locations, stream miles).
- The specific variable that will be measured and the protocol that will be used.
- The range of values the monitoring can produce and what these would mean.
- The expected response (as in response to management or outside pressures) and the magnitude of change expected.
- The time frame and spatial scale over which change is expected to be demonstrated.

The monitoring component of each reserve management plan will clearly present the rationale for using indicators. Indicators must be applicable and appropriate measures of the biological goals and

objectives. The recommendation of the Science and Technical Advisory Committee, as well as review and approval from the wildlife agencies will be sought when an indicator is used..

6.5.7 Monitoring Actions

6.5.7.1 Landscape-Level Actions

The JPA will direct landscape-level monitoring toward tracking large areas, landscape-level processes, and regional issues that affect the Plan Area. Tables 6.3, 6.6, and 6.7 correlate landscape-level monitoring actions with biological goals and objectives for landscapes. The section below summarizes the specific monitoring actions the JPA will carry out to track environmental issues at the landscape level and ensure the JPA meets the landscape-level goals and objectives. Compliance monitoring is described above in Section 6.5.3.1, *Compliance Monitoring,* and will take place at all levels of monitoring, including the landscape level.

6.5.7.1.1 Assimilate Results of Pre-Acquisition Assessments and Other Surveys

The JPA will collect information on landscape features through pre-acquisition assessments, including biological surveys, updated land cover mapping, assessments of habitat suitability for covered species, aerial photo interpretation, and the biological resources present or expected on-site, that provide information on the extent, quality, and distribution of land cover types in the Reserve System. These data will be used to refine existing species habitat models and develop natural community conceptual models. Additionally, the JPA will combine this information with landscape-level information collected by other organizations or individuals in the region to provide resource managers, including the JPA, with an understanding of how critical biological resources are generally trending under the influence of HCP/NCCP implementation as well as under the influence of other human activities and other environmental factors (e.g., fire, drought, disease). The JPA will also collect annual information on precipitation and whether the Plan Area is experiencing a wet or dry rainfall year, to facilitate trends analysis and potential effects on baseline and results of surveys for covered species and natural communities.

6.5.7.1.2 Refine Land Cover Maps

At the landscape level, the JPA will monitor, using existing aerial photos or satellite imagery, the extent and distribution of land cover types within the Plan Area every 5 years. If feasible, this monitoring will occur at a more refined level following significant natural events that affect the reserve system (e.g., flood and wildfire). This effort will begin during the Inventory Phase but will continue throughout all phases of HCP/NCCP implementation. The JPA will verify land cover mapping in the field at sites where aerial photo interpretation is difficult. The JPA will improve species models, including maps, as new data become available.

6.5.7.1.3 Assess and Monitor Landscape Linkages

One of the goals of the conservation strategy is to sustain and enhance the effective movement and genetic exchange of native organisms within and between natural communities inside and outside the Plan Area. To monitor landscape linkages, the JPA will use a combination of compliance monitoring (to ensure that land acquisition requirements are met) and effectiveness monitoring (to ensure that species utilize linkages effectively and that management actions to increase permeability or improve connectivity are successful).

The inventory phase of monitoring will prioritize acquisition of linkages, develop management protocols to enhance linkages, and develop success criteria for the effectiveness of linkages at sustaining movement and genetic exchange. The targeted studies phase will test methodologies for monitoring linkages. The objective of the targeted studies phase is to determine the most cost-effective and accurate way of evaluating whether landscape linkages are functioning within the context of the HCP/NCCP. The long-term monitoring phase will implement methodologies identified in the targeted studies phase.

6.5.7.1.4 Track Invasive Species

A primary goal of the HCP/NCCP is to enhance or restore representative natural landscapes to maintain or increase native biological diversity. To that end, the conservation strategy proposes to eradicate or reduce the cover, biomass, and distribution of targeted populations of nonnative invasive plants. Within the reserve system, the JPA will map occurrences of invasive nonnative plants.

The JPA will coordinate monitoring protocols for invasive plants with those of other local entities to ensure consistency with these programs and facilitate the sharing of monitoring results. The JPA will use this monitoring information to determine the need for management actions to control the spread of existing invasive plants as well as potential future invasions. The JPA will also review the effectiveness of control methods. The JPA will share this monitoring information with state and local land management agencies charged with the control of invasive plants.

During the inventory phase of monitoring, the JPA will identify and prioritize problems; map occurrences of invasive plants, if possible; develop an exotic species control program; and develop success criteria for the effectiveness of eradication or reduction efforts. The targeted studies phase will develop protocols for invasive species monitoring and test methodologies for monitoring eradication efforts. The objective of the targeted studies phase is to determine the most cost-effective and accurate way of controlling invasive species. The long-term monitoring phase will entail implementation of methodologies identified in the targeted studies phase.

The JPA will also document occurrences of invasive animals in GIS, and develop management actions to prioritize and address nonnative wildlife that adversely affects covered species or Plan Area species diversity. The bullfrog, for example, is an invasive species of special concern because it competes with native amphibians for resources. During the targeted studies phase, the JPA will develop protocols to monitor the presence/absence of bullfrogs in covered species aquatic habitat over time. Monitoring will track the effectiveness of bullfrog control. These protocols will then be used as part of long-term monitoring for bullfrog control.

The JPA will monitor and report instances of disease, as they are discovered. The JPA will maintain a watchlist of dangerous diseases for the Plan Area, in coordination with other agencies that maintain similar watchlists for the area, and will periodically monitor animals and plants, as part of species and natural community monitoring, to ensure that any occurrences of dangerous diseases are identified.

The JPA will track, on an annual basis, the status of diseases and nonnative invasive species in order to expeditiously initiate remedial actions described in Section 7.7.1, *Changed and Unforeseen Circumstances*.

6.5.7.2 Natural Community–Level Actions

The section below provides specific monitoring actions that the JPA will carry out to track environmental issues at the natural-community level and ensure that the HCP/NCCP is meeting natural-community-level goals and objectives.

6.5.7.2.1 Cultivated Lands Monitoring Actions

The reserve system will include cultivated lands managed for a variety of wildlife-compatible agricultural uses. Monitoring actions will evaluate the effectiveness of agricultural land uses and management to provide habitat for target covered species, protect and improve water quality, enhance connectivity between natural communities, and buffer natural communities and other existing biological resources from urban/suburban development.

Assess Conditions of Natural Community

The JPA will monitor cultivated lands to document baseline conditions, evaluate community function, and identify enhancement and other management actions the JPA will implement to enhance community functions and habitat for covered species. These tasks include:

- Use pre-acquisition assessments, site inventories, and other surveys to identify land to be managed for agriculture; the distribution of potential habitat for covered species and wildlife; the distribution of areas to be enhanced to improve community functions and to provide habitat and connectivity for covered species; and to inform the development of agricultural land management plans.
- Assess the use of existing cultivated lands on reserve system lands by covered species and other wildlife. The JPA will use this information to assess the success of future agricultural uses and management practices in providing habitat for covered species.
- Develop a conceptual ecological model for cultivated lands and identify indicators of community function.
- Prioritize habitats and other areas for enhancement and restoration (e.g., planting of nest trees for Swainson's hawk; planting vegetated buffer strips). The JPA will identify and select sites based on their potential to provide habitat for covered species and natural communities..
- Identify areas that the JPA will manage to provide habitat for covered species such as giant garter snake and tricolored blackbird.
- Identify suitable wildlife-compatible agricultural uses and management practices for the reserve system that are compatible with the biological goals and objectives of the HCP/NCCP.
- Begin pre-treatment monitoring of sites considered for enhancement and develop criteria for evaluating success. These criteria will be suitable to evaluate whether management enhances habitat for target covered species and other wildlife and enhances target ecosystem services.

Monitor Use of Cultivated Lands by Covered Species

As discussed in Section 6.4.3, *Conservation Measure 3: Manage and Enhance the Reserve System,* the conservation measures for cultivated lands include management activities that support habitat for covered species and other wildlife and benefit natural communities. The following are specific monitoring tasks that will help the JPA achieve these goals and objectives:

- Develop criteria to evaluate the success of land management (e.g., leaving winter cover crops; depth of water and timing of flooding in ricelands) in enhancing habitat for covered species and natural communities.
- Monitor ricelands and other habitats (e.g., irrigation canals and other waterways) managed to provide habitat for giant garter snake and include monitoring to determine occurrence of giant garter snake.
- Develop pilot projects that test the effects of different agricultural management techniques (e.g., different cover crops, crop harvest height) on use by target covered species.

6.5.7.2.2 Annual Grasslands Monitoring Actions

Assess Condition of Natural Community

The JPA will conduct monitoring to assess the status and trends of the grassland community and to evaluate community function. If feasible, information on the historical ecology of grassland will help guide assessments. The JPA will carry out the tasks listed below to document the baseline conditions from which change will be measured.

- Use pre-acquisition assessments and site inventories to document the distribution and vegetation types of grasslands.
- Develop a management-oriented conceptual model for grasslands that includes important factors such as the effects of rainfall, temperature, fire, herbivory (i.e., grazing) and succession to woody communities (e.g., blue or valley oak woodland), and identify indicators for community function as well as any critical uncertainties that may require additional directed studies.
- Assess and monitor invasive nonnative plants. This task will entail developing maps and descriptions of the distribution and abundance of target invasive species; their known or potential effects on ecosystem function; native biological diversity; sensitive natural communities; covered species; and the means and risk of the spread of invasive species to other areas within and outside the reserve system lands. Focus on species that have the greatest potential to threaten grasslands such as yellow and purple star-thistle, barbed goat grass, teasel, and others.
- Assess the historic extent, conditions, and fire return interval of grassland within the Plan Area using aerial photographs and historic records.
- If prescribed burns are feasible and desirable, prepare burn plans that describe pre- and post-burn monitoring to determine effects.
- Assess grassland landscape connectivity between reserves.
- Examine potential negative effects of grazing on sensitive areas and substrates such as rock outcrops and seeps.

Monitor Actions to Promote Native Plants and Reduce Invasive Species

As discussed in Section 6.4.3, *Conservation Measure 3, Manage and Enhance the Reserve System,* the conservation measures for grasslands include implementation of management actions that will promote propagation of native plants, reduce and control invasive nonnative species, and encourage

native biodiversity through the maintenance of dynamic mosaics of vegetation types and biological gradients. Specific tasks to further these goals and objectives are listed below.

- Develop success criteria for grassland enhancement and evaluate the success of management actions (i.e., grazing, burning, mowing, and seeding) in reducing nonnative plants and promoting the extent and diversity of native plants.
- Develop guidance for grazing within the Plan Area and grazing plans for specific parcels, as applicable, using an experimental approach to achieve the biological goals and objectives.
- Develop pilot projects that test the effects of different grazing practices (e.g., grazing intensity, duration, season, species) on the maintenance and regeneration of native grasses and forbs. If possible, combine grazing treatments with other management techniques such as prescribed burns and hand seeding to detect interactions between management treatments.
- Evaluate the success of any herbicide applications used to control nonnative plants in target areas.

Monitor Ground Squirrel Populations and Burrow Use

It will be important to monitor populations and/or burrow use and density because of its importance in functioning as a prey base for some predatory covered species and providing refugia for some terrestrial covered species. The tasks necessary to carry out the goals and objectives pertaining to fossorial mammals are listed below.

- Monitor ground squirrels and/or populations of other small mammals to determine the abundance of prey and burrows for several covered species (e.g., western burrowing owl, California tiger salamander) and many common species.
- Determine if ground squirrel burrows are being used by covered species.

6.5.7.2.3 Alkali Prairie Monitoring Actions

Enhancement activities at Spring Lake Alkali Sink Preserve, Woodland Park, and Woodland Regional Park will have the goal of improving or increasing the alkali sink natural community. The expected outcome of habitat enhancement will be a larger area of habitat occupied by palmate-bracted bird's-beak and an increase in the number of plants. Monitoring and adaptive management for this natural community is described further, for palmate-bracted bird's beak, in Section 6.5.7.3.1, *Palmate-bracted Bird's Beak*.

6.5.7.2.4 Fresh Emergent Wetland Complex Monitoring Actions.

For the purpose of this HCP/NCCP, the monitoring and adaptive management of fresh emergent wetland complex includes the monitoring and adaptive management of lacustrine and adjacent upland land cover associated with the fresh emergent wetland natural community. The HCP/NCCP collectively refers to fresh emergent wetlands with associated lacustrine land cover and adjacent uplands as *fresh emergent wetland complex*.

Monitoring actions will evaluate the effectiveness of management to protect, restore, manage, and enhance fresh water emergent wetland complex by increasing native vegetative cover, biomass, and structural diversity within and around the margins of wetland areas. At the same time, the JPA will use monitoring actions to evaluate efforts to reduce the cover and biomass of nonnative invasive plants, access by feral and domestic mammals, and numbers of predatory wildlife and fish species.

Monitoring actions will also track the response of covered species (e.g., giant garter snake, tricolored blackbird) to habitat management activities. The JPA will need a reasonable understanding of metapopulation dynamics in the vicinity of these management actions to determine whether the actions are causing the change in population level or the population is experiencing typical fluctuation.

Assess Condition of Natural Community

The JPA will conduct monitoring to assess the status and trends of the fresh emergent wetland complex and to evaluate community function. The JPA will conduct the tasks listed below to determine the baseline condition of fresh emergent wetland complex.

- Use pre-acquisition assessments, site inventories, and other surveys to determine the distribution and abundance of wetlands within and adjacent to the reserve system. Map the distribution and assess connectivity of wetlands and associated upland areas.
- Develop a conceptual ecological model for wetlands and identify indicators for community function as well as any critical uncertainties that may require additional directed studies.
- Prioritize restoration site for fresh emergent wetland complexes. The JPA will identify and select potential restoration sites on the basis of their physical processes and hydrologic, geomorphic, and soil conditions to ensure that successful restoration can occur and be self-sustaining.
- Identify wetlands with abundant nonnative predators or ponds where native species are affected by feral and domestic animal entry. Prioritize these sites for predatory species eradication and control.
- Assess nonnative invasive plants, including maps and descriptions of their distribution and abundance; their known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species; and the means and risk of their spread to other areas inside and outside the reserve system.
- Begin pre-treatment monitoring of sites considered for enhancement, restoration, and creation and develop criteria for evaluating success. These criteria will be suitable to evaluate if habitat management increases hydrogeomorphic and ecologic functions, improves habitat value, increases landscape connectivity, and enhances the habitats' ability to support existing and new populations of covered species.

Evaluate Restoration and Enhancement Activities

The JPA will conduct the tasks listed below to determine the response of restoration and enhancement actions on increasing native vegetative cover, biomass, structural diversity, and regional connectivity for the benefit of covered species.

- Determine indicator species for monitoring restoration and enhancement and develop success criteria.
- Initiate pilot projects to develop restoration, and enhancement measures for individual sites on the basis of hydrologic conditions; extent and quality of existing covered species habitats (e.g., percent native vegetation and presence/absence of exotic wildlife such as bullfrogs); existing wildlife use; and the potential for adverse effects (e.g., disturbance and/or removal of existing pond/wetland habitat). These measures will include descriptions of plant material

requirements (e.g., collected and propagated from local sources); planting and construction methods; and adaptive management and monitoring requirements.

- Determine and quantify changes in habitat that result from restoration and enhancement actions.
- Survey wetland capacity and water duration and monitor to ensure that the ecological and hydrogeomorphic functions related to these parameters are maintained or improved.
- Evaluate the use of fresh emergent wetland complexes (including adjacent uplands) by covered species.

Evaluate Efforts to Reduce Impacts associated with Livestock and Nonnative Plants and Animals

To monitor and evaluate the results of efforts to reduce impacts caused by livestock and nonnative species on wetland habitats, the JPA will conduct the following actions.

- Determine the effect on the vegetative community and the relative benefit to covered species of different management treatments such as access/exclusion by livestock, and predator control.
- Monitor and record populations and incursions of nonnative predators in target wetlands.
- Evaluate the success or potential adverse effects of any herbicide applications used to control nonnative plants in target areas. The use of herbicides and pesticides, however, is not a covered activity.

6.5.7.2.5 Lacustrine and Riverine

Adaptive management of lacustrine and riverine communities is focused on the overall goal of promoting natural community functions and habitat heterogeneity and connectivity to benefit covered species and native biodiversity. For the purpose of this HCP/NCCP, monitoring and adaptive management of the lacustrine and riverine natural community excludes lacustrine components that are addressed as a component of fresh emergent wetland complexes (Section 6.5.7.2.4, *Fresh Emergent Wetland Complex Monitoring Actions*).

Monitoring activities will focus on the effectiveness of management to accomplish the following:

- Improve habitat quality and connectivity for covered species and improve native biodiversity along riverine corridors;
- Enhance and restore lacustrine and riverine habitats at a diversity of successional stages;
- Control invasive species in lacustrine and riverine habitats;
- Improve in-channel habitat by removing or modifying anthropogenic features such as rip-rap and in-stream barriers, and installing in-channel habitat features (e.g., large woody debris) designed to enhance habitat for covered species; and
- Reduce sediment entering into Plan Area ponds and streams and remove sediment in targeted stream reaches to improve habitat for target covered species.

Assess Condition of Natural Community

The JPA will conduct monitoring to assess the status and trends of the lacustrine and riverine natural community on the reserve system and to evaluate community function. The JPA will conduct the tasks listed below to determine the baseline condition of lacustrine/riverine complex.

- Conduct pre-acquisition assessments and site inventories to document and map the distribution and condition of lacustrine and riverine communities to verify and revise, if necessary, existing maps of land-cover;
- Identify and prioritize sections of lacustrine and riverine habitat, within and outside of the reserve system, suitable for restoration and enhancement;
- Document and assess the connectivity of riverine corridors along Sacramento River, Cache Creek and Putah Creek, and between reserves and other public lands, and prioritize key riverine and riparian sections for acquisition, restoration, and enhancement;
- Synthesize known water quality data, including sediment data; identify key uncertainties; and prioritize issues/topics for directed study;
- Develop a management-oriented conceptual model of the lacustrine and riverine natural community, and identify ecological indicators for community function and uncertainties that may require directed studies; and
- Assess the distribution and relative abundance of targeted nonnative, invasive plant species, including threats to ecosystem processes, covered species, and biodiversity, and prioritize species for eradication.

Monitor Stream Restoration Projects

Stream restoration and enhancement projects in the Plan Area, including actions carried out through the Cache Creek Resources Management Plan, will focus on removing channelization features, stabilizing banks, recreating natural stream features such as meanders, pools, runs, and riffles, and reconnecting the floodplain to the active channel. These projects will serve multiple purposes, including reducing sediment deposition, improving habitat for covered species including the western pond turtle and restoring ecological processes. The JPA will monitor areas slated for stream restoration before restoration commences and after restoration is completed to assess the effectiveness of the restoration project. The monitoring program will focus on evaluating whether an enhancement or restoration project is achieving its goals and objectives. The JPA will assess the restoration project by comparing the target of enhancement and restoration actions with success criteria. Success criteria will be project-specific, and will be established during the development of reserve management plans. In addition, the JPA will conduct the following monitoring tasks to evaluate the efficacy of stream enhancement/restoration projects.

- Develop specific, measurable success criteria for restoration projects and monitor indicators in restored areas to assess the efficacy in restoring natural hydrogeomorphic and ecological processes, and improving habitat for covered species;
- Use data from previous monitoring efforts to assess whether populations of covered species are increasing in relation to stream enhancement and restoration efforts; and
- Monitor sediment loading rates pre- and post-project for projects designed to reduce sedimentation.

6.5.7.3 Species-Level Actions

The JPA will conduct monitoring to assess the status of covered species and to determine the extent to which the conservation strategy is being implemented and the extent to which biological goals and objectives for covered species are being met. The section below summarizes the specific

monitoring actions that the JPA will carry out to track environmental issues at the species level and ensure that species-level goals and objectives are being met. Covered species monitoring will address the following issues relevant to the HCP/NCCP.

- Status and trends of covered species within the reserve system (i.e., status and trends monitoring).
- The response of covered species to HCP/NCCP species-specific conservation measures and adaptive management (i.e., effects-of-management monitoring).
- Directed studies to resolve critical management uncertainties for some covered species.

In some cases, covered species presence is the response variable for monitoring the effectiveness of management at the community level. In those cases, monitoring is described in Section 6.5.8 *Natural Community–Level Actions*.

The JPA will initiate baseline surveys for covered listed species within 1 year of the acquisition of lands potentially supporting this species. The JPA will initiate species-specific conceptual models for covered species within 1 year of HCP/NCCP implementation. Within that first year of implementation, the JPA will select monitoring variables and additional indicators (biotic or abiotic). The JPA will develop a survey schedule to ensure that species status is monitored at the appropriate seasonal periods within the year.

Initially, the JPA will monitor covered species on an annual basis; however, the JPA may adjust the frequency of monitoring on a species-by-species basis once the status of species in the reserve system is established. Recommended annual monitoring is for species status monitoring only (i.e., not trends monitoring). However, monitoring frequency for species addressed in finalized USFWS recovery plans will not fall below the recommendedfrequencies in these plans.

Targeted studies and monitoring related to the effects of management actions will take place on a time schedule that is relevant to the specific effort at hand, and the JPA will develop a monitoring schedule for these activities on a case-specific basis. The JPA will develop success criteria and monitoring protocols to incorporate monitoring results into the adaptive management strategy. Finally, the JPA will identify and track additional threats to species survival.

6.5.7.3.1 Palmate-Bracted Bird's Beak

Document and Monitor Status of Palmate-Bracted Bird's-Beak

The JPA will complete a comprehensive baseline survey of palmate-bracted bird's-beak in the reserve system to document the occurrence and relative abundance of the species and to acquire the baseline data necessary to evaluate long-term adaptive management and monitoring.

Botanists will carry out the survey by walking parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site. If more than one botanist conducts the survey, it will include at least one member who has observed palmate-bracted bird's-beak growing in its natural habitat, who will train the other botanists to recognize palmate-bracted bird's-beak by observing the species in the portion of the reserve where it has been previously documented and mapped. The botanist will conduct the survey during the blooming period (June 1 to July 31), when the plants are most evident and identifiable. The botanist(s) will record additional observations during the survey including the size and vigor of the plants, the presence of pollinators visiting the plants, and a list of all associated plant species. The botanist(s) will map all locations of palmate-bracted bird's-beak plants found during the survey using GPS data recorders, and enter the data into a GIS database.

The botanist(s) will document the results of the survey in a report that describes the survey methods, the area surveyed, dates of the survey, the observability and phenology of the species at that time, and the abundance and distribution of all the species. The report will also discuss factors that may have affected the growth and vigor of the plants, including but not limited to the seasonal rainfall totals, disturbances, and the presence of invasive plants. The report will include a map showing the locations of the plants.

The botanist(s) will perform the monitoring annually for a minimum of three years (however the length of this survey will be dependent on water year types) and will continue until population has been determined to be stable or increasing, or as directed by the monitoring requirements for future restoration activities.

Expand Palmate-Bracted Bird's-Beak Population

The Spring Lake Alkali Sink, Woodland Park, and Woodland Regional Park parcels are physically separated by roads and canals, which constrain the natural ebb and flow of the population into different parts of the habitat. An objective of the HCP/NCCP is to expand the palmate-bracted bird's-beak population into suitable, currently unoccupied habitat. The U. S. Fish and Wildlife Service has demonstrated that translocating palmate-bracted bird's-beak into restored habitat appears to be a feasible method for creating new stands and expanding the amount of occupied habitat, based on the establishment of populations at three locations at the Sacramento National Wildlife Refuge Complex (California Department of Fish and Wildlife 2014). These new populations have persisted for more than 20 years. Expansion of the Plan Area population will be guided through preparation and implementation of a translocation plan that will detail the methods for collecting propagation material (seeds, greenhouse-grown plants, etc.), preparing translocation sites, and monitoring the newly established stands. Suitable locations for establishing new stands will be determined during the comprehensive baseline surveys.

6.5.7.3.2 Valley Elderberry Longhorn Beetle

Document and Monitor Status of Valley Elderberry Longhorn Beetle

As the JPA acquires new reserves into the reserve system, it will survey potential habitat to document the occurrence and relative abundance of host elderberry plants and valley elderberry longhorn beetle and to prioritize sites for long-term adaptive management and monitoring.

The JPA will develop protocols and sampling methods for detecting and documenting occurrences and relative abundance of valley elderberry longhorn beetle (including timing of surveys and monitoring intervals) in coordination with USFWS and species experts to monitor distribution and relative abundance in the reserve system. The JPA may refine protocols to monitor status and trends by using methods testing.

At each reserve where potential habitat for valley elderberry longhorn beetle occurs, the JPA will assess and document the following:

- The distribution and relative abundance of host plants (i.e., elderberry species);
- Relative health and age of the host plants;
- The distribution and relative abundance of valley elderberry longhorn beetle (e.g., as indicated by exit holes);

- The proximity to other habitats; and
- The presence of factors (threats) that could affect population stability (e.g., adjacent land use, pesticide-use).

The JPA will document occurrences in GIS and use this data to prioritize sites for enhancement and restoration and to identify potential factors that limit the distribution of valley elderberry longhorn beetle in the Plan Area. The JPA will also use this information to update the habitat model for valley elderberry longhorn beetle. At locations where potential habitat for valley elderberry longhorn beetle occurs, but where valley elderberry longhorn beetles are not found, the JPA will document the presence of factors that may be impeding use of the site. Based on the assessment data, if conditions are suitable, the JPA will develop a plan to enhance and/or restore riparian habitat for existing populations and transplant elderberry that are occupied by valley elderberry longhorn beetle into appropriate sites.

Evaluate Species Response to Enhancement and Restoration of Riparian Habitat

The JPA will monitor the response of valley elderberry longhorn beetle populations to enhancement or restoration actions designed to improve and restore habitat for valley elderberry longhorn beetle. One way to evaluate the success of restoration and enhancement actions and techniques is to compare the relative abundance of valley elderberry longhorn beetle individuals or exit holes before and after treatments. Valley elderberry longhorn beetle populations are likely to fluctuate regardless of management actions. Therefore, it may be necessary to compare the fluctuations that occur in the relative abundance of valley elderberry longhorn beetle at restoration and enhancement sites to the fluctuations that occur at reference sites.

The JPA will monitor patch occupancy and relative abundance in enhanced and restored sites to assess the effectiveness of enhancement and restoration actions implemented to improve and expand habitat for valley elderberry longhorn beetle. For example, if restoration actions such as re-vegetation with elderberry plants or invasive plant removal are implemented in an area—and if the relative abundance of valley elderberry longhorn beetle increases in that area over time—then some of that increased abundance could be attributed to the actions implemented. This would be especially true if the relative abundances at reference sites did not increase at the same rate. In such cases, restoration actions would precede as before. If the relative abundance of valley elderberry longhorn beetle did not increase over time, however, or if the population in the habitat patch were extirpated, the restoration actions would be modified to achieve better results—or would be replaced with alternate restoration actions.

In addition, populations of elderberry plants may be monitored to determine whether the valley elderberry longhorn beetle host plants are abundant and healthy enough to support valley elderberry longhorn beetle populations. In some cases it may also be beneficial to monitor natural recruitment of elderberry plants to estimate whether elderberry populations are stable enough to support valley elderberry longhorn beetle populations over the long-term. Where elderberry re-vegetation is implemented, it will be necessary to monitor long-term survival of transplants to guide propagation and outplanting procedures.

Monitor Potential Threats

Invasion by the exotic Argentine ant into riparian habitat may potentially threaten the survival of valley elderberry longhorn beetle (Huxel 2000). The severity, extent of impacts, and ecological

relationships between Argentine ants and valley elderberry longhorn beetle are not well understood, however, and some studies have not found significant relationships between the presence of Argentine ants and valley elderberry longhorn beetle (Huxel 2003). Argentine ants may colonize restored and native sites occupied by valley elderberry longhorn beetle on their own, or by being transported to restored sites in the soil of potted plants (Talley et al. 2006). Furthermore, irrigation may promote ideal conditions for the growth and survival of Argentine ants (Talley et al. 2006). The JPA will consider conducting directed studies to evaluate the effects of Argentine ants on populations of valley elderberry longhorn beetles on the reserve system if monitoring data indicate that valley elderberry longhorn beetles are declining or not successfully colonizing or establishing populations in restored or enhanced sites or if data in the scientific literature indicate that Argentine ants may be limiting the distribution and abundance of valley elderberry longhorn beetle. The JPA will monitor the distribution and relative abundance of Argentine ants at target sites on reserves that support habitat for valley elderberry longhorn beetle on a case by case basis. The JPA will monitor the scientific literature and regularly consult with scientific experts to remain current on new findings that further clarify the relationship between Argentine ants and valley elderberry longhorn beetle. The JPA will adapt future management (including conducting targeted studies) when necessary, based on new knowledge of threats to valley elderberry longhorn beetle.

6.5.7.3.3 California Tiger Salamander

Document and Monitor Species Status

During the breeding season, which begins soon after the first cool rains of late-fall and early winter, adult California tiger salamanders migrate to breeding pools. Before hatching and after larvae hatch out and are developing, the probability of detecting presence is highest. The JPA will conduct surveys during the breeding season using the most recent methodologies that are accepted by USFWS and CDFW. The JPA will coordinate monitoring actions that take place under the HCP/NCCP with those of other local agencies to ensure that unnecessary redundancies are eliminated and that data can inform both processes.

During the non-breeding season, when individuals are underground in upland refugia, this species is more difficult to detect and methods to do so are often cost prohibitive. To determine quality and quantity of upland habitat for this species, surveys for California ground squirrel colonies and pocket gopher activity may serve as a surrogate. This is discussed further below. In general, the JPA will assume that if upland habitat is suitable and within the range of known dispersal distances from an observed breeding location, then the upland habitat is occupied as well. The JPA will extrapolate densities of adult salamanders using upland habitat in a given area from densities of adult and larval salamanders detected in breeding habitat through seining or other methods.

The JPA will conduct surveys of potential breeding habitat in lands acquired for the reserve system according to the survey schedule outlined above. Once the JPA has established that potential breeding adults are present, it will conduct a more in-depth survey during the breeding season, based on approved methodologies, to determine an estimate of the size of the breeding population and an estimate of breeding success. Potential breeding habitat is defined as seasonal and some perennial wetlands, including stock ponds. Some riparian areas within stream corridors could also support breeding tiger salamanders if there are adjacent wetlands or large, slow water areas (e.g., side channels or scour pools) and no predatory fish species. The JPA will use this information to document baseline levels for population monitoring during the permit term and beyond in areas where repeatable testing is appropriate. Baseline information will comprise the following.

- Ponds/wetlands occupied by tiger salamander larvae and/or breeding adults.
- Adult, larva, and egg mass numbers.
- Unoccupied breeding habitat that may have the potential to support breeding populations. This item will include an evaluation of the possible factors hindering successful breeding at that location.
- Assessment of upland habitat around occupied and potential breeding habitat.
- Presence of bullfrogs and predatory fish species in occupied or potential habitat.
- Signs suggesting presence of non-native salamander alleles (hybrids).
- Presence of other factors (threats) that appear to affect breeding success at a given location where breeding is occurring.
- Estimate of the distance between known or potential breeding sites to help guide creation or enhancement of more robust populations.

The JPA will document the information in GIS layers and use this data to prioritize areas for enhancement and restoration. The JPA will also describe management actions for target upland areas surrounding breeding habitat.

In years following baseline data collection, the JPA will conduct California tiger salamander population monitoring during each breeding season at the survey frequencies described above in the introduction to Section 6.5.7.3, *Species-Level Actions*. The JPA will use larval salamander numbers in select breeding pools to determine the local population of salamanders, within the known dispersal distance from the breeding pool, and to contribute to an overall population status and trends assessment across the reserve system. The reserve management plan will document breeding pools that the JPA will monitor, and will provide monitoring guidelines and population targets.

Additionally, the JPA will monitor upland habitat condition and use during the breeding season within 1.3 miles of a representative sample of known breeding pools. The JPA will base the evaluation of upland habitat condition on best available scientific information at the time including the Recovery Plan currently being prepared by FWS. The JPA will correlate changes in salamander numbers in breeding pools with surrounding land uses. For example, if grazing is implemented as a management activity in an area where grazing previously did not occur, the JPA will discern the effect this has on habitat quality for tiger salamanders by determining how it affects the breeding activity at known breeding ponds in the area.

The JPA will develop monitoring protocols to assist in demonstrating compliance with species occupancy requirements described in Tables 6-2(a), *Newly Protected Lands Commitments* and 6-2(b), *Pre-permit Reserve Lands Commitments*.

Evaluate Covered Species Response to Habitat Enhancement, Restoration, or Creation

The JPA will monitor ponds or wetlands that are targeted for restoration, enhancement, or creation to determine the response of breeding tiger salamanders to habitat management. The JPA will correlate management activities with population numbers, and assess the relative success of different techniques on maintaining or increasing tiger salamander populations to guide future management efforts. The JPA will monitor newly created ponds and enhanced or restored wetlands

and ponds for target species response, including presence/absence surveys for tiger salamander larvae and breeding adults.

In addition, the JPA will survey upland areas near created, enhanced, or restored breeding habitat for habitat suitability. While surveying for the presence of individuals can be cumbersome (e.g., scoping or excavating ground squirrel burrows) and time consuming, determining accessibility of upland habitat from breeding ponds and its suitability for non-breeding season use is a simpler undertaking. Surveyors will determine whether there are any barriers between breeding habitat and upland sites. Surveyors will also determine if there are sufficient underground refugia available for tiger salamanders during the non-breeding season. The JPA will correlate changes in this upland habitat availability and suitability with breeding population numbers. For example, if the size of a ground squirrel colony is reduced following a prescribed burn and the next year the California tiger salamander breeding population is substantially reduced, then the JPA might infer that prescribed burning had a negative effect on the tiger salamander population during this brief window.

Similarly, if the vegetative communities surrounding breeding habitat change due to restoration or enhancement (e.g., oak woodland planting, burning, grazing, tree thinning), the JPA will track the effects on the breeding tiger salamander population and infer its relationship with the management in these upland areas. In select instances, directed studies might be developed to better understand how complex management issues influence tiger salamander populations over time.

Evaluate Use of Burrows

The JPA will monitor habitat conditions in upland areas adjacent to a representative sample of occupied breeding habitat, and adjacent to unoccupied breeding habitat that is being actively managed for California tiger salamander. Due to the importance of both breeding and upland habitat to the success of this species, the JPA will use this information to determine what the limiting biological factors are for unoccupied breeding habitat. Monitoring the size and burrow density of ground squirrel colonies adjacent to breeding habitat will be essential. Monitoring the response of ground squirrel colony size and burrow density to upland management techniques will be used as a proxy to determine the quality and quantity of upland habitat available for California tiger salamanders.

To develop more detailed information on how California tiger salamanders use underground refugia in upland habitat, the JPA can survey burrows and other refugia on the reserve system using a burrow probe (also known as a "digiscope"). This tool provides the means to confirm or deny occupancy of burrows in upland areas, though this method is not very cost effective for a large reserve system. Rather, the JPA can use this technique periodically to test the assumptions about upland habitat quality characteristics. In general, the JPA will assume that if breeding habitat is occupied then adjacent uplands within typical dispersal distance are being utilized as well.

Evaluate Response of Predator Control Programs

During baseline surveys to document the status of native species populations, the JPA will also complete a description of breeding habitat that is occupied by bullfrogs and predatory fish species. These data will inform management actions within the reserve system. Subsequent surveys for bullfrogs and predatory fish will be conducted to determine the effectiveness of eradication efforts. This will also allow for an assessment of the response of native amphibian populations to nonnative species eradication efforts.

Monitor Additional Threats

The JPA will monitor for diseases including chytrid fungus and any other diseases harmful to covered species that are discovered in the reserve system during implementation. This monitoring will include assessing the effectiveness of any disease-control measures. Spread of these diseases becomes a concern when biologists access more than one breeding site in a short period of time. Biologists will utilize accepted antiseptic protocols during all aquatic survey work to minimize the potential for cross-contamination.

6.5.7.3.4 Western Pond Turtle

Document and Monitor Species Status

The JPA will conduct surveys of potential western pond turtle habitat in land acquired for the reserve system to select sites for monitoring and document baseline population levels. The JPA will then revisit these sites and measure the population levels against the baseline to determine the effectiveness of management actions. Baseline surveys will entail an assessment of the characteristics listed below.

- Stream reaches, ponds, wetlands, or reservoirs occupied by western pond turtle adults.
- Unoccupied aquatic habitat with the potential to support populations (typically adjacent to occupied habitat).
- Basking sites that could be monitored repeatedly.
- Adjacent upland overwintering habitat for stream turtles (turtles using ponds remain in the water in winter).
- Adjacent upland nesting habitat, particularly in areas where nesting has been documented in the past.
- Presence of other factors (threats) seemingly affecting breeding success at a given location (e.g., adjacent land use).
- Observations on size structure of the population to ensure that young turtles are present and that successful reproduction is occurring.

The JPA will document this information in GIS layers and use the data to prioritize areas for enhancement. The JPA will use this process to determine the potential for unoccupied breeding habitat to be enhanced to support western pond turtles in the future. It will also help predict how proposed restoration or enhancement of aquatic habitat and adjacent uplands might affect western pond turtle nest sites.

Western pond turtles can be observed year-round in perennial streams, ponds, and wetlands and on the fringes of reservoirs. The JPA may conduct surveys at times as early as March, but the highest probability of detection to determine presence of the species is during the summer months when individuals can be counted while basking during the middle of the day. The JPA will use repeated annual surveys of basking sites as an index for overall population numbers. This method will likely be more effective in ponds and wetlands, where aquatic habitat is well defined, than in streams or lakes where individuals are able to move greater distances through the water.

In many cases, it could be beneficial to install artificial basking sites in ponds or wetlands that the JPA would monitor every year. This would facilitate monitoring in areas where there are no basking sites or where sites are submerged during high-water periods. In streams and along reservoir

margins, existing information on species distribution and baseline survey data of suitable basking sites will provide an inventory of future survey sites. Once these basking sites are identified, the JPA will monitor them at the frequencies described above in the introduction to Section 6.5.10, *Species-Level Actions*, to estimate the number of individuals present. These results will be used to estimate the population level in the area and will allow for some analysis of population response to management actions.

Evaluate Species Response to Enhancement and Restoration of Aquatic Habitat

The JPA will monitor stream reaches, ponds, and wetlands that are targeted for restoration or enhancement to determine the response of western pond turtle populations to those activities. The JPA will assess relative success of different techniques for maintaining or increasing western pond turtle populations to guide future management efforts. The JPA will monitor enhancement or restoration of occupied habitat by assessing changes in the average number of individuals observed during basking site surveys. This method will only be useful at monitoring long-term trends, but it will give some sense of the population response to the change in habitat.

In areas where nesting is known to occur, the JPA will monitor the number of nesting attempts or the success rate of nests to determine how site-specific management prescriptions are affecting turtles during the nesting period. The opportunities to conduct this type of monitoring may be limited due to the number of known nesting areas and the difficult nature of monitoring nesting turtles without disturbing important nesting areas. The JPA will determine the best approach for monitoring western pond turtle once reserves are acquired and reserve management plans are being developed. Trapping or observations can provide information on the relative abundance of young (small) turtles as an index to reproductive success.

In some streams, alternate, off-stream water sources will be provided for livestock to discourage them from entering the stream. Some ponds will be partially fenced to exclude grazing and promote growth of emergent vegetation. The JPA will monitor western pond turtle populations and compare them to baseline conditions to determine if these methods improve habitat quality and increase numbers of turtles.

Additional habitat enhancements, such as changes in flow regimes, may be implemented in streams that support western pond turtle habitat. Monitoring by the JPA regarding how these flows affect habitat quality will be important. Changes to riverine systems, such as Cache Creek and Putah Creek, to conditions that are more natural will inherently benefit western pond turtles in the Plan Area.

Monitor Additional Threats

Nesting sites and nest success are thought to be the limiting factor for this species in the Plan Area. Identifying known or potential nest sites in the reserve system and along target streams will provide valuable information that informs efforts to conserve the species. Studies have shown that while western pond turtle populations can seem relatively stable due to the presence of adults, there may be minimal recruitment of juveniles into the population (Reese 1996). Focusing on aquatic habitats is important, but extending that focus to include adjacent uplands, where nesting could occur, is critical to guaranteeing the long-term stability of the populations.

6.5.7.3.5 Giant Garter Snake

Document and Monitor Status of Giant Garter Snake

Giant garter snake inhabits wetlands, agricultural wetlands, and associated waterways. These include sloughs, marshes, low-gradient streams, ponds, small lakes, irrigation and drainage canals, rice fields, and adjacent uplands (USFWS 1999).

Two methods will be used to monitor giant garter snake: visual surveys and trapping surveys. Visual surveys are less time and labor intensive and will be used initially to assess the status of giant garter snake on potential habitat, to assess habitat condition, and to prioritize sites for long-term management. Visual surveys are conducted when individuals can be counted while basking during the middle of the day during the peak of the snake's active season (April – August). The JPA will conduct visual surveys using the best available protocol for this species (e.g., USFWS 1999). The JPA will conduct these visual surveys systematically, along transects that run adjacent to potential aquatic habitat. Permanent transects should be established that can be used for future visual surveys, habitat assessments, and trapping surveys to facilitate long-term monitoring of giant garter snake. The JPA will use habitat assessments to guide management actions, and to assess the relationship between habitat characteristics, management actions, and occurrence of giant garter snake.

If necessary, floating traps, used in conjunction with mark-recapture techniques (e.g., Casazza et al. 2000), may be used to augment visual surveys, to document presence, generate indices of relative abundance, to document the size/age distribution of a population, and to estimate survival and recruitment within populations. If trapping is deemed necessary to augment visual surveys, the JPA will consult with USFWS and/or CDFW to develop trapping survey protocol. Trapping survey sites should be located along transects used for visual surveys and habitat assessments, so that trapping data can be compared with habitat assessments at each sample point.

In addition to surveying potentially suitable habitat for giant garter snake, the JPA will:

- Characterize conditions of potential aquatic habitat conditions (e.g., water depth, temperature).
- Characterize vegetation and structure of physical substrate in potential aquatic and adjacent upland habitat. Features that may be assessed include percent cover of dominant plant species, bare ground, basking sites, and land use of adjacent upland habitat.
- Document the presence of basking sites that could be monitored repeatedly.
- Document the presence of prey species as detected incidentally on visual surveys and caught in traps.
- Assess the presence of small mammal burrows and suitable refugia in adjacent uplands.

The JPA will document location data using GIS and will use this data to prioritize sites for enhancement and restoration. The JPA will also use this information to update the habitat model for giant garter snake. The JPA will provide occurrence data to the wildlife agencies through the CNDDB database, or other protocol approved by the wildlife agencies.

Evaluate Species Response to Enhancement and Restoration of Aquatic and Upland Habitat

The JPA will restore, manage, and enhance fresh emergent wetland complexes, rice fields, associated waterways (e.g., canals) and adjacent upland habitat to provide habitat for giant garter snake. Habitat degradation and fragmentation are primary threats to giant garter snake (USFWS

1999, 2006c) and ultimately, habitat fragmentation may limit the ability of giant garter snake to colonize habitat on the reserve system. Therefore, at unoccupied sites, the success of restoration and management will be assessed based on habitat-based performance criteria (e.g., percent cover of emergent vegetation and basking sites, minimum density of small mammal burrows or other suitable refugia in adjacent uplands), rather than the relationship between presence (or abundance) of giant garter snake and enhancement actions. For example, the JPA may monitor wetland vegetation in order to determine whether the vegetative cover and plant composition of a site is at target levels. This will be especially important at sites where habitat is restored. USFWS (1999) recommends that wetland vegetation be monitored to ensure that the cover measured on restored areas is 90% of the amount of cover on reference sites; that species composition of restored areas is 90% similar to that of reference sites; and that wetlands meet Corps jurisdictional criteria (USFWS 1999). The JPA should select reference sites from nearby sites that support relatively stable populations of giant garter snake. Should giant garter snake occur on the reserve system, the presence and relative abundance (if data are available) of giant garter snake will be compared amongst management treatments to assess the relative success of different management techniques.

Monitor Potential Threats

The JPA will monitor the presence of nonnative predators and competitors in giant garter snake habitat. Nonnative species such as domestic cats may prey on giant garter snake. Domestic cats have been observed hunting and killing giant garter snakes (USFWS 1993, as cited in USFWS 2006), even as far away as two miles from the closest urban development. The JPA will develop and implement an invasive animal control program if monitoring data indicate that nonnative predators and/or competitors are threatening the persistence, or expansion, of giant garter snake in the reserve system.

6.5.7.3.6 Swainson's Hawk

Document and Monitor Species Status

The JPA will monitor the nesting population within the Plan Area at 5-year intervals. Every 5 years, the JPA will conduct a complete census of the breeding population using methods described in Estep (2008). The census will include identifying active nest sites, associated land uses, reproductive output, and possible threats. Trends in the nesting population will reveal the extent to which the goal to maintain the nesting population is being met. If the nesting population declines by more than 10%, this will initiate a meet and confer process with the wildlife agencies, as described in Section 7.7.1.10, *Loss of Swainson's Hawk Habitat and Populations below Threshold*. The JPA and the wildlife agencies will examine causes for population declines as needed to assess the extent to which the decline could be related to land use/habitat changes or other activities within the Plan Area or other range-wide causes.

In association with nesting population monitoring, the JPA will monitor land uses/crop patterns and the extent of nesting habitat within the Plan Area at 5-year intervals. Using up-to-date aerial photos, the JPA will map the extent and type of each land use/crop type and suitable nest trees/habitat using GIS. The JPA will tally totals of each type and examine the data with regard to the extent of suitable foraging and nesting habitat for the Swainson's hawk. The JPA will conduct ground-truthing as needed. Trends in the extent of nesting and foraging habitat will reveal the extent to which habitat goals are being met in the Plan Area. Section 7.7.1.10, *Loss of Swainson's Hawk Habitat and*

Populations below Threshold, describes how the JPA will respond if the extent of suitable Swainson's hawk habitat in the Plan Area drops below a specified threshold.

JPA will annually monitor land uses/crop types to confirm the property is meeting easement conditions regarding crop restrictions and management. Annual monitoring of each conservation property will require a site visit to examine and record conditions. If conditions are not being met, the JPA will intervene and notify the landowner to address deficiencies.

The JPA will annually monitor the extent of existing and future nesting habitat on the reserve system. The JPA will monitor the trend in the sustainability of trees that can provide habitat and actions taken to maintain or create new nesting habitat. The goal on each reserve system property will be to increase the extent of nesting habitat by avoiding removal of trees, allowing for regeneration, and planting future nesting trees in hedgerows and other locations. The planting of new native trees will include determining success rates and remedial action.

Evaluate Species Response to Habitat Enhancement and Restoration

The JPA will monitor the success and condition of habitat restoration actions, such as hedgerows and tree planting. Success rates and remedial actions will be established to ensure that easement conditions for these elements are being met. The JPA will monitor management actions that are included in the easement conditions, such as postponing disking and bedding of harvested fields until later in the breeding season, leaving sufficient uncultivated space around mature trees, and restricting the use of rodenticides. If conditions are not being met, the JPA will intervene and notify the landowner to address deficiencies.

6.5.7.3.7 White-Tailed Kite

Document and Monitor Species Status

The JPA will monitor the nesting population of the white-tailed kite within the Plan Area at 5-year intervals while searching for Swainson's hawk nests. Every 5 years, a complete census of the breeding population will be conducted by the JPA using methods described in Estep (2008). The census will include identifying active nest sites, associated land uses, reproductive output, and possible threats. The JPA will evaluate causes for population declines as needed to assess the extent to which the decrease could be related to land use/habitat changes or other activities within the Plan Area or other range-wide causes.

Evaluate Species Response to Habitat Enhancement and Restoration

The JPA will monitor the success and condition of habitat restoration actions, such as hedgerows and tree planting. Monitoring will occur in conjunction with Swainson's hawk monitoring as described above.

6.5.7.3.8 Western Yellow-Billed Cuckoo

Document and Monitor Species Status

The JPA will survey all suitable western yellow-billed cuckoo habitat within the reserve system, in accordance with the survey schedule described in the introduction to Section 6.5.7.3, *Species-Level Actions*, to document the baseline estimate of the population size within the Reserve System. The JPA will monitor and evaluate the condition of yellow-billed cuckoo habitat in the riparian woodland

areas along, portions of the Sacramento River, Cache Creek and Putah Creek. Baseline information for the species will comprise the components listed below.

- Location of occupied habitat.
- Estimate of number of breeding pairs
- Assessment of nesting habitat quantity and quality (e.g., percent of native and nonnative plants).
- Assessment of any additional nearby threats (e.g., sources of noise or other disturbance).

Evaluate Species Response to Habitat Enhancement, Creation, or Restoration

Additional surveys conducted by the JPA will be focused along riparian corridors where restoration and enhancement is expected to occur; for example, along Cache Creek through Cache Creek Resources Management Plan activities.

Monitor Additional Threats

Studies to determine nest success will be conducted annually if nesting is detected in the Plan Area. The results of these studies will inform management decisions to increase nest success in the Plan Area. Potential management actions are listed below.

- Feral cat removal or relocation.
- Nonnative predator control.
- Restricted public access to important breeding areas during the nesting season.

6.5.7.3.9 Least Bell's Vireo

Document and Monitor Species Status

The JPA will conduct surveys of valley foothill riparian providing habitat for least Bell's vireo within the reserve system. Initially, the JPA will document any nesting activity in the Plan Area. Since least Bell's vireos have been documented potentially breeding at only one location in the recent past, the JPA may use other songbird species (e.g., song sparrow, common yellowthroat, Wilson's warbler, black headed grosbeak) that nest in the understory of riparian woodland as indicators of habitat quality until least Bell's vireos are documented nesting in the Plan Area. The focus areas for least Bell's vireo will initially be the species' modeled habitat (Appendix A, *Species Accounts*) within the reserve system. Surveys along these stream reaches will characterize the songbird communities (also part of natural community monitoring) and detect any least Bell's vireos present during the nesting season. Species status will be based on presence in the reserve system. The JPA will also monitor targeted sites outside the vireo's modeled habitat at least every 5 years to determine if habitat is expanding. Through adaptive management, the vireo model may change in the future due to new information.

Surveys will consist of either standard point count or area search methods (Ralph et al. 1993) depending on the terrain and size of the reach. The nesting season for riparian songbirds is typically April 15–July 31 in the Plan Area. The JPA will record locations of all singing males, nests, or other evidence of breeding activity using a GPS receiver. During baseline surveys, the JPA will revise the species habitat model as needed to reflect riparian habitat quality and actual nesting habitat within the reserve system. The JPA will focus subsequent surveys on those areas to monitor changes in the population.

Evaluate Species Response to Habitat Enhancement and Restoration

Additional surveys conducted by the JPA will be focused along riparian corridors outside the reserve system where enhancement and restoration activities will take place along portions of Sacramento River, Cache Creek and Putah Creek. Those alterations could change the riparian vegetation, making it more or less suitable for breeding least Bell's vireo. The JPA will assess actual effects by monitoring breeding least Bell's vireo populations along these stream reaches, should they be present or, in their absence, by monitoring breeding populations of other riparian understory obligates. Some modifications to land use, such as excluding livestock from stream corridors or stabilizing sources of sediment, could also change the vegetative structure along stream reaches. Monitoring least Bell's vireo and other riparian obligate songbird species will offer insight into how these changes affect the function of the riparian community..

Monitor Additional Threats

The JPA assumes that the distribution of the local population will continue to expand northward as it has in the recent past. Once a least Bell's vireo population is established in the Plan Area, there could be additional threats to nests and adults. Studies to determine nest success will be conducted annually once nesting is detected in the Plan Area. In addition to documenting nest success, these studies will document reasons for nest failure and incidence of brown-headed cowbird parasitism (a major threat in established populations in southern California). The results of these studies will inform management decisions to increase nest success in the Plan Area. Potential management actions are listed below.

- Brown-headed cowbird control program.
- Feral cat removal or relocation.
- Native and/or nonnative predator control (e.g., red fox, raccoon, skunk).
- Restricted public access to important breeding areas during the nesting season.

6.5.7.3.10 Bank Swallow

Document and Monitor Species Status

The JPA will monitor all suitable floodplain habitat within the reserve system in accordance with the survey schedule described in the introduction to Section 6.5.7.3, *Species-Level Actions*, to document the baseline estimate of the population size within the reserve system. The bank swallow is intimately tied to natural river processes. Since most colonies are located on eroding river banks, presence of this species in sustainable numbers is an indicator of the healthy riparian ecosystem that results from a river's lateral migration within its floodplain. The combination of hydrology, erosion, sediment deposition, river migration, and ecological disturbance and succession result in the physical and biological environment that provides essential habitat for the bank swallow. Baseline information for the species will comprise the components listed below.

- Location of active nest colonies.
- Estimated number of individuals and nests or actively used nest holes in the colony.
- Presence of apparently old colonies (i.e., old colony site no longer occupied) and the number of nest holes.
- Assessment of nesting habitat and riverine quality.

- Assessment of natural river processes, natural water flows, erosion, flooding, and sedimentation.
- Assessment of additional nearby threats.

The JPA will document this information in GIS layers and use it to prioritize areas for protection and enhancement.

The JPA will survey potentially suitable habitat once every five years. If bank swallows are found nesting on reserve lands, colonies will be monitored annually to determine presence, estimate colony size, and assess potential threats to the colony.

The JPA will develop monitoring protocols to assist in demonstrating compliance with species occupancy requirements described in Table 6-2(a), *Newly Protected Lands Commitments*, and 6-2(b), *Pre-permit Reserve Lands Commitments*.

Additional surveys conducted by the JPA will be focused along riparian corridors where stream or riparian restoration activities, are expected to occur, such as along portions of Sacramento River, Cache Creek and Putah Creek. Potentially suitable habitat will be surveyed regularly, using the methods described above, to assess the use of restored and enhanced habitat by bank swallows and to inform future restoration and enhancement projects. Restoration and enhancement actions in or adjacent to nesting colonies will occur outside the breeding season.

Monitor Additional Threats

Bank swallow nesting habitat is naturally ephemeral, as natural river processes erode existing banks while creating new, suitable nesting habitat; therefore, the existing colony sites in the Plan Area are subject to erosive forces that may collapse the existing nest colony sites while potentially generating new, suitable habitat.

6.5.7.3.11 Tricolored Blackbird

Document and Monitor Species Status

The JPA will survey all suitable fresh emergent wetland and other appropriate nesting areas within the reserve system in accordance with the survey schedule described in the introduction to Section 6.5.7.3, *Species-Level Actions*, to document the baseline estimate of the population size within the reserve system. Baseline information for the species will comprise the components listed below.

- Location of occupied wetlands and hedgerows or other breeding sites.
- Estimate of number of birds in colony.
- Assessment of nesting habitat quantity and quality (e.g., percent of native and nonnative plants).
- Assessment of any additional nearby threats (e.g., heron rookeries, sources of noise or other disturbance).
- Identification of nesting on agricultural lands where harvest will take place.

The JPA will document this information in GIS layers and use the data to prioritize areas for enhancement or restoration.

Once baseline data are collected, the JPA will conduct monitoring for tricolored blackbird colonies during the breeding season. The JPA will estimate population size of established colonies in the Plan Area. Tricolored blackbirds typically nest from early April through early June. Since the probability of detecting nesting colonies is highest during May, the JPA will conduct surveys during or near the month of May. Each colony should be visited twice during the breeding season, preferably 10–14 days apart, to determine a range of breeding individuals at the colony, by at least two observers on the same day. The mean number of birds estimated by the two observers can be used to determine the size of the breeding colony. The surveyor will observe the colony through binoculars or a spotting scope at a distance that will not change the behavior of the nesting birds. The JPA may revise these monitoring guidelines if better methodologies become available based on the best available scientific information during implementation.

Evaluate Species Response to Habitat Enhancement, Restoration, or Creation

The JPA will monitor enhanced or restored fresh emergent wetland areas twice from April to June to determine if a tricolored blackbird nesting colony is present or, if one is already established, to document the current population size. In habitat where tricolored blackbird colonies currently exist, the JPA will conduct all enhancement or restoration activities outside the nesting season. Following those management actions, the JPA will monitor tricolored blackbird colony size to determine the population response to the management actions. In target areas where tricolored blackbirds were not observed prior to management actions, subsequent surveys will document whether new colonies establish in the area.

Monitor Additional Threats

In instances where tricolored blackbirds are nesting in nonnative plants (e.g., Himalayan blackberry), there is the risk that nonnative species control could result in the loss of nesting habitat. Accordingly, the JPA will weigh the removal of nonnative plant species against the loss of important nesting habitat for this species. The JPA should attempt to transition the nonnative habitat to native habitat that will also support nesting tricolored blackbirds. The JPA will monitor colony response to those actions and the result will inform future management prescriptions for colony sites with nonnative plants.

In general, it is difficult to monitor nest success of tricolored blackbirds because while nesting they are very susceptible to disturbance. Some information about colony success can be gained through annual monitoring of colony size, but this approach often fails to identify specific stressors. Some species (e.g., feral cats) can have a deleterious effect on colonies. For colonies that are near urban areas, feral cat removal programs could increase the success of nesting tricolored blackbirds. Similarly, robust populations of nonnative red foxes or even native skunks and raccoons can have significant adverse effects on nesting birds. In general, control programs will not address native species. Targeted programs could be initiated, however, in response to observations of individuals taking nests, eggs, or nestlings.

6.5.8 Data and Reporting

Proper data management, analysis, and reporting are critical to the success of the monitoring and adaptive management program. Data on monitoring methods, results, and analysis must be managed, stored, and made available to JPA staff, decision makers, scientific advisors, wildlife agencies, other interested government agencies including the Corps and Regional Boards, and other appropriate persons. A database and clear reporting procedure are also required for permit

compliance. The requirements for database development, maintenance, and data reporting for monitoring are described in Chapter 7, *Plan Implementation*. The reporting requirements for monitoring include the following (also found in Chapter 7):

- A description of the landscape-, natural community–, and species-level monitoring undertaken during the reporting period and a summary of monitoring results, including covered species status and trends.
- A description of the adaptive management process utilized during the reporting period (e.g., consultation with science advisors).
- A summary of the recommendations or advice provided by the wildlife agencies, science advisors, and the Independent Conservation Assessment Team (if applicable) regarding adaptive management and monitoring.
- A summary of the monitoring program objectives, techniques, and protocols including monitoring locations, variables measured, sampling frequency, timing, and duration, analysis methods, and who performed the analyses.
- An assessment of the efficacy of the monitoring and research program and recommended changes to the program based on interpretation of monitoring results and research findings.
- An assessment of the efficacy of habitat restoration and creation methods in achieving performance objectives and recommended changes to improve the efficacy of the methods.
- A description of all HCP/NCCP directed studies undertaken during the reporting period; a summary of study results; and a description of integration with monitoring, assessment, and compliance elements.
- An assessment of the appropriateness of performance indicators and objectives (see Table 6-11 for examples) based on the results of effectiveness monitoring, and recommended changes to performance indicators and objectives.
- A description of any actions taken or expected regarding changed circumstances, including remedial actions.
- A description of any unforeseen circumstances that arose and responses taken.

6.6 Post-Permit Conservation Requirements

After the permit term, the Permittees are obligated to continue to manage and maintain the reserve system. Land acquired for the reserve system must continue to be managed beyond the permit term to ensure it retains the biological values established during the permit term. Similarly, limited monitoring will continue beyond the permit term to ensure that management actions are effective. Other obligations, however, disappear after the permit term. Land acquisition, enhancement, restoration, and creation obligations will be completed prior to the end of the permit term and will not continue post-permit.

The JPA or its successor[19] will be responsible for ensuring the management of reserve system lands in perpetuity. All reserve system lands will be managed in perpetuity according to the applicable Reserve Management Plan.

[19] The JPA may or may not exist after the permit term. Regardless, all Permittees have the obligation to maintain the reserve system after the permit term.

Following the permit term, the JPA or its successor will continue to conduct effectiveness monitoring, though at a reduced scale from that required during the term of Permits. Compliance monitoring is not required after the permits end. Effectiveness monitoring actions that the JPA or its successor will implement post-permit may include the following.

- Monitoring of nonnative species on reserve lands to determine if control actions need to be implemented to maintain covered species habitat functions, in perpetuity.
- Monitoring of ecological responses to substantial changes in management (e.g., grazing regimes) of reserve lands implemented during the post-permit period, in perpetuity.
- Monitoring necessary to document the status and trends in natural communities and covered species and their habitats on reserve lands at 10 year intervals to provide information necessary to determine the ongoing effectiveness of the reserve system in maintaining ecological functions, in perpetuity.

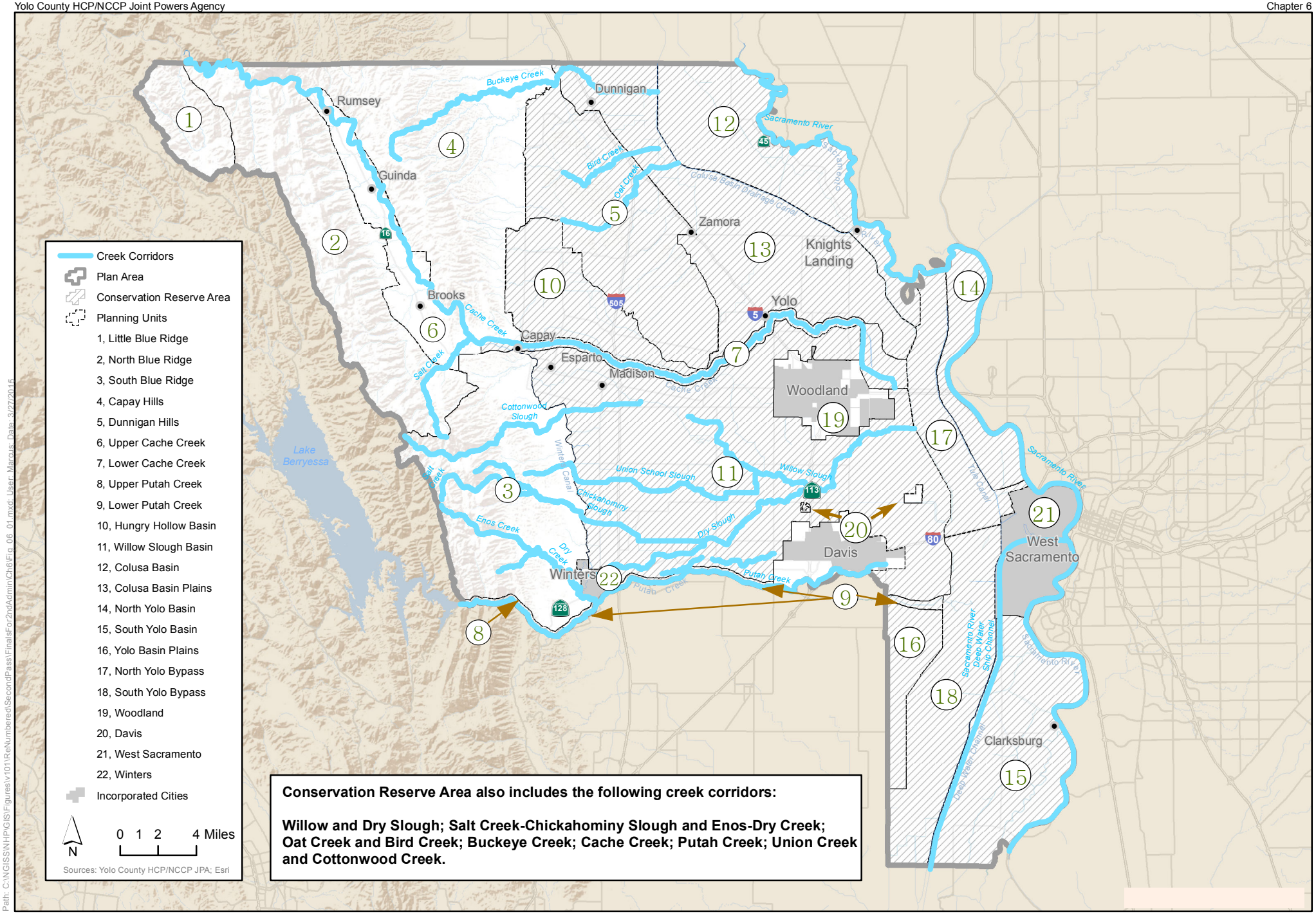

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Figure 6-1

Planning Units and Conservation Reserve Area

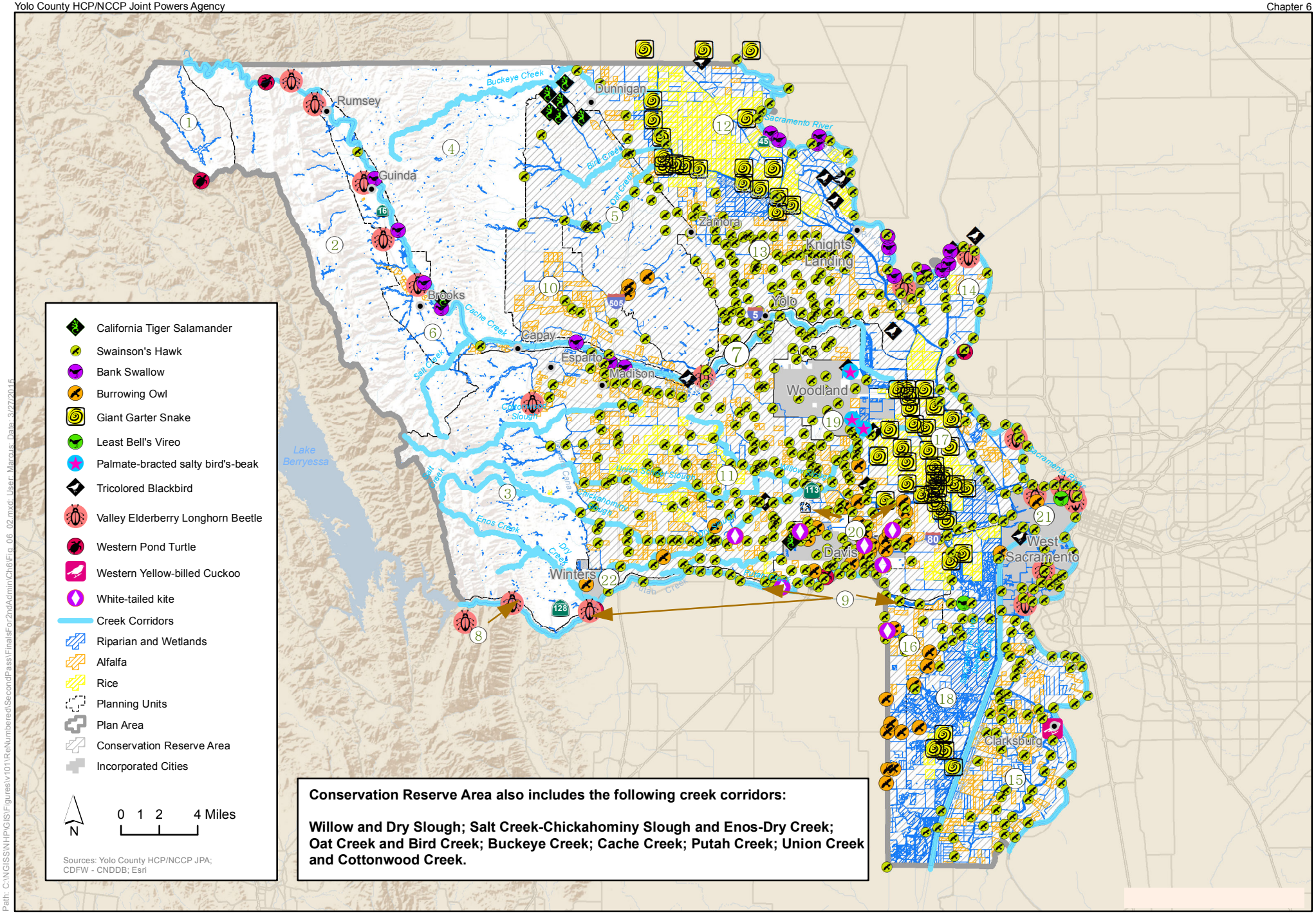

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Figure 6-2
Covered Species Occurrences

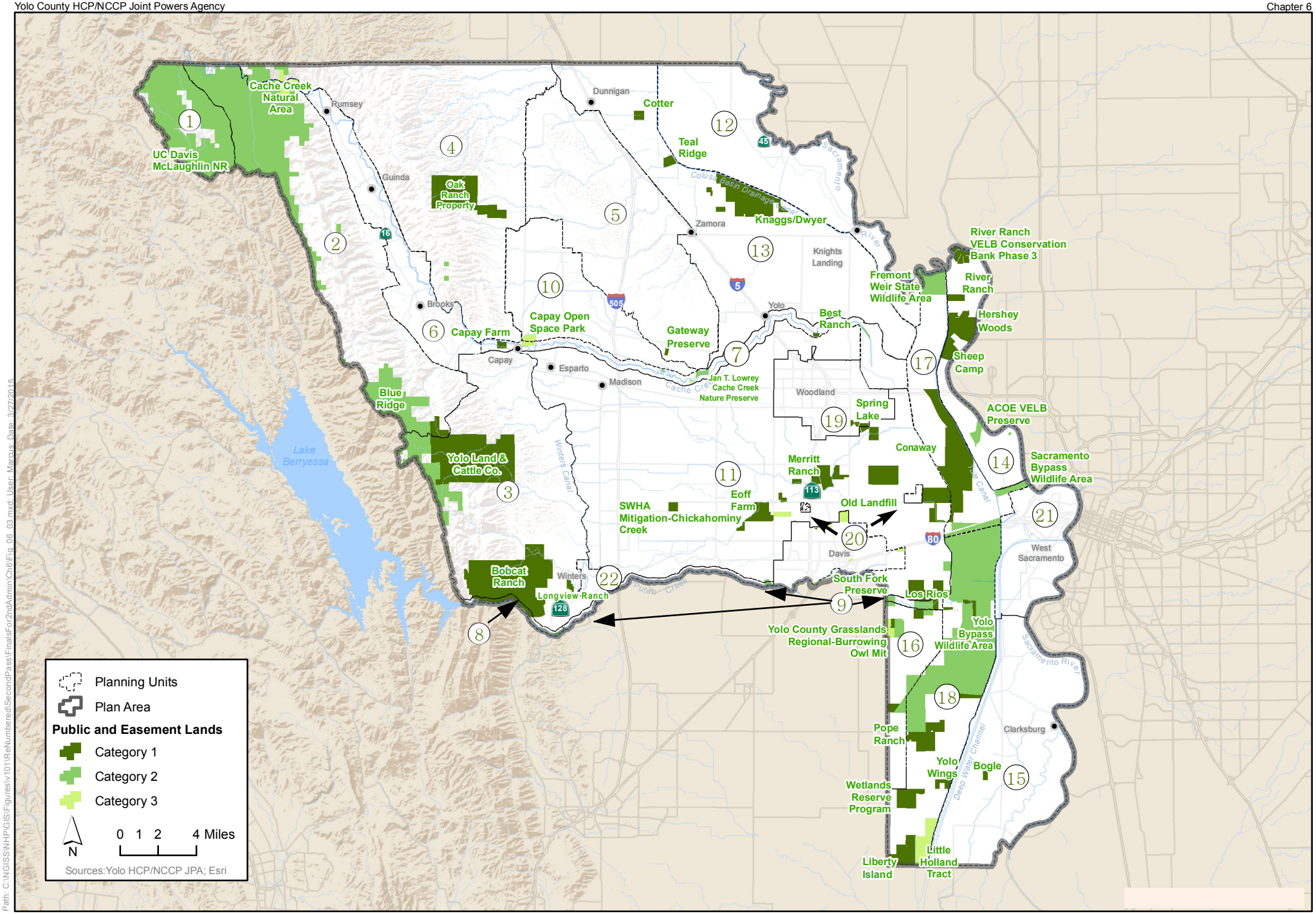

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Figure 6-3

Baseline Public and Easement Lands

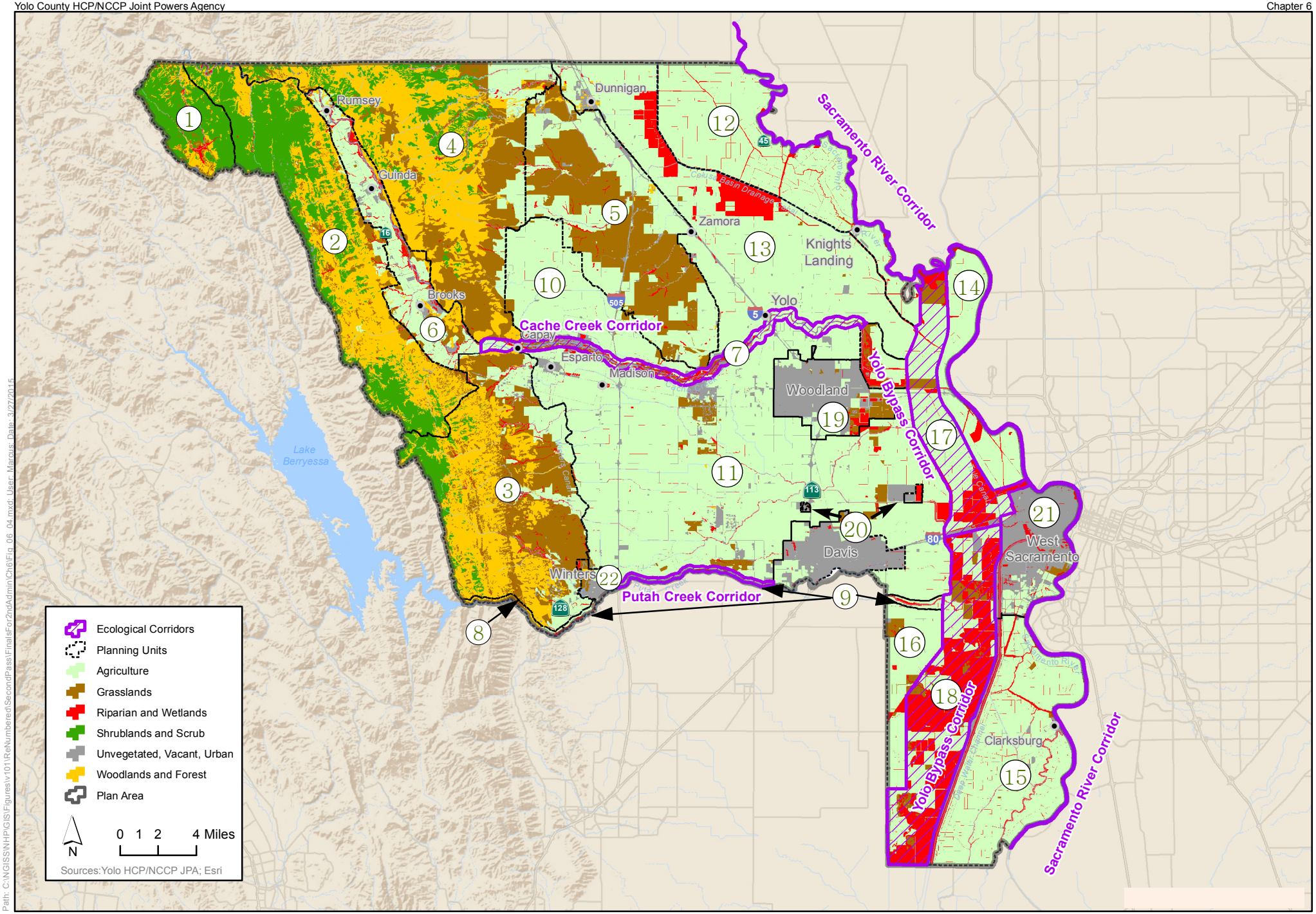

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Figure 6-4
Ecological Corridors

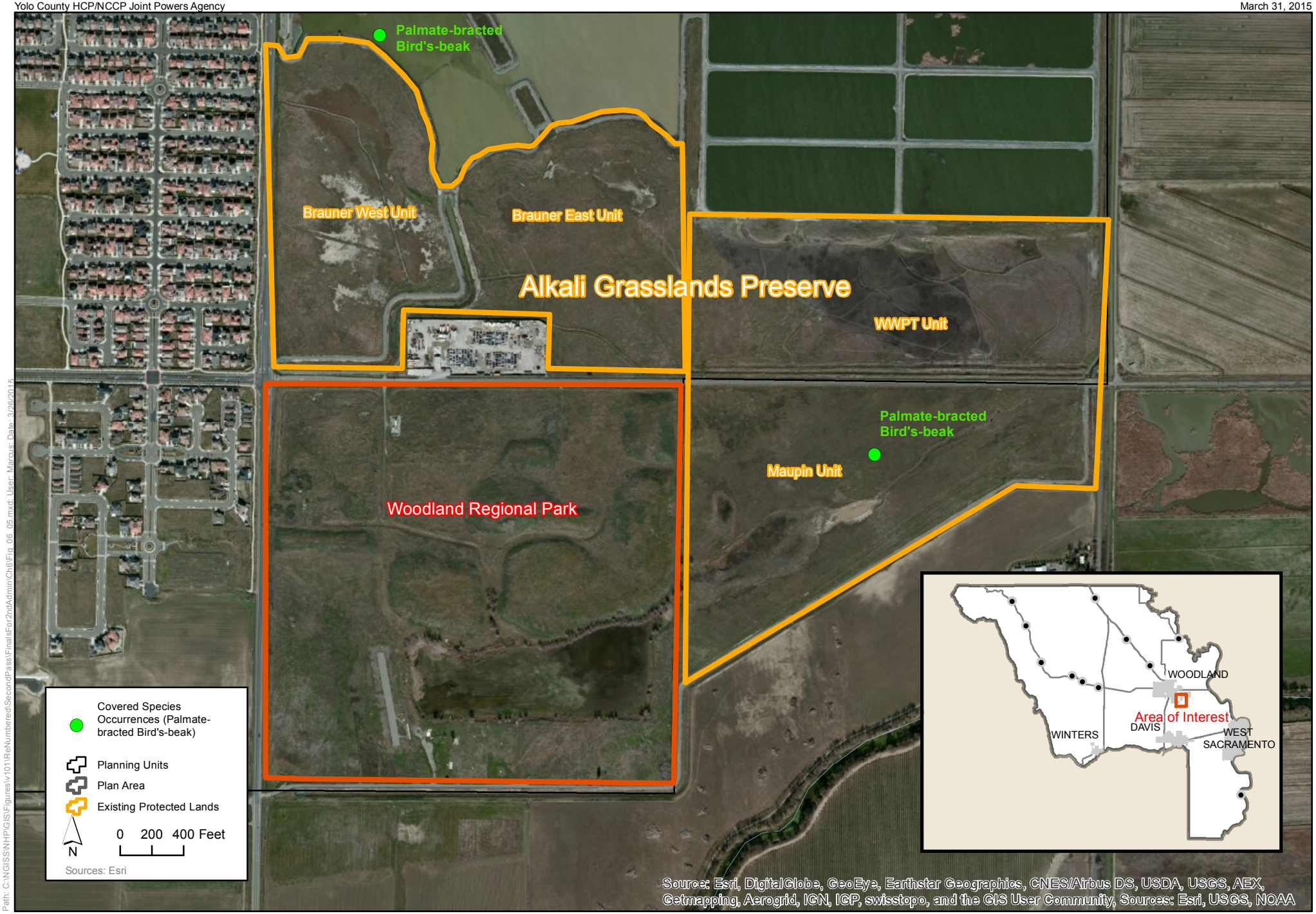

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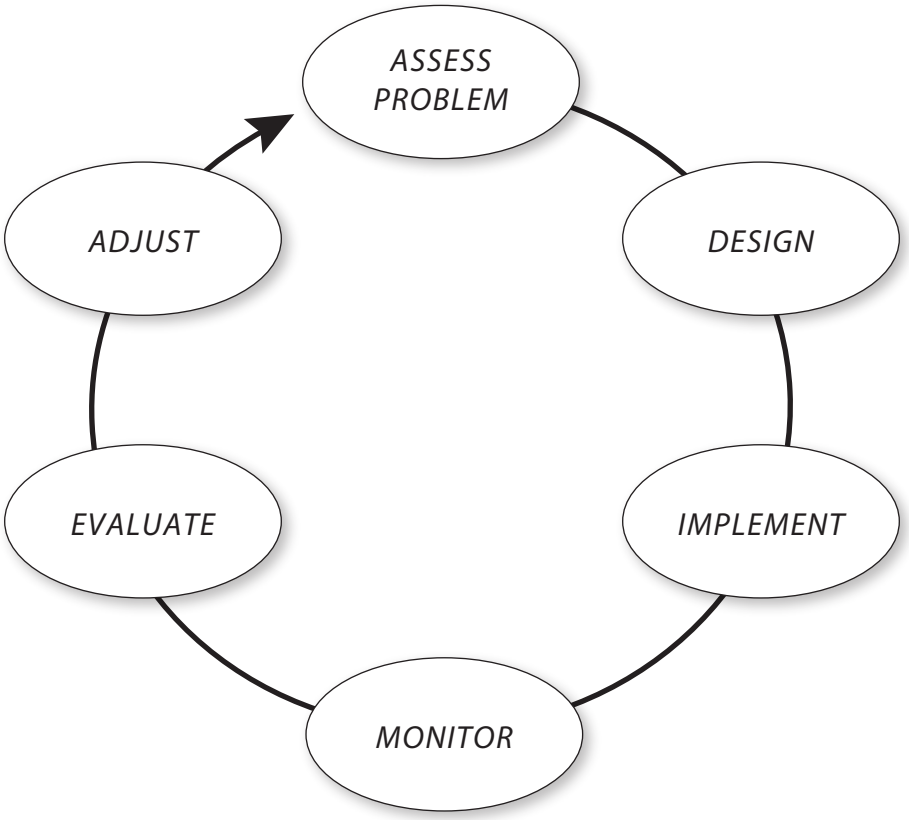
Figure 6-5

Alkali Prairie Natural Community and Public Easement Lands

Adaptive Management Process



Adapted from William et al. 2007.

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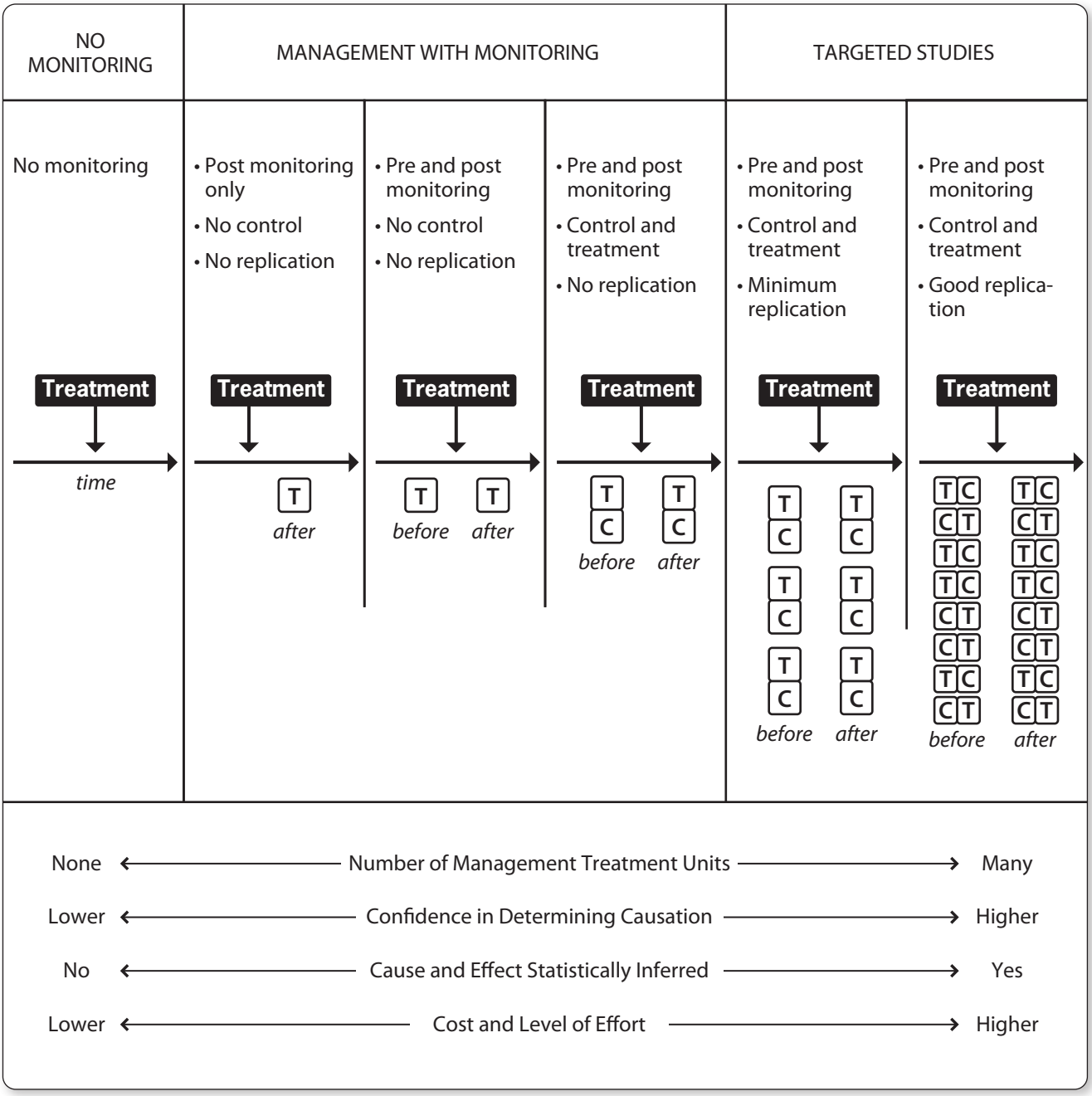
Figure 6-6
Adaptive Management Process



Adapted from Elzinga et al. 1998.

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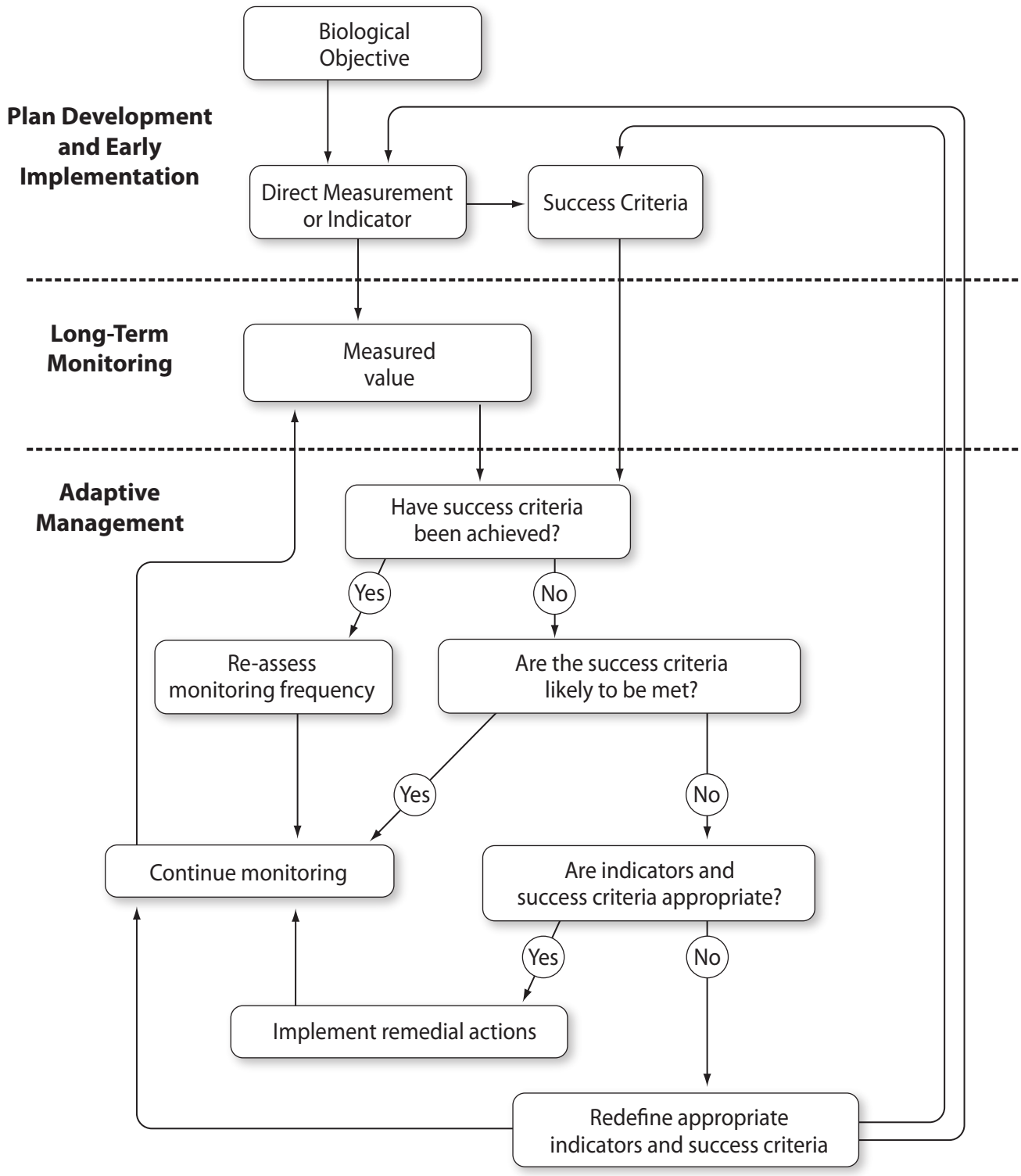
Figure 6-7
Continuum of Experimental Management



Adapted from Draft Guadalupe River Project, Downtown San Jose, California, Mitigation Monitoring Report (Jones & Stokes 2002)

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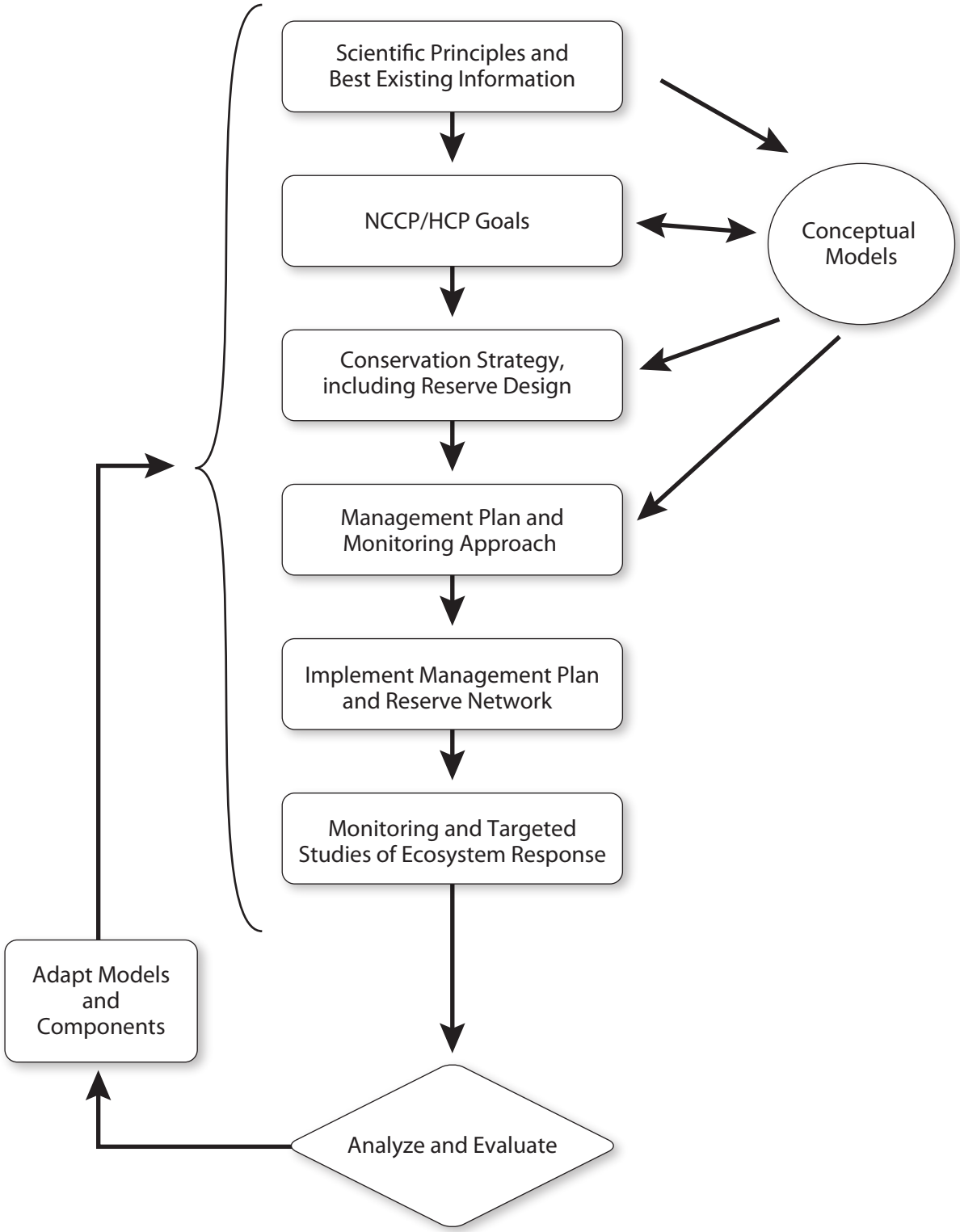
Figure 6-8
Flowchart of the Adaptive Management Process



Excerpted from Atkinson et al. 2004.

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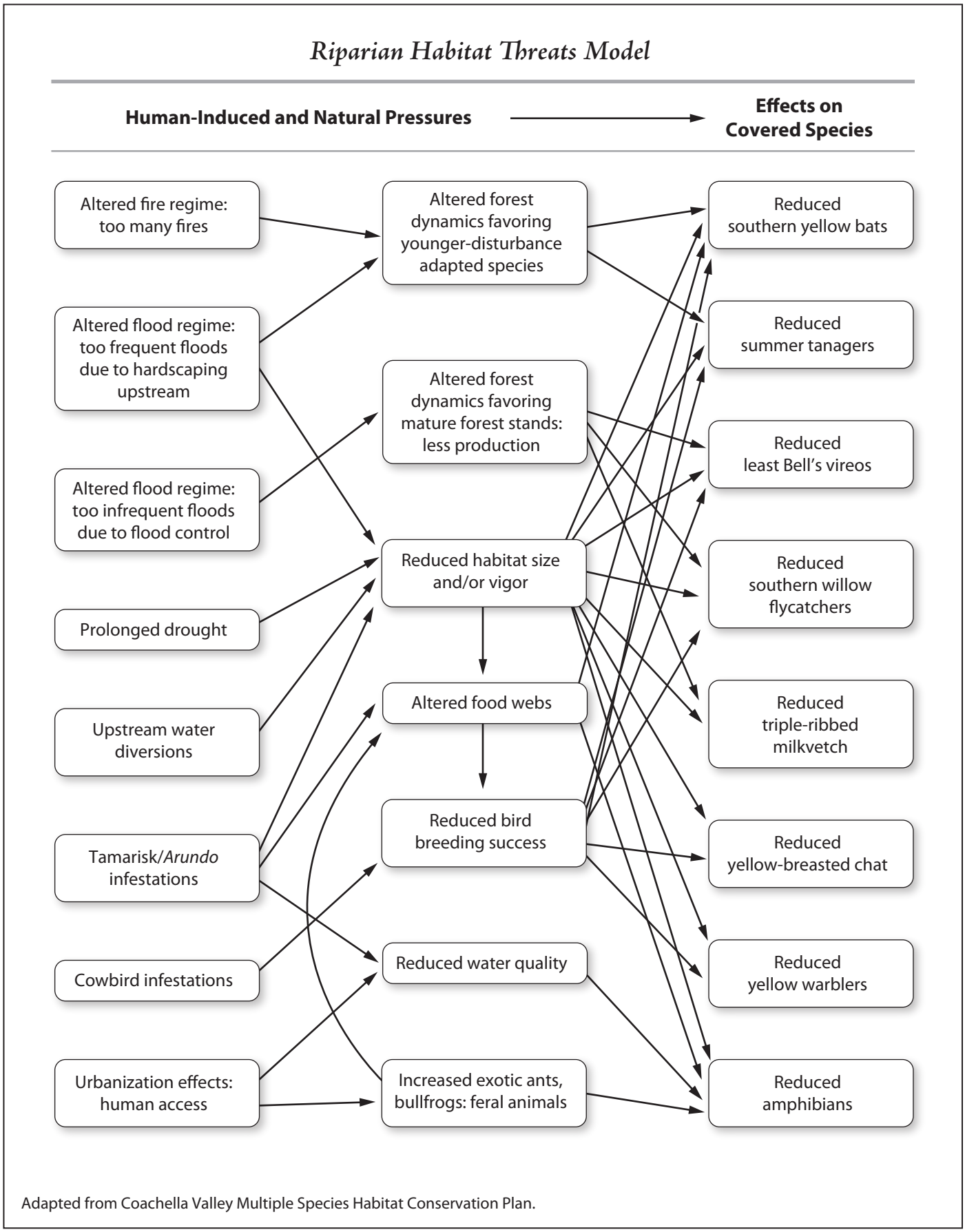
Figure 6-9
Adaptive Management Feedback Loop



Adapted from Coachella Valley Multiple Species Habitat Conservation Plan.

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Figure 6-10
Example Stress-Response Model 1

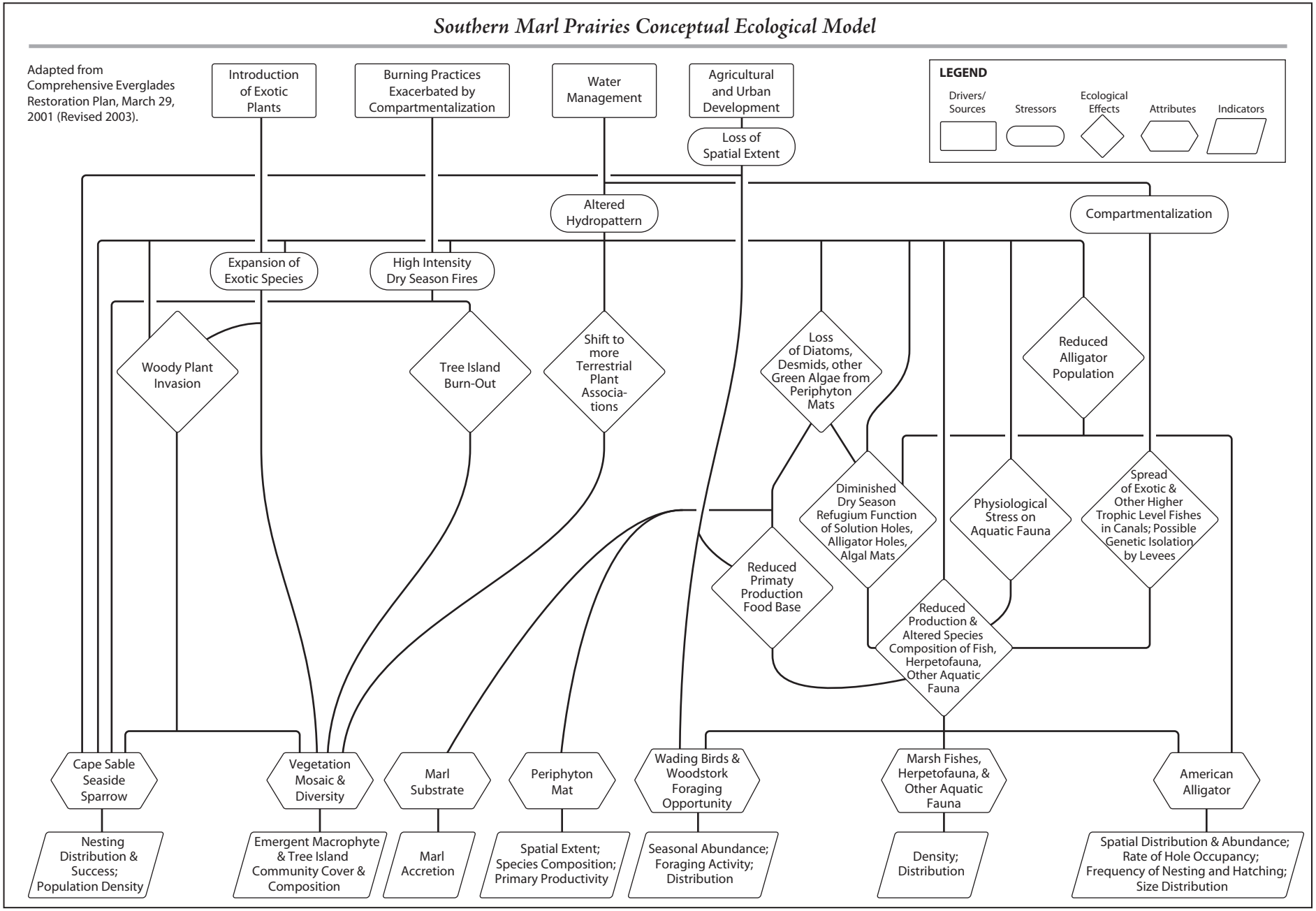

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Figure 6-11
Example Stress Response Model 2