CHAPTER 5. CONSERVATION STRATEGY

5.1 INTRODUCTION

This chapter presents the Butte Regional Conservation Plan (BRCP) Conservation Strategy, which consists of multiple components that are designed collectively to achieve the BRCP planning goals and conservation objectives described in Chapter 1, *Introduction*, and the Planning Agreement (Appendix H, *Butte Regional Conservation Plan Planning Agreement*). The Conservation Strategy identifies the intended biological outcomes of BRCP implementation and describes the means by which these outcomes will be achieved. The Conservation Strategy includes specific and measurable BRCP biological goals and objectives and a comprehensive set of conservation measures designed to provide for the conservation of covered species and the natural communities upon which they depend, and to appropriately avoid, minimize, and mitigate for the impacts of the covered activities (Chapter 2, *Covered Activities*) on these resources. The Conservation Strategy provides for the establishment of monitoring and adaptive management programs to ensure the BRCP conservation measures can evolve as new data and information become available. The BRCP Conservation Strategy has been developed to meet the regulatory standards of section 10 of the federal Endangered Species Act (ESA)[1] and the state Natural Community Conservation Planning Act (NCCPA).

The elements of the Conservation Strategy are as follows:

- Methods and approach to achieving conservation, including a framework and assembly principles for the development of the system of conservation lands based on the principles of conservation biology (Section 5.2, *Methods and Approach*).
- Biological goals and objectives for landscape, natural community, and species-specific levels that represent the intended biological outcomes of BRCP implementation (Section 5.3, *Biological Goals and Objectives*).
- Conservation measures (Section 5.4, *Conservation Measures*) to achieve the biological goals and objectives
- A description of how implementation of the conservation measures is expected to conserve each of the natural communities, covered species, and BRCP local concern species (described in Section 5.5, *Conservation Provided for Natural Communities*, Section 5.6, *Conservation Provided for Covered Species*, and Appendix N, *Benefits of Conservation Measures for Local Concern Species*, respectively).

[1] The BRCP also provides the necessary information for (U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NFMS) intra-agency consultations under section 7 of the ESA to support the permit issuance decisions by these agencies.

5.2 METHODS AND APPROACH

The methods and approach to developing the Conservation Strategy are described in this section, including the framework of the Conservation Strategy and the development of the terrestrial and aquatic components of the Conservation Strategy.

5.2.1 Framework for the Conservation Strategy

The Conservation Strategy is designed to meet the regulatory requirements of ESA and the NCCPA and to streamline compliance with California Environmental Quality Act of 1970 (CEQA), National Environmental Policy Act of 1969 (NEPA), and other applicable environmental regulations (Chapter 1, *Introduction*). To meet the NCCPA permit standards, the Conservation Strategy provides for the conservation of covered species by protecting, enhancing, restoring, and managing natural communities and species habitat. The Conservation Strategy also achieves the objectives listed below, pursuant to the NCCPA (Fish and Game Code Section 2820).

- Conserve, restore, and provide for the management of representative natural and semi-natural[2] landscapes.
- Establish reserves that provide for the conservation of covered species within the BRCP geographic area and linkages to adjacent habitat outside the BRCP Plan Area.
- Protect and maintain habitat areas that are large enough to support sustainable populations of covered species.
- Incorporate in the reserves (BRCP conservation lands) a range of environmental gradients and high habitat diversity to provide for shifting species distributions in response to changing circumstances.
- Sustain the effective movement and interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the reserve system (BRCP conservation lands).

The Conservation Strategy is based on the best scientific data available (Chapter 3, *Ecological Baseline Conditions* and Appendix A, *Covered Species Accounts*) and was designed using a multi-level ecological approach in accordance with principles of conservation biology (Noss 1987). At the highest ecological level, biological goals and objectives were developed to encompass ecological processes, environmental gradients, biological diversity, and regional landscape connectivity. Conservation measures were developed to achieve these landscape-level goals and objectives. At the middle ecological level, goals, objectives, and conservation measures were developed to conserve natural communities through the protection, enhancement,

[2] A semi-natural landscape is defined as one that is disturbed by human activity but still provides important habitat for a variety of native species.

restoration, and management of physical habitat. At the finest ecological level goals, objectives, and conservation measures address additional specific needs (additional to the landscape-level and natural community-level conservation) of covered species to protect individuals and populations and to protect and enhance specific areas of species habitat.

Using this hierarchical approach, the conservation needs of many covered species are met through the landscape and natural community-level measures, with additional conservation needs met by species-specific measures for covered species whose conservation needs could not be fully addressed at the landscape and natural community levels.

The conservation measures are described with sufficient detail and specificity to allow for their implementation. Because of the large scale and long timeframe over which the BRCP will be implemented, the conservation measures are also designed to be flexible to allow for adaptive management with ever increasing knowledge over time. For example, natural community-level actions provide broad management guidelines and principles so future land managers can implement specific techniques on the grounds that are best suited to site conditions. Preserving this flexibility is an important component of the Conservation Strategy.

5.2.2 Information Sources

Primary sources of information used to develop the Conservation Strategy include the following:

- Ecological information presented in Chapter 3, *Ecological Baseline Conditions*;
- Covered species life history and status information presented in Appendix A;
- Recommendations provided by the BRCP Independent Science Advisory Panel (see Appendix G, *Independent Science Advisors Reports*;
- Relevant United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) biological opinions issued under ESA;
- The *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005);
- The public draft recovery plan for Central Valley salmonids (NMFS 2009);
- Previously prepared species conservation and management plans applicable to the Plan Area;
- Information provided by technical experts familiar with the ecological resources of and conservation opportunities in the Plan Area;
- Information provided by USFWS, NMFS, and California Department of Fish and Wildlife (CDFW) resource experts; and
- Covered species habitat models presented in Appendix A.

5.2.3 Assembly of Conservation Lands

5.2.3.1 Regulatory Context

A major aspect of a Natural Community Conservation Plan (NCCP) is to describe the proposed design of a reserve system[3] within the plan area. The NCCPA requires that a reserve system (referred to as a "system of habitat reserves") or equivalent conservation be described in the plan:

> *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 reserve system does not need to be specifically described with demarcated boundaries on a map; rather, it can be described based on a defined process driven by a set of design criteria. Such design criteria for the BRCP follow the BRCP conservation land assembly principles described in Section 5.2.3.6, *Role of Public and Easement Habitat Lands* and are listed as site selection criteria in Conservation Measure 1. The reserve system under the BRCP is referred to as the "BRCP conservation lands."

5.2.3.2 Ecosystem Considerations

The NCCPA requires that the plan address the conservation of ecosystem functions, environmental gradients, biological diversity, and shifting species distributions. A well-prepared Habitat Conservation Plan (HCP) under the ESA also addresses these issues, though there is no specific regulatory requirement to do so under the ESA. As a joint HCP/NCCP the BRCP addresses the species, habitat, and natural community conservation requirements of both ESA and NCCPA. Conservation of biological diversity in the Plan Area is addressed through a number of conservation measures and application of the following elements of the Conservation Strategy.

- **Landscape-Level Conservation.** Landscape-level goals address the spatial distribution of natural communities on major geomorphic surfaces or landforms in the Plan Area This approach conserves the natural communities and biodiversity associated with each of the geomorphic landforms.
- **Connectivity and Patch Size.** Conservation land assembly principles addressing minimum patch sizes and connectivity for each natural community also support

[3] The term reserve" refers to any area of land or water used in implementing the HCP/NCCP to achieve the conservation goals of the plan. These areas may be acquired and protected through fee title or conservation easement and may include existing, restored, created, or enhanced habitat. The reserve system refers to the complete assemblage of reserves within the plan area. The BRCP refers to this "reserve system" as the "BRCP conservation lands."

conservation of biodiversity. Species with the largest range and movement requirements and species that are most sensitive to movement barriers were used to set minimum thresholds for protection of natural communities and thus serve as appropriate parameters for addressing these habitat requirements for other native species in the Plan Area.

- **Environmental Gradients.** Measures to protect environmental gradients also protect biodiversity. Environmental gradients are important to biodiversity, individual and population movement and migration, and shifting species distributions. The landscape-level goals and objectives are designed to direct the distribution of and spatial relationships among BRCP conservation lands so natural environmental gradients present in the Plan Area will be protected. Regional climate change as a result of factors causing global climate change is anticipated to result in shifting species distributions within the Plan Area. Based on predicted changes in local climate, it is anticipated that species distributions will shift to higher altitudes and higher latitudes (though some plant and invertebrate distributions may shift more in response to moisture changes). Thus, protecting natural environmental gradients across elevations in the Plan Area will provide an appropriate range of conditions to accommodate these distributional shifts.
- **Ecological Processes.** The conservation strategy includes conservation land assembly principles and habitat management measures to address ecological processes. The configuration of BRCP conservation lands (size, shape, and proximity to developed land) can have a profound effect on the type and effectiveness of habitat management techniques that can be used (e.g., managed grazing, controlled fire, and watershed management). Habitat management measures to recreate natural disturbance regimes and a mosaic of successional ecological communities also serve to maintain biodiversity.

5.2.3.3 Landscape Context -- Conservation Acquisition Zones

To facilitate the development of a spatially explicit conservation strategy, and to ensure that biological goals and objectives are addressed consistently throughout the Plan Area, the Plan Area is divided into six Conservation Acquisition Zones (CAZs): Sierra Foothills, Cascade Foothills, Northern Orchards, Southern Orchards, Basin, and Sacramento River (Figure 3–1, *Butte Regional Conservation Plan Conservation Acquisition Zones (CAZ)*).

CAZs are large sections of the Plan Area each dominated by different large-scale ecological, geomorphic and land use conditions. Each CAZ supports its own predominant ecological, topographical, landscape, and other natural community conditions that differentiate it from other CAZs. While CAZs were generally identified for major natural geomorphic and ecological features, the specific CAZ boundaries were delineated using clearly recognizable features, such as roads and parcel boundaries, rather than vegetation, soil type, or geologic feature edges, to allow for easy identification of those boundaries for planning and implementation of the BRCP.

The primary purpose of CAZ units is to describe the specific areas in which conservation actions (such as land acquisition and habitat restoration) will occur without necessarily identifying

individual parcels for the actions. For each CAZ, specific goals and criteria are identified in the conservation strategy for the protection of natural communities and species habitats they support such that an organized assembly of the system of conservation lands can be conducted by Butte County Association of Governments (BCAG) as the Implementing Entity (see Chapter 9, *Implementation Structure*).

This approach focuses conservation actions in a spatially explicit manner while maintaining the flexibility to conduct these actions on different parcels within a CAZ to meet the same conservation objectives (i.e., to respond to willing sellers where they arise). The arrangement of the CAZs also provides a mechanism to apply conservation actions at several spatial scales using consistent units (e.g., within a watershed, within a combination of CAZs, or within a single habitat type).

In defining BRCP covered activities, 11 Urban Permit Areas (UPAs) were delineated to address impacts and conservation within the existing and planned future urban portion of the Plan Area (Chapter 2, *Covered Activities*). These UPAs are a spatial subset of the CAZs in which they are contained. Thus, the spatial scale at which biological goals and objectives were developed is relevant biologically through the CAZs that represent major ecosystem units (Figure 3–1) and also related to the UPAs that comprise the areas in which most future development and impacts on biological resources are projected to occur.

Brief descriptions of major features of the CAZs are provided below:

Sierra Foothills CAZ is dominated by the geologic features that define the foothills of the Sierra Nevada within the Plan Area. Highway 70 was used as a clear way to identify the boundary between the Sierra Foothills and Cascade Foothills CAZs, though the actual geologic boundary is just north of Highway 70. Highways 70 and 99 were used as a clear way to identify boundaries between the Sierra Foothill CAZ and the Southern Orchard and Basin CAZs. The Sierra Foothills CAZ encompasses portions of several major geological formations including Jurassic Volcanic Rock, Laguna, Lovejoy, and Riverbank. The land cover is dominated by grasslands, vernal pools terrain, and oak woodlands and savanna natural communities; Lake Oroville and associated forebay and afterbay; and the urban and rural residential communities associated with the City of Oroville.

Cascade Foothills CAZ is dominated by the geologic features that define the foothills of the Cascade Range within the Plan Area. Highway 70 was used as a clear way to identify the boundary between the Cascade Foothills and Sierra Foothills CAZs, though the actual geologic boundary is just north of Highway 70. Highway 99 was used as a clear way to identify boundary between the Cascade Foothill CAZ and the Northern Orchard CAZ. This CAZ encompasses portions of the Red Bluff, Riverbank, and Tuscan geological formations. The land cover is dominated by grasslands, vernal pool terrain, and oak woodlands and savanna natural communities and the urban and rural residential communities associated with the City of Chico.

Northern Orchards CAZ is dominated by orchards and lies on more recent and coarser textured alluvial soils between the flood plain of the Sacramento River and Highway 99, which generally corresponds to the break in the slope at the toe of the Cascade Foothills. While this CAZ is dominated by the Modesto geomorphic formation, at the northern end of the CAZ there is an area comprised of the older Riverbank and Red Bluff formations. The northern boundary of the CAZ corresponds to the border of Butte County while the southern boundary with the Basin CAZ roughly corresponds to the northern extent of finer textured basin soils and areas of rice production and follows parcel boundaries and the channel of Butte Creek.

Southern Orchards CAZ is dominated by orchards and, similar to the southernmost area of the Northern Orchard CAZ, lies on the Lower Modesto geological formation geological formation with coarser textured soils than the clay soils of the rice production region in the Basin CAZ to the west. The northern end of the CAZ follows the southern border of the Thermalito Afterbay while the southern boundary corresponds to the border of Butte County.

Basin CAZ is dominated by rice production, duck clubs, and CDFW areas. Its western border is Butte Creek and the Butte County line and its southern border is also the county line. Its northern and southeastern borders are demarcated by parcel boundaries between the Northern Orchard and Southern Orchard CAZs that generally mark soil transitions. Its northeastern border follows Highway 99.

Sacramento River CAZ is dominated by riparian forest and scrub, managed wetlands, irrigated cropland, and orchards on soils associated with the Sacramento River formed by natural levee, channel, and basin deposits. Seven Mile Road and River Road mark the eastern boundary of the CAZ, separating it from areas dominated by rice land and orchards in the Basin and Northern Orchards CAZs.

5.2.3.4 Spatial Considerations for Conservation Lands

Spatial considerations are important in conservation reserve design (Spencer et al. 2010, Huber et al. 2010). The development of a conservation lands reserve system for covered species is intricately linked to dynamic landscape processes (e.g., dispersal, seasonal distribution, migration, metapopulation structure).

The BRCP conservation lands design tenets are based on numerous studies and theoretical components of the discipline of conservation biology (Kirkpatrick 1983; Margules et al. 1988; Vane-Wright et al. 1991; Nicholls and Margules 1993; Pressey et al. 1993, 1996, 1997; Church et al. 1996; Ando et al. 1998; Polasky et al. 2001, Spencer et al. 2010).

Typically, diversity, rarity, naturalness, size and representativeness are the most widely used design criteria for reserve systems (Margules et al. 1988). Other considerations include island biogeography design principles (MacArthur and Wilson 1963, 1967). These are: 1) area effect – the larger the reserve, the greater the species richness (i.e., species/area relationship) and the greater the chances of long-term viability of populations (more individuals); 2) isolation or

distance effect – the less the distance between reserve units, the greater the opportunity for gene flow, colonization, and rescue effect (e.g., also see Brown and Kodric-Brown 1977); 3) species equilibrium – the number of species that an area can support is determined by a balance between colonization and extinction; and 4) edge effect – the larger the ratio of reserve area to reserve perimeter, the lesser the edge effect. An edge effect is defined as a change in the "conditions or species composition within an otherwise uniform habitat as one approaches a boundary with a different habitat" (Ricklefs 1993). Edge effects at the boundary between natural lands and human-occupied lands ("urban edge effects") arise due to human-related intrusions such as unofficial youth recreational activities, invasive species, feral predators (dogs, cats), lighting, noise, off-road activities, contaminants, and other disturbances. Although some species may be unaffected by edges or even show preferences for them, human-induced edge effects are generally unfavorable to native species

Patch size is related to the concept of ecological thresholds (i.e., a point or zone at which a relatively rapid change occurs from one condition to another) (Huggett 2005). For example, some species are limited in the maximum distance between patches they will cross, or in the minimum habitat patch a species requires to fulfill its reproductive needs. Most special-status species are area-sensitive and breed or forage only in patches exceeding a certain minimum size. In addition, rates of predation or nest parasitism may increase as patch size declines (Donovan et al. 1995, Robinson et al. 1995, Tewksbury et al. 2006). Patch configuration is important for various factors. If patches are spatially aggregated, they are prone to suffer simultaneously from large-scale disturbances such as fires or floods.

A particularly important spatial requirement is the connectivity of landscapes, which has been shown to influence the persistence of metapopulations (a number of distinct populations of a species in the same general area). Landscape connectivity is a measure of "the degree to which the landscape facilitates or impedes movement among resource patches" (Taylor et al. 1993). Impaired or reduced connectivity within a landscape increases habitat fragmentation and isolation, which in turn can lead to lower species diversity (Bolger et al. 1997, Bolger et al. 2000) or extinction of local populations (Hanski 1994, Gu et al. 2002, Nabe-Nielsen et al. 2010). If patches are too distant from each other or separated by an inhospitable "matrix," species may not recolonize patches or may suffer from genetic isolation. Barrier-limited species are sensitive to fragmentation and edges as they restrict movements or may impose increasing mortality (e.g., roads). Populations are thus more likely to persist in larger, better connected habitat fragments. It is the challenge of an effective reserve strategy to relate the structural connectivity (among map elements) to the functional connectivity (the response of individuals to the landscape's structure).

Wildlife movement corridors are increasingly considered as an important management concept that can aid in the enhancement of landscape connectivity (Price et al. 1994, Beier and Noss 1998). Movement corridors are often linear and facilitate efficient movement by providing adequate cover and lack of physical obstacles for movement (Beier and Loe 1992), but generally do not provide a full complement of life history requirements. Linkages, in contrast, provide

resources that meet the life history requirements for the species as well as movement habitat for a particular species. Landscape linkages are capable of sustaining a full range of natural community and ecosystem processes, such as seed dispersal and animal movement over a period of generations. Because habitat connections may function only as movement corridors for some species, but provide a linkage for others, the BRCP conservation strategy's focus is on identifying linkages, assuming that they do not constrain movement for the majority of covered species. Linkages, therefore, serve to ameliorate habitat fragmentation and isolation.

"Assembly principles" are rules used in regional conservation planning to describe desired land and habitat characteristics and to guide selection of high-value conservation lands during plan development and plan implementation. The conservation land assembly principles will guide BCAG in the acquisition of lands for the establishment of the conservation lands system over time during BRCP implementation. Spatial considerations that address landscape-level needs of the covered species (e.g., dispersal, seasonal distribution, migration, metapopulation structure) are important in ensuring that conservation lands are assembled in a manner that achieves the biological goals and objectives. The NCCP General Process Guidelines (Department of Fish and Game [DFG] 1998) and NCCPA describe reserve design tenets that provide the framework for the conservation planning process, and can be summarized as follows:

- Conserve covered species and their habitats throughout the Plan Area;
- Conserve large habitat blocks;
- Conserve habitat diversity;
- Keep reserves contiguous and connected; and
- Protect reserves from encroachment and invasion by nonnative species.

The conservation land assembly principles are consistent with these tenets and have been developed to provide guidance to BCAG in its evaluation and selection of conservation lands. Criteria based on these principles for acquisition of specified natural communities are described in conservation measure CM1, Acquire Lands (Section 5.4.1.1).

5.2.3.4.1 Conservation Lands System Assembly Principles

- Select lands known to be occupied by covered species or that support suitable habitat that is contiguous with occupied habitat (lands currently known to be occupied by covered species).
- Select patches of natural communities that support the highest functioning habitat for covered species that are available.
- Select lands with ecological functions that will serve to achieve multiple biological objectives.
- Select lands that will protect covered species of limited distribution.

- Select lands with high connectivity to other habitat areas that support other life history functions of the target 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).
- Select lands that capture the range of variability (e.g., gradients, geological substrates) on which a natural community occurs.
- 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 intact and relatively undisturbed watersheds).
- Select lands that maximize connections to conservation lands within and outside of the Plan Area to provide connectivity to covered species and other native species populations and occurrences within and outside the Plan Area, to maintain gene flow and the movement of individuals and populations at all time-scales.
- Select lands that, in addition to supporting covered species habitats and occurrences, are occupied by non-covered special-status wildlife and plant species.
- Select lands that provide habitat mosaics (e.g., grassland/oak woodland) as opposed to lands with only single vegetation communities represented.
- Select lands that are of sufficient size and configuration to ensure that they can be effectively managed to maintain or enhance ecological processes and habitat function given site constraints. This includes protecting large, connected and contiguous grasslands, which facilitate effective grazing and range management.
- Select lands with a watershed context and maximize the acreage of watersheds protected. Conserve all or as much of entire watersheds as practicable consistent with achieving acreage targets to maintain natural hydrological connectivity and water quality (e.g., from tributaries to mainstem rivers, from wetlands to uplands).
- Select lands that include confluences of riverine/riparian systems (i.e., junctions of tributaries with larger streams or rivers) as riparian junctions can serve as biodiversity hotspots.
- For achieving aquatic natural community and species habitat targets, select lands with sufficient upland habitat around aquatic habitats to maintain water quality and ecological integrity. Protect habitat buffer zones based on stream size and order, adjacent vegetation types, and the needs of associated species.

5.2.3.4.2 Conservation Lands System Assembly Concepts

The following describes important conservation land assembly concepts embedded within the assembly principles and that capture the dynamic interdependencies among sites and species populations.

Patch Size. Applying conservation protection to larger units of land supporting natural communities and covered species habitats contributes to achieving a variety of conservation goals and objectives. Larger land areas provide for species with larger home range sizes, such as large mammals and raptors. Larger units also are more likely to support more species, larger populations of covered species, and more diverse ecological conditions at varied elevations. Large conservation parcels have a lower edge-to-area ratio, and therefore have less potential to experience detrimental effects of adjacent land uses. In addition, larger parcels often provide more ecological functions, such as supporting pollinator and prey populations, and they can be more efficiently managed than several smaller parcels encompassing the same acreage of land. However, small parcels can also provide viable conservation functions, especially when they are essential in sustaining covered species (i.e., localized occurrences of rare plants), where they may provide a "stepping stone" in bridging gaps between larger units, or where preserving large parcels is not an option. For example, the conservation strategy will prioritize the protection of small freshwater springs and seeps as likely hotspots of aquatic insect diversity and endemism (Erman 1996).

Desired minimum patch sizes that will be used to guide BCAG in its acquisition of each natural community are presented in Table 5–1, *Natural Community Acquisition Patch Size, Configuration, and Habitat Connectivity Considerations Based on Planning Species* (see separate file). These minimum patch sizes are based on the habitat requirements of the "planning species"[4] listed in Table 5–1 that were selected for this purpose. These species were selected as planning species for establishing minimum patch size requirements because they currently or historically occurred in the Plan Area and because they are "area-limited species"[5] and include two covered species (i.e., western yellow-billed cuckoo and yellow-breasted chat). They have the largest habitat patch size requirements among native species inhabiting each of the natural communities; thus, achieving the patch size requirements for these species fulfills achieving the patch size requirements of all the covered species and most other native species associated with each of the natural communities. It is also important to consider minimum patch size constraints within the context of the landscape and adjacent parcels. A medium-sized parcel connected to another medium-sized parcel may provide a combined patch size sufficient to provide ecological functions to covered species, while a larger parcel embedded in an inhospitable land cover matrix may not. Thus, minimum desired patch sizes may be attained by acquiring smaller patches of the natural community that adjoin other existing protected patches of a size sufficient to achieve the overall patch size objective. To achieve the habitat acquisition targets for some covered species, it may not be possible to acquire natural communities in the recommended patch sizes; in these instances, the minimum covered species habitat patch size requirements for covered species listed in Table 5–2, *Covered Wildlife Species Habitat Acquisition Patch Size,*

[4] Planning species are species with habitat requirements or other needs that assist in developing plan goals and objectives. Such species may be area-, dispersal-, resource-, or process-limited (Lambeck 1997).

[5] *Area-limited species* have large home ranges, occur at low densities, or otherwise require large areas to maintain viable populations. Examples include large mammals (especially carnivores) and large raptors (Lambeck 1997).

Configuration, and Habitat Connectivity Considerations (see separate file) will be used to guide acquisition of conservation lands.

Connectivity with Existing Habitat Areas. The life history requirements of many of the covered wildlife species are supplied by several habitat types that are located within the movement distance of the target covered species. Consequently, it is important that habitat types on lands protected under the BRCP be located within the movement distance of the target covered species to lands supporting other habitat types required by the covered species. Connectivity of habitats and their spatial arrangement affect not only the persistence of species but also the general ecological functioning of protected lands and the ability to effectively manage them (Williams et al. 2005). The focus of the BRCP conservation strategy is the development of effective conservation land assemblages (Gurd et al. 2001) consisting of various parcel sizes linked by migration corridors and protected by buffer zones (Spencer et al 2010). The position of a parcel within the context of the landscape and the patch's contribution to ecosystem functions and processes are important considerations.

Wide-ranging and migratory species, such as black-tailed deer herds, was used to identify important corridors among and the spatial arrangement of Conservation System Lands (Table 5–1). Establishing terrestrial and aquatic buffer zones will be considered based on the ecological context (stream size, ecotone type, and species and ecological functions to be protected [Semlitsch and Bodie 2003]). Maintaining upland habitat buffers around riparian and aquatic systems is a crucial element for maintaining the integrity and connectivity of aquatic systems (Naiman and Decamps 1997) and for the conservation of amphibians and reptiles (Roe and Georges 2007). The habitat connectivity considerations for each of the covered wildlife and fish species that will be used by BCAG to guide selection of conservation lands for acquisition are presented in Table 5–2.

Covered Species Occurrence. Conservation of habitat for the covered species is one purpose of the BRCP. In general, areas that support more covered species or larger populations of covered species will receive priority for selection as conservation lands. The estimated extent (areal or linear) of habitat that will need to be conserved to achieve the goals and objectives was based on presently known species occurrences and species habitat models (Appendix A). Land protection thus will be guided by accumulating information on species occurrences during Plan implementation, to ensure protection of areas of known species occurrence (rather than relying solely on predicted occurrence based on species habitat models).

Natural Disturbance Regimes. Erosion, sedimentation, floods, fire, drought, storms and herbivory are important ecosystem processes that have formed and maintained the natural diversity of the Plan Area. The ability to maintain these natural disturbance processes, as well as other ecosystem processes, is important to maintaining natural diversity. Livestock grazing and proper range management are important management tools for grasslands, swale complex, vernal pool, and oak savanna communities and specific covered species habitats within these communities. The BRCP conservation strategy recognizes the cultural and ecological role of

livestock grazing that has shaped the working landscapes of the Plan Area. Managed grazing can maintain desired vegetation conditions, biological diversity, and some covered species in the Plan Area. For example, grazing can control woody vegetation and maintain some grassy stream and pond banks for use by pond turtles, giant garter snakes, or other species; maintain desired habitat conditions for grassland species like burrowing owls and tricolored blackbirds; and control invasive plants that otherwise can dominate vernal pool vegetation and adversely affect covered plants. Management actions on conservation lands will include continuation of successful grazing practices and modification of grazing practices to improve ecological conditions as appropriate. Management actions such as prescribed burning may be required to restore or maintain ecological processes. Conservation lands will be selected based in part on the degree to which natural hydrologic and other physical disturbance processes (e.g., herbivory, fire regime) are intact or can be restored quickly. Major riparian corridors are the "backbones" of a hydrologically connected assemblage of protected lands, and riparian junctions provide opportunities to develop protected nodes. Protection of mature riparian vegetation communities, native floodplains, and restoration of native riparian vegetation and hydrological functions to broaden existing riparian vegetation and floodplains is a high priority, where feasible. A diversity of flow regimes of aquatic systems will be considered, to support the biological diversity and productivity associated with seasonal or intermittent flow regimes (Maslin et al. 1997, Richter and Richter 2000).

Relationship to Existing Conservation Areas. BCAG will give preference to acquisition of conservation lands that adjoin or may be linked to other Public and Easement Habitat Lands (PEHL; see Section 5.2.3.6), in balance with other conservation land assembly needs (i.e., to achieve wide geographic representation of habitats). Spatial scale in designing the conservation lands assembly is an important consideration, as it ensures not only effective linkages between locally important patches but also an ecologically meaningful connectivity with conservation lands outside the Plan Area (Huber et al. 2010). Lands proximal to, and linking with, existing PEHL are better suited to support mobile species, allow greater management flexibility (e.g., prescribed fire), and buffer conservation lands from external disturbances. Hydrological connectivity is important for supporting ecological function in aquatic, wetland, and riparian systems. (Mount 1995). As lands are protected during Plan Implementation, decisions regarding selection of subsequent lands to be protected will be based in part on the configuration of conservation lands in place at that time.

Compatibility with Other Conservation Programs. BCAG will give preference to acquisition of conservation lands that also serve to achieve other regional and local conservation programs where those other programs are compatible and consistent with BRCP goals and objectives. Examples are protecting lands that contribute to the strategy of the California Essential Habitat Connectivity Project (Spencer et al 2010) and that provide connectivity with habitat planned for protection in adjacent counties (e.g., Yuba-Sutter HCP/NCCP), and areas of specific local concern, such as protecting watershed conditions that are important salmon or steelhead fish runs in Butte County streams (e.g., Butte Creek, Big Chico Creek).

Adjacent Sources of Disturbance. Developed and disturbed areas adjacent to conservation lands, including roads, towns, and agricultural lands, have the potential to introduce a variety of influences that may disrupt natural processes and degrade resource values, including noxious weeds, pesticide drift, incursion by free-ranging pets and nonnative wildlife, unplanned fire ignitions, ground disturbance from trespass use, noise, poaching, spread of disease and other disturbances (Possingham et al. 2000, Shafer 2001). Furthermore, roads and other linear structures may impede the movement of species among patches, thereby fragmenting habitats. Road effects can be mitigated with a variety of enhancement actions (See Spencer et al 2010 for a framework for considering roads essential habitat connectivity areas) which may be integrated in site-specific management plans for conservation lands. "Soft" edges [6] between protected land and sources of disturbances are desired and may be enhanced with appropriate protective buffers. Effects of adjacent land uses and effects of conservation land management on adjacent land uses will be considered in selecting conservation lands and prescribing management to protect and enhance values.

5.2.3.5 Setting of Conservation Targets

Conservation targets were established for the natural communities and the covered species habitats they support. Conservation targets represent the extent (e.g., acreage, linear miles of channel, number of ponds) and distribution of natural communities and covered species habitats to be protected, enhanced, and restored to contribute to the conservation of each of the covered species and meet the regulatory requirements of the ESA and the NCCPA. The conservation targets serve as the basis for the natural community and habitat conservation-related biological objectives described in Section 5.3. Conservation targets encompass actions sufficient to provide for the habitat-related conservation needs of the covered species. The process used to develop conservation targets is presented in Figure 5–1, *Process for Establishing Natural Community and Covered Species Habitat Targets and Conservation Measures* (see separate file).

The development of conservation targets was an iterative process that relied on numerous information sources and several sequential steps of analysis and refinement. Information used to develop the conservation targets for both natural community and covered species included the following:

- Distribution and extent (areal or linear) of each natural community and its constituent land cover types within the Plan Area (Figures 3–11 through 3–19; Table 5–3, *Existing Acreage of Natural Communities and Land Cover Types within CAZs and UPAs* [see separate files]).

[6] "Edge permeability" or "edge abruptness" between habitat patches in a mosaic landscape has a strong influence on the distribution of species and their population structure. In natural landscapes, edges between habitat patches may be subtle or "soft" (e.g., ecotones between mixed oak and blue oak woodlands), compared to abrupt or "hard" edges that often result from human influences or disturbances (e.g., roads, clearcuts, agricultural fields). Individual organisms respond differently to soft and hard edges (Wiens et al. 1985). Hard edges are often perceived as barriers by organisms and tend to create movement along the edge, while soft edges favor movement of organisms across an edge.

- Distribution and extent (areal or linear) of each covered species' modeled habitat located within the Plan Area (Appendix A; Table 5–4, *Existing Extent Modeled Covered Species Habitat Types and Covered Plant Species Occurrences within CAZs and UPAs* [see separate files]).
- Primary threats and stressors for each of the covered species (Appendix A).
- Location of habitat areas known to be occupied by each of the covered species (Appendix A).
- The distribution and extent (areal or linear) of existing patches of PEHL for each natural community and covered species habitat (Figure 5-2, *Existing Protected Lands and Conservation Acquisition Zones* [see separate file] and Section 5.2.3.6).

To establish the conservation targets, the above information was evaluated for each of the following variables:

- **Patch size and connectivity.** With the exception of species with limited habitat requirements and distributions (e.g., Butte County meadowfoam), the conservation targets were formulated to include large patches of connected natural communities and modeled covered species habitats and to exclude small fragmented patches.
- **The proportion of each natural community type currently protected within each of the CAZs.** The conservation targets were formulated to include consideration for the extent (areal or linear) and location of PEHL natural communities and covered species habitats that are present in each of the CAZs.
- **Connectivity with existing protected habitats.** The conservation targets were formulated to include consideration for establishing connectivity of BRCP conservation lands with PEHL in the Plan Area and protected lands adjacent to the Plan Area.
- **Natural communities supporting covered species habitats.** The conservation targets were formulated to include the portions of natural communities that support modeled habitat for multiple species, and exclude areas that supported modeled habitat for no or a relatively small number of species, except where patches are important to the conservation of a particular species.
- **Location of important known covered wildlife species population centers and covered plant species occurrences.** The conservation targets were formulated to protect a proportion of these habitat areas such that these populations and occurrences will be conserved.
- **Proximity of covered species modeled habitats to known occupied habitat.** The conservation targets were formulated to protect occupied habitats, as well as unoccupied habitat areas that are connected to known occupied habitat areas such that unoccupied habitats can be occupied in the future through natural processes or with implementation of habitat enhancement measures.

The conservation targets for protecting each of the natural communities is presented in Table 5–5, *Natural Community Protection Targets* (see separate file) and the rationale for each of the natural community conservation targets is presented in Table 5–6, *Rationale for the Natural Community and Agricultural Habitat Protection Targets* (see separate file). Natural community restoration targets are presented in Table 5–7, *BRCP Restoration Targets* (see separate file). Section 5.5 provides a description of how achieving the natural community targets presented in Table 5–5 will conserve each of the natural communities. A description of how achieving the natural community conservation targets are expected to benefit local concern species is presented in Appendix N.

Covered species habitat conservation targets were further established through an iterative process that involved the following activities:

- Evaluating a set of criteria (see below) based on the conservation status of each covered species and need for protecting its habitat to contribute to its conservation;
- Using these criteria ratings to assign an overall priority rating and associated habitat conservation goal; and
- Re-evaluating and adjusting the goals based on individual species conservation needs that were not fully captured through application of the criteria.

The following criteria were used to evaluate the conservation needs of each of the covered species for the Plan Area.

- **Rarity.** The listed status of a covered species is a general indication of the species' overall ecological status and rarity, representing the results of a formal evaluation process with scientific and public input. Species that have been designated as Species of Concern by USFWS and Species of Special Concern by CDFW have undergone a scientific review that identified a concern with their conservation status. The listing status of each covered species was rated qualitatively as "high" (listed under ESA or California Environmental Quality Act [CESA] as threatened or endangered), "Moderate" (recognized as a USFWS Species of Concern or CDFW Species of Special Concern or given a California Native Plant Society [CNPS] Rare Plant Rank 1B), or "Low" (not federally or state-listed, on lists of concern, or given a CNPS Rare Plant Rank 1B).
- **Population and Habitat Trend.** Listing status as well as current information on population and habitat trends were used to evaluate the status of covered species populations. Evaluation of this criterion was based on information presented in Appendix A. The following qualitative criterion ratings were used: "High" – Substantial threats and/or decline in habitat, "Moderate" – Moderate threats and ongoing decline habitat, and "Low" – limited decline, stable, or increasing habitat extent (areal or linear).
- **Importance of Plan Area to Statewide Habitat.** Species for which Butte County occurrences are important to their range-wide conservation were considered of high

conservation priority. The importance of occurrences in Butte County to the overall population of a species was determined based on information presented in Appendix A, and on information regarding density and productivity of Butte County occurrences or populations relative to other portions of the species' range. The following qualitative criterion ratings were used: "High" – Butte County supports more than 25 percent of statewide habitat or populations for the species, "Moderate" – Butte County supports 5 to 25 percent of habitat or populations for the species, and "Low" – Butte County supports less than 5 percent of statewide habitat or populations for the species.

- **Degree to Which Butte County Habitat is Limiting to Local Populations.** This criterion addresses whether habitat is the limiting factor that determines the number of occurrences or size of species populations in Butte County. Although many covered species populations are regulated by availability of suitable habitat, populations for a number of species are either influenced by or strongly controlled by other factors, including competing species, availability of seasonal habitats elsewhere, predators, and disease. The conservation targets for protecting each of the covered species modeled habitat types and plant occurrences is presented in Table 5–8, *BRCP Covered Species Modeled Habitat Protection Targets* (see separate file) and the rationale for each of the covered species conservation targets is presented in the rationale statements for the biological objectives established for each of the covered species in Section 5.3.2.3, *Species-Level Biological Goals and Objectives*. Section 5.6 provides a description of how achieving the covered species targets presented in Table 5–8 will contribute to the conservation of each covered species. Conservation actions also include targeted species-specific actions, including actions identified in recovery plans, such as habitat enhancements.

5.2.3.5.1 Mitigation Component of Conservation Targets

This section describes the approach to mitigation for the impacts of BRCP covered activities, in addition to impact avoidance and minimization measures, to address permit issuance requirements of section 10 of the ESA.[7] The acreage of BRCP habitat mitigation is a subset of the overall conservation targets for each natural community and covered species (Tables 5–5, 5-7, and 5–8) as the overall conservation targets are designed to contribute to the conservation of species. The mitigation and conservation components of each of the natural community and covered species conservation targets are presented in Tables 5–7, 5–9, *Natural Community Conservation and Mitigation Targets for Protection and Restoration,* and 5–10, *Covered Species Habitat Conservation and Mitigation Targets* (see separate files), respectively. Table 5–11, *Natural Community Mitigation Requirements for Permanent Direct Effects* (see separate file) presents the mitigation requirements for impacts to natural communities and Table 5–12,

[7] Section 10 of the ESA requires that permit applicants identify the steps to be taken that "minimize and mitigate" the impacts on covered species. 16 USC § 1539(a).

Covered Species Mitigation Requirements for Permanent Direct Effects (see separate file) presents the mitigation requirements for impacts to covered species habitat.

Habitat mitigation is provided through the acquisition, protection, and subsequent management in perpetuity of existing natural communities and covered species habitats and/or restoration of natural communities and covered species habitats. Mitigation may also be provided through acquisition of mitigation credits from qualified mitigation banks. For BCAG to use a mitigation or conservation bank for BRCP purposes, the conditions at the bank must meet all of the BRCP criteria (e.g. level of land protection, quality of habitat, conservation land assembly principles, management plans, monitoring) for the natural communities and covered species or must be brought up to BRCP standards to be credited to the BRCP (see Chapter 8, *Plan Implementation*, Section 8.7.6, *Use of Mitigation and Conservation Banks*). Protected and restored natural communities and habitat must be of equal or greater function than the affected natural communities and covered species habitats.

5.2.3.6 Role of Public and Easement Habitat Lands

An important consideration in the assembly of BRCP conservation lands is the extent (areal or linear) and distribution of lands that are in public ownership or under conservation that serve to conserve natural communities and covered species habitats. These lands are referred to as PEHL in the BRCP Plan Area. The BRCP PEHL Geographic Information System (GIS) dataset was developed to identify existing PEHL within the BRCP Plan Area. It was compiled from various public sources from different time periods. Ownership information was collected and organized into attributes which included County, County Assessor's Parcel Number (APN), Management Level, Management Agency, Alias (if known), Type (type of ownership), and Data Source. Although the boundaries depicted within the data do not represent legal boundaries, they represent the best available information and are sufficient to guide development of the conservation lands system at a landscape level. More detailed information necessary for land acquisition and other decisions will be acquired by the BRCP Implementing Entity during Plan implementation.

The public dataset sources used to generate the PEHL GIS data layer included the following:

- CDFW Lands GIS data layer 2010 (DFG 2010);
- California Protected Areas Database March 2009 (Green Info Network 2009);
- Wildlife Conservation Board 2010;
- CaSIL Conservation Lands data layer 2005 (California Natural Resources Agency 2005);
- CA Public, Conservation and Trust Lands, v5.2 (California Natural Resources Agency 2007); and
- Butte County Land Parcel Data (Butte County 2010).

In addition to these public data sources, BRCP Stakeholder Committee members, including representatives from The Nature Conservancy and the Northern California Land Trust, also provided protected lands information and online web searches were conducted to identify additional protected lands and associated spatial extents (areal or linear) and cross reference the GIS data layers to ensure accuracy.

The data layer was created by overlaying source data on top of county parcel boundary data. Parcels identified as PEHL via source datasets were then attributed with the appropriate information.

Based on the ownership, land manager, and easement information derived from the above sources, the data was evaluated and grouped into two PEHL categories defined as follows.

- **Category 1 PEHL:** Lands that are subject to irrevocable protection against a change in primary land use through local, state or federal authority and with a primary management

goal related to ecological protection. This category of PEHL is considered to meet the definition of "protected" under the BRCP and are also referred to as "existing protected lands."

- **Category 2 PEHL:** Lands that are subject to irrevocable protection against a change in primary land use through local, state or federal authority with a primary land management goal of open space for mixed use in a manner that maintains ecological value.

Only Category 1 PEHL are considered to be protected for conservation purposes. Category 2 PEHL, though not considered to be protected under the BRCP, were used to inform the development of the BRCP (e.g., conservation targets, spatial distribution requirements for BRCP conservation lands, habitat corridors). PEHL may or may not be specifically managed to benefit covered species, but they do protect and may be managed to improve the ecological functions of the natural communities present on PEHL (e.g., providing habitat for covered and other native species, maintaining connectivity among habitat areas, and serving as ecological corridors). Conservation actions may be implemented on PEHL but they may not be credited as contributing towards achieving the conservation component of the conservation targets unless they meet BRCP protection, management, monitoring, and adaptive management standards (see Section 8.7.4, *Land Acquisition*). Properties excluded from consideration as PEHL lands included those owned by the Department of Defense and City and County parks not being managed for ecological function. Figure 5–3, *Decision Matrix for Assigning Public and Easement Habitat Lands (PEHL) Categories* (see separate file) illustrates the decision matrix that was applied to assign PEHL categories. The distribution of existing PEHL by CAZ is presented in Figure 5–2. The areal or linear extent of each natural community and covered species habitat type within existing PEHL are presented in Tables 5–13, *Extent of Natural Communities on Public and Easement Habitat Lands* and 5–14, *Extent of Modeled Covered Species Habitat Types and Occurrences on Public and Easement Habitat Lands* respectively (see separate files).

The following rules were used to identify PEHL Category 1 and Category 2 properties based on ownership, land managers, and easements.

Category 1 properties ("existing protected lands"):

- All CDFW owned and managed lands (e.g., Gray Lodge Wildlife Management Area, Upper Butte Basin Wildlife Management Areas, Jon Bechtel Trust Lands, and Table Mountain Reserve).
- All parts of the Oroville Wildlife Area, including both CDFW and California Department of Water Resources (DWR) owned/managed parcels.
- All USFWS owned and managed lands (e.g., Sacramento River Wildlife Refuge and Llano Seco Wildlife Refuge).
- Permanent private conservation easements (e.g., easements held by The Nature Conservancy, California Wildlife Foundation, Northern California Land Trust, and Ducks

Unlimited; and easements managed by CDFW and USFWS [e.g., private easement parcels associated with Llano Seco Refuge managed by FWS]).

- Esquon Ranch – permanent conservation easement.
- Permanent mitigation lands (e.g., Highway 149 mitigation lands, Wurlitzer mitigation site, City Light Preserve, Enloe Preserve).

Category 2 properties ("other PEHL"):

- City of Chico Bidwell Ranch
- Bureau of Land Management owned lands
- All local parks with undeveloped habitat (e.g., Bidwell Park)
- All State parks (e.g., Bidwell-Sacramento River State Park)
- Department of Water Resources owned properties, except those that are part of the Oroville Wildlife Area (which are Category 1)
- Mitigation banks that have not sold all of their credits (e.g., Dove Ridge Mitigation Bank),
- City of Chico Creekside Open Space

5.3 BIOLOGICAL GOALS AND OBJECTIVES

This section describes the biological goals and objectives for the BRCP. The BRCP biological goals and objectives are consistent with the guidance provided in the federal Five-Point Policy for Habitat Conservation Plans (65 *Federal Register* [FR] No. 106 at 35242, June 1, 2000) and with the BRCP Planning Agreement conservation goals and objectives. Biological goals[8] are defined as broad guiding principles for development of the conservation strategy that can be parsed into more manageable subsets of biological objectives. These biological goals are intended to be broad principles designed to guide the conservation strategy to meet the statutory criteria of the NCCPA and sections 7 and 10 of the ESA. The biological objectives[9], in turn, include measureable metrics[10] by which to assess progress in meeting the goals and to help inform the adaptive

[8] For Biological Goals the Five-Point Policy states, "In the context of HCPs, biological goals are the broad, guiding principles for the operating conservation program of the HCP… Multiple species HCPs may categorize goals by species or by habitat, depending on the structure of the operating conservation program."

[9] For Biological objectives the Five-Point Policy states, "For more complex HCPs, biological objectives can be used to step down the biological goals into manageable, and, therefore, more understandable units… If the operating conservation program is relatively complex, the biological goal is divided into manageable and measurable objectives. Biological objectives are the different components needed to achieve the biological goal such as preserving sufficient habitat, managing the habitat to meet certain criteria, or ensuring the persistence of a specific minimum number of individuals… Biological objectives should include the following: species or habitat indicator, location, action, quantity/state, and timeframe needed to meet the objective."

[10] Metrics are measurements or characteristics of species, natural communities, and ecological systems that are used to track progress toward the achievement of biological goals and objectives. The metric value is the quantity of the specific unit of measurement, for example, the metric may be *acres of protected habitat* and the metric value may be a *target of protecting 100 acres of habitat*.

management process (see Section 7.3, *Adaptive Management Plan*). Monitoring metrics that may be used to measure progress towards achieving the biological objectives are presented in Section 7.2, *Monitoring Program*. The biological goals and objectives were used to develop the conservation measures described in Section 5.4 and will be used by BCAG to guide BRCP implementation.

5.3.1 Development of Biological Goals and Objectives

Development of the biological goals and objectives was based on the following data and information:

- Distribution and extent of each natural community within the Plan Area (see Chapter 3, *Ecological Baseline Conditions*);
- Distribution and extent of each covered species' modeled habitat within the Plan Area (see Appendix A);
- Primary threats and stressors for each of the covered species (see Appendix A);
- Location of habitat areas known to be occupied by each of the covered species (see Appendix A);
- Distribution and extent of existing protected patches of each natural community and covered species habitat (Figure 5–2);
- Potential for increasing connectivity with conserved habitat areas adjacent to the Plan Area (from documents of HCP/NCCPs approved or under development for lands that are adjacent to the Plan Area); and
- Information provided by experts with species-specific knowledge for the BRCP Plan Area.
- Final and draft Recover Plans

Although the Sacramento River and Feather River support habitat for several of the covered species in the Plan Area, BRCP goals, objectives, and conservation actions are not proposed for these rivers because the channels, banks, and flow of these rivers are controlled and managed predominately by state and federal agencies (e.g., DWR, U.S. Army Corps of Engineers, and Bureau of Reclamation), not under the jurisdiction of BCAG. Planning for these rivers has been or is being conducted by those state and federal agencies.

Biological Goals and Objectives were developed at three ecological levels:

- Landscape-level goals and objectives are designed to provide for ecosystem functions, sufficient habitat for covered species, and to maintain the biological diversity in the natural communities of the Plan Area. Landscape-level goals and objectives provide for the maintenance of linkages along ecological (including elevation) gradients, protection of intact watersheds, protection and restoration of habitat mosaics, appropriate disturbance

regimes and successional patterns, and establishment of conservation lands units of appropriate size and shape. Landscape-level goals and objectives address the conservation requirements of species that have large ranges or that migrate between various distinct seasonal habitats (e.g., summer and winter range) as well as specialist species restricted to small patches of unique habitat (e.g., seeps, large vernal pools, alkali soils).

- Natural community-level goals and objectives are designed to provide for the appropriate amounts, distribution, configuration, and management of natural communities to conserve covered species and biodiversity in the Plan Area. Goals and objectives were established based on the broad needs of biological communities as determined through application of the conservation land assembly principles (see Section 5.2.3.6), and the conservation needs for the covered species and their habitats provided by each of the natural communities Natural community protection objectives were established as described in Section 5.2.3.5, *Setting Conservation Targets*, and are expressed as an extent of habitat conservation (in acres or miles) for each covered species by CAZ. The target amount of natural communities to be conserved (both protection and restoration) for each natural community is provided in Table 5–5.
- Species-level biological goals and objectives are designed to address individual species requirements. Species-level habitat objectives were established as described in Section Section 5.2.3.5 and are expressed as an extent of habitat conservation (in acres or miles) for each covered species by CAZ. The target amount of habitat to be conserved (both habitat protection and restoration) for each covered species is provided in Table 5–8. Achieving the natural community-level objectives also achieves the habitat protection, enhancement, and restoration objectives established for each of the covered species.

The Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005) identifies goals and objectives for recovering several of the vernal pool-associated federally listed species covered under the BRCP and for ensuring the long-term conservation of several vernal pool-associated covered species that are not federally listed. The BRCP biological goals and objectives along with the conservation measures (Section 5.4) have been designed such that the applicable Recovery Plan recovery and conservation goals for these species are achieved with BRCP implementation.

The Recovery Plan provides for habitat conservation plans to meet the goals for species recovery using alternative conservation approaches than presented in the Recovery Plan, stating the following:

> While this recovery plan identifies a specific strategy for obtaining recovery of the covered vernal pool plant and animal species, it is not the only mechanism through which recovery may be obtained. Alternative conservation mechanisms, such as currently proposed or future HCPs that cover the species in this plan and vernal pool habitat, may be deemed equivalent to implementation of this Recovery Plan for the covered area if they contain the following elements:

1. Permanently protected vernal pool preserves within the area covered by the HCP in large contiguous blocks of suitable habitat;
2. Protection of the entire genetic range of each listed species within the area covered by the HCP;
3. Protection of all populations of species with 25 or fewer total occurrences addressed in [the Recovery Plan] within the area covered by the HCP[11];
4. Connectivity with other preserves within the area covered by the HCP;
5. Adaptive management of the preserves within the area covered by the HCP to support the species addressed in this recovery plan; and
6. Sufficient funding for management, maintenance, and monitoring of the preserves in perpetuity (USFWS 2005).

The BRCP Conservation Strategy includes all of these elements identified in the Recovery Plan for all applicable covered species and therefore provides an "alternative conservation mechanism" to the Recovery Plan to provide for the conservation of these species:

- Butte County meadowfoam (federal ESA listed),
- Hairy Orcutt grass (federal ESA listed),
- Slender Orcutt grass (federal ESA listed),
- Greene's tuctoria (federal ESA listed),
- Hoover's spurge (federal ESA listed),
- Ferris' milkvetch,
- Ahart's dwarf rush,
- Vernal pool fairy shrimp (federal ESA listed),
- Vernal pool tadpole shrimp (federal ESA listed),
- Conservancy fairy shrimp (federal ESA listed), and
- Western spadefoot toad.

Elements 1 through 4 listed above are addressed in the BRCP through the conservation targets (Tables 5–5 and 5–8), the application of the minimum patch size requirements for conservation of natural communities supporting the species (Table 5–15, *Acreage and Minimum Patch Sizes of Protected Natural Communities* [see separate file]), and requirements for selection of

[11] The following covered species are known from 25 or fewer occurrences and therefore meet this criterion in the Recovery Plan: Conservancy fairy shrimp, Greene's tuctoria, and Ferris' milk-vetch.

conservation lands described in Section 5.2.3.4, *Spatial Considerations for Conservation Lands*. Element 5 is addressed through the vernal pool and other relevant monitoring requirements described in Section 7.1, *Monitoring Program* and application of the adaptive management decision making process described in Section 7.2, *Adaptive Management Plan*. Element 6 is addressed through the funding sources and mechanisms described in Chapter 10, *Implementation Costs and Funding Sources*. How BRCP goals, objectives, conservation measures, and adaptive management provisions address Elements 2 and 3 is described for each of the species in Section 5.6.

5.3.2 Goal and Objective Statements

This section presents the landscape-level, natural community-level, and covered species-level biological goals and objectives. Each goal and objective is assigned a unique alphanumeric code that will assist with monitoring BRCP implementation. Many of the conservation measures address multiple goals and objectives, reflecting both the hierarchy of these goals and objectives and the interrelationships among them. Conservation measures that will collectively achieve all of the biological objectives are presented in Table 5–16, *Applicable BRCP Biological Goals, Objectives, and Conservation Measures for Natural Communities and Covered Species* (see separate file).

Descriptions and models of covered species habitats and natural communities referred to in the biological goals and objectives are presented in Chapter 3, Ecological Baseline Conditions and in Appendix A. The objectives are measurable, and the schedule for implementing conservation measures to achieve the objectives is presented in Chapter 8, Plan Implementation.

5.3.2.1 Landscape-Level Goals and Objectives

Goal LAND1: Large interconnected landscape representing the range of physical and biological attributes (e.g., slope, soils, hydrology, climate, and plant associations) and the diversity of natural communities in the Plan Area.

Protected lands will be spatially distributed to provide a mosaic of geographically and ecologically diverse natural communities, habitat for covered and other native species, and to facilitate elevational and latitudinal movement of natural communities and species in response to climate change.

> **Objective LAND1.1**: Establish a system of 90,417 acres of protected and restored lands in the Plan Area comprised of the quantities of each natural community and land cover type indicated in Tables 5–5 and 5–7 within 45 years (*Note: Chapter 8 contains information regarding the acquisition schedule, including the jump start, stay ahead, and rough proportionality provisions*).
>
> **Objective LAND 1.2:** Control invasive species on reserve lands at a level to ensure sustainable populations of Covered Species.

Goal LAND2: Protection and maintenance of natural ecological processes.

Objective LAND2.1: Ensure hydrological processes (e.g. sloughing) needed to maintain sustainable populations for species like bank swallow.

Goal LAND3: Movement and genetic exchange of native organisms within and between natural communities.

Objective LAND 3.1: Protect at least 40 percent of critical winter range habitat designated for the East Tehama Deer Herd, the Bucks Mountain Dear Herd, and the Mooretown Deer Herd (Figure 3–20, *Deer Herds and Habitat Ranges in the Plan Area*) that is provided by blue oak savanna, blue oak woodland, live oak woodland, and mixed oak woodland within 45 years.

Objective LAND 3.2: Protect at least 20 percent of winter range habitat designated for the East Tehama Deer Herd, the Bucks Mountain Dear Herd, and the Mooretown Deer Herd (Figure 3–20) that is provided by blue oak savanna, blue oak woodland, live oak woodland, and mixed oak woodland within 45 years.

Objective LAND3.3: In the Plan Area north of the City of Chico, establish a habitat corridor comprised of oak woodland and savanna, grassland, riparian, wetland, and aquatic natural communities within 45 years that is along the northeast-southwest elevation gradient between the foothills at the eastern boundary of the Plan Area and the Sacramento River at the western boundary of the Plan Area (across the Cascade Foothills and Northern Orchards CAZs; Figure 5–4, *Locations within which Ecological Corridors will be Protected under the BRCP* [see separate file]). Land cover requirements for these natural communities within these CAZs are provided in Table 5–5 and minimum patch size is provided in Table 5–15. Criteria for corridors are provided in Sections 5.4.1.1.4, *Connectivity* and 5.4.1.3, *CM3: Identify High Priority Locations for Wildlife Passage Structures and Secure Funding*. The BRCP schedule for the conservation component is summarized in Table 8–2, *BRCP Schedule for Conservation Component (i.e., Non-Mitigation) of Specified Biological Resources*.

Objective LAND3.4: In the Plan Area south of the City of Chico and north of the City of Oroville, establish a habitat corridor comprised of oak woodland and savanna, grassland, riparian, wetland, and rice land within 45 years along the east-west elevation gradient between the foothills at the eastern boundary of the Plan Area and Butte Creek at the western boundary of the Plan Area (across the Cascade Foothills and Basin CAZs; Figure 5–4).

Objective LAND3.5: In the Plan Area south of the City of Oroville, establish a habitat corridor comprised of oak woodland and savanna, grassland, riparian, wetland, and agricultural land within 45 years along the east-west elevation gradient between the

foothills at the eastern boundary of the Plan Area and the Feather River (across the Sierra Foothills and Southern Orchard CAZs) (Figure 5–4).

Objective LAND3.6: In the Plan Area adjacent to the Sacramento River, establish a habitat corridor the length of the Sacramento River in the Sacramento River and Northern Orchards CAZs that is comprised of patches of riparian, wetland, and aquatic (e.g., ponds and oxbows) natural communities within 45 years. Habitat patches may be disconnected by intervening orchard lands and the corridor width will be determined by the width of habitat patches lying between river levees (or the top of the river bank where levees are not present) and adjacent orchard or other agricultural lands (Figure 5–4).

Objective LAND3.7: Facilitate movement of native wildlife across roadways (see Section 8.1.5, Conservation Measure 3: Identify high-priority locations for wildlife passage structures and secure funding).

Goal LAND4: Protected seeps distributed throughout the Plan Area.

Objective LAND 4.1: Protect 10 seeps that support emergent wetland vegetation within BRCP protected grassland and oak savanna and oak woodland natural communities.

Goal LAND5: Protected ponds distributed throughout the Plan Area.

Objective LAND5.1: Protect 80 ponds. (See Table 5–3 for more information regarding location of existing ponds. See also Objectives NACO6.3, NACO 6.4, SPEC 11.3, and SPEC 11.4 for more information regarding Covered Species that will benefit from pond protection and management of ponds.)

Goal LAND6: Protected major rock outcrops and cliff faces.

Objective LAND6.1: Protect major rock outcrops and cliff faces. (See Section 5.6.8, *American Peregrine Falcon*, for more information regarding this objective.)

5.3.2.2 Natural Community-Level Goals and Objectives

The following are the biological goals and objectives for natural communities and agricultural lands. The process and considerations used to develop the extent of this land cover type to be protected are described in Section 5.2.3.5 and Tables 5–1 and 5–2. All conservation targets are inclusive of both conservation and mitigation obligations.

Goal NACO1: Large contiguous areas of oak woodland and savanna.

Objective NACO1.1: Protect 20,491 acres of oak woodland and savannah, consisting of 2,862 acres of blue oak savanna, 5,873 acres of blue oak woodland, and 11,756 acres of interior live oak and mixed oak woodland that are spatially distributed as indicated in

Table 5–5. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Goal NACO2: Large contiguous areas of grassland, with and without vernal swale complex.

Objective NACO2.1: Protect 34,841 acres of grassland, consisting of 13,441 acres of grassland without vernal swale complex and 21,400 acres of grassland with vernal swale complex that are spatially distributed as indicated in Table 5–5. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO2.2: Within the 21,400 acres of protected grassland with vernal swale complex, restore 306 wetted acres of vernal pools and swales. Pool density, connectivity, and bathymetry of the restored pools will be based on best approximations of historic conditions on the restoration site. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO2.3: Increase distribution and abundance of burrows in grassland.

Goal NACO3: Large contiguous areas of riparian natural community.

Objective NACO3.1: Protect 6,370 acres of riparian, consisting of 5,650 acres of existing cottonwood-willow /valley oak riparian forest and 720 acres willow scrub that are spatially distributed as indicated in Table 5–5. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO3.2: Restore 179 acres of riparian, distributed within the Plan Area as indicated in Table 5–7. Restoration targets will consist of cottonwood-willow riparian forest that attains California Wildlife Habitat Relationships (CWHR) habitat stage 3P[12] within 10 years of initial restoration actions and/or valley oak riparian forest that trends towards achieving a CWHR habitat stage designation of 5D[13] within 50 years. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO3.3: Restore 11 acres of willow scrub distributed within the Plan Area as indicated in Table 5–9. Willow scrub will attain CWHR canopy closure class M[14]

[12] 3 = pole tree, canopy diameter 15–30 feet, dbh 6–11 inches; P = Open cover, canopy closure 25–39 percent (Mayer and Laudenslayer 1988).
[13] 5 = medium/large tree, canopy diameter greater than 45 feet, diameter at breast height (dbh) greater than 24 inches; D = Dense cover, canopy closure 60-100 percent (Mayer and Laudenslayer 1988).
[14] M = moderate cover (40-59 percent canopy closure).

within 5 years of initial restoration actions. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Goal NACO4: A diversity of representative wetland types distributed throughout the Plan Area.

Objective NACO4.1: Protect 695 acres of emergent wetland that is spatially distributed within the Plan Area as indicated in Table 5–9. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO4.2: Restore 126 acres of emergent wetland, distributed within the Plan Area as indicated in Table 5–9, to achieve a CWHR habitat stage designation of 2D[2] within 10 years of initial restoration actions. Restored emergent wetland shall be supported by un-assisted hydrologic inputs, except when needed to maintain giant garter snake habitat functions.

Goal NACO5: Free-flowing perennial and intermittent streams.

Objective NACO5.1: Protect 242 acres of free-flowing perennial stream (equivalent to 20 miles of stream channel and both channel banks with a buffer except where one bank is located outside of the Plan Area) that are spatially distributed as indicated in Table 5–5.

Objective NACO5.2: Protect 73 acres in Table 5–5 of intermittent stream (equivalent to 12 miles of stream channel and both channel banks except where one bank is located outside of the Plan Area) that are spatially distributed as indicated in Table 5–5.

Goal NACO6: Agricultural land coverland cover types that have value for wildlife.

Objective NACO6.1: Protect and maintain 23,182 acres of land in rice production that are spatially distributed as indicated in Table 5–5. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO6.2: Protect and maintain 3,780 acres of irrigated pasture and irrigated cropland that are spatially distributed as indicated in Table 5–5. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–11.

Objective NACO6.3: Maintain and enhance habitat conditions for covered species on BRCP protected agricultural lands by maintaining field borders that support habitat for native wildlife (e.g., rodents, songbirds) and trees for raptor nesting and perching.

[2] 2 = emergent vegetation greater than 12 inches in height; D = Dense cover, canopy closure 60–100 percent (Mayer and Laudenslayer 1988).

5.3.2.3 Species-Level Goals and Objectives

The following are species-specific biological goals and objectives. The process and considerations used to develop the extent of this land cover type to be protected for each of the covered species are described in Section 5.2.3.5 and Tables 5–1 and 5–2. All conservation targets for modeled habitat are inclusive of both conservation and mitigation obligations.

Species level objectives are written when the needs of a species cannot fully be met at the landscape or natural community level. Objectives are written for species whose natural community based modeled habitat for one or more life history requirements is in a specific distribution amongst CAZs and species with specific management requirements, occurrence targets or occupancy requirements. For a complete list of all landscape, natural community and species goals, objectives, and conservation measures that apply to each covered species, see Table 5–16.

Goal SPEC1: Maintain or increase the population of tricolored blackbird.

> **Objective SPEC1.1**: Protect up to three occupied tricolored blackbird nesting sites within 5 years of their discovery.

Goal SPEC2: Maintain or increase the population of yellow-breasted chat.

> **Objective SPEC2.1:** Protect 2,835 acres of modeled yellow-breasted chat nesting and foraging habitat, above 200 feet in elevation. These acreages are subsets of protected lands within the 5,650 acres of protected cottonwood-willow and valley oak riparian forest and 720 acres of willow scrub (see Table 5–5). These acres will be distributed according to Table 5–8.
>
> **Objective SPEC2.2:** Protect 185 acres of known yellow-breasted chat nesting and foraging habitat in the Cascade Foothills CAZ.

Goal SPEC3: Maintain or increase the population of bank swallow.

> **Objective SPEC3.1**: Protect 242 acres (equivalent to 20 miles) of stream channel with a buffer, of which at least 121 acres is bank swallow nesting habitat. Where one bank is located outside of the Plan area, protect the bank that is within the Plan Area. These acres will be distributed according to Table 5–8.
>
> **Objective SPEC3.2**: Protect all occupied bank swallow nesting colonies along tributaries to the Sacramento River within 5 years of their discovery.

Goal SPEC4: Maintain or increase the population of western burrowing owl.

> **Objective SPEC4.1**: Increase nest burrow availability for burrowing owls. Increases in nest burrow activity will be achieved through habitat protection, increasing ground

squirrel populations, use of artificial burrows, and managing for sufficient prey populations. Locations of these actions are described in Table 5–5, *Natural Communities Protection Targets*, and the schedule is described in Table 8–2, *BRCP Schedule for Conservation Component (i.e., Non-Mitigation) of Specified Biological Resources*.

Goal SPEC5: Maintain or increase the population of western yellow-billed cuckoo.

Objective SPEC5.1: Protect all new western yellow-billed cuckoo nest sites within 5 years of their discovery.

Goal SPEC6: Maintain or increase the distribution of the wintering population of greater sandhill crane.

Objective SPEC6.1: Protect 21,660 acres of unprotected modeled greater sandhill crane winter roosting and foraging habitat and 500 acres of traditional upland use area habitat in accordance with the distribution requirements in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC6.2: Create and manage 160 acres of greater sandhill crane winter roosting habitat in the Basin CAZ.

Goal SPEC7: Maintain or increase the population of California black rail.

Objective SPEC7.1: Of the 10 protected seeps (Goal LAND4), protect at least five that are occupied by California black rail.

Goal SPEC8: Maintain or increase the population size and distribution of nesting American peregrine falcon.

Objective SPEC8.1: Of the 21,400 acres of grassland with vernal swale complex, 695 acres of emergent wetland, and 23,182 acres of rice that will be protected (Table 5–5), protect 29,157 acres of modeled American peregrine falcon seasonal and year-round foraging habitat, according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC8.2: Protect 35 acres of American peregrine falcon habitat containing known nest sites, per Table 5–8.

Objective SPEC8.2: Protect all unprotected American peregrine falcon nest sites within 5 years of being discovered within the Plan Area over the term of the BRCP.

Goal SPEC9: Maintain or increase the abundance of Swainson's hawk.

Objective SPEC9.1: Protect 4,325 acres of modeled Swainson's hawk nesting habitat and 18,680 acres of unprotected modeled Swainson's hawk nesting and foraging habitat and modeled foraging habitat distributed within the Plan Area as indicated in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC9.2: Restore 179 acres of Swainson's hawk nesting habitat distributed in the Plan Area as indicated in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Goal SPEC10: Maintain or increase the abundance of white-tailed kite.

Objective SPEC10.1: Protect 5,725 acres of modeled white-tailed kite nesting habitat and 50,516 acres of unprotected modeled white-tailed kite year-round foraging habitat and modeled breeding season foraging habitat distributed within the Plan Area as indicated in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Goal SPEC11: Maintain or increase the abundance of bald eagle.

Objective SPEC11.1: Of the protected 5,560 acres of cottonwood-willow and valley oak riparian forest and 11,756 acres of live oak woodland and mixed oak woodland (Table 5–5), include 4,435 acres of modeled bald eagle nesting habitat (within one mile of the Sacramento and Feather Rivers, Big Chico and Butte Creeks and Lake Oroville) according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC11.2: Of the protected 21,400 acres of grassland with vernal swale complex, 242 acres of open water perennial stream channel and 23,182 acres of rice, include 21,195 acres of modeled bald eagle seasonally available foraging habitat, according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC11.3: Protect two new (currently unknown and unprotected) bald eagle nest sites that have been occupied more than once within 5 years of being detected.

Objective SPEC11.4: Within 5 years of their discovery, protect four bald eagle winter roosts.

Goal SPEC12: Maintain or increase the giant garter snake population.

Objective SPEC12.1: Protect and maintain 27,547 acres of modeled giant garter snake breeding and movement habitat comprised of 23,182 acres of rice, 585 acres of emergent wetland and willow scrub, and 3,780 acres of adjoining cropland distributed in the Plan Area in accordance with Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC12.2: Restore 500 acres of giant garter snake habitat comprised of a mosaic of emergent vegetation, open water, and upland habitat primarily in the Basin CAZ[15].

Objective SPEC12.3: Establish a giant garter snake corridor at least 0.6 mile wide comprised of contiguous patches of riparian, wetland, and aquatic natural communities and agricultural lands that support giant garter snake movement habitat. The corridor shall connect the Llano Seco Unit of the Upper Butte Basin Wildlife Area in the Sacramento River CAZ to the Little Dry Creek Unit of the Upper Butte Basin Wildlife Area and to Gray Lodge Wildlife Area in the Basin CAZ (Figure 5–4).

Goal SPEC13: Maintain or increase the population of Blainville's horned lizard.

Objective SPEC13.1: Protect at least 400 acres in any combination of the following: (1) occupied sites or (2) grassland, blue oak woodland, blue oak savannah, or cottonwood willow valley oak riparian forest that are connected to occupied sites. Habitat will be protected within 5 years of the discovery of occupied habitat.

Goal SPEC14: Maintain or increase the population of western pond turtle.

Objective SPEC14.1: Protect and maintain 10,965 acres of unprotected modeled western pond turtle aquatic habitat: emergent wetland, nesting and movement habitat, and aquatic, nesting, and movement habitat distributed in the Plan Area in accordance with Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC14.2: Control bullfrog populations in protected ponds occupied by or adjacent to habitat occupied by western pond turtle to ensure sustainable populations of this Covered Species and other native species that utilize these ponds.

Goal SPEC15: Maintain or increase the population of foothill yellow-legged frog.

[15] All of the restoration is expected to be located in the Basin CAZ which supports the center of the Plan Area population. BCAG, however, may restore a portion of habitat in the adjoining Sacramento River, Northern Orchards, and/or Southern Orchard CAZs where such restoration meets giant garter snake habitat restoration requirements.

Objective SPEC15.1: Of the protected land cover types in the Sierra Foothills and Cascade Foothills CAZs (Table 5–5), include 2,025 acres of modeled foothill yellow-legged frog habitat within 130 feet of perennial or intermittent stream channels above 300 feet in elevation, according to the distribution in Table 5–8. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Goal SPEC16: Maintain or increase the population of western spadefoot toad.

Objective SPEC16.1: Of the 495 acres of protected emergent wetland in the Sierra Foothills CAZ (Table 5–5), include 225 acres adjoining grassland, grassland with vernal swale complex, vernal pools, altered vernal pools, or blue oak savanna, according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC 16.2: Of the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include least at 13,700 acres of western spadefoot toad breeding and foraging/movement/aestivation habitat within the Chico, Doe Mill, Honcut, Oroville, Vina Plains, Palermo, and/or Richvale Recovery Core Areas (Appendix A, Figure A.16-1) according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC16.3: Control bullfrog and mosquitofish populations in protected ponds occupied by or adjacent to habitat occupied by western spadefoot toad to ensure sustainable populations of this Covered Species and other native species that utilize these ponds.

Goal SPEC17: Increase the extent of spawning habitat to support the survival of salmonids -- Central Valley steelhead, Central Valley spring-run Chinook salmon and Central Valley fall/late-fall run Chinook salmon.

Objective SPEC17.1: Distribute 30,000 cubic yards of spawning gravels of a suitable size for use by Chinook salmon and steelhead among suitable spawning locations within Big Chico Creek, Little Chico Creek, Butte Creek, Little Dry Creek, Rock Creek, and/or Mud Creek.

Goal SPEC18: Improve juvenile survivorship of salmonids -- Central Valley steelhead, Central Valley spring-run Chinook salmon and Central Valley fall/late-fall run Chinook salmon.

Objective SPEC18.1: Remove, modify, or screen up to 25 of the 42 currently unscreened diversions that pose a high risk for entrainment of juvenile salmonids on Big Chico Creek and Butte Creek in the Cascade Foothills, Northern Orchards, and Basin CAZs (Figure 5–5, *Location of Screened and Unscreened Diversions* [see separate file]).

Goal SPEC19: Improve habitat connectivity for Central Valley steelhead, Central Valley spring-run Chinook salmon, Central Valley fall/late-fall run Chinook salmon.

Objective SPEC19.1: Remove at least five impediments, if present, to upstream and downstream passage for covered and other native fish in Pine Creek, Rock Creek, Mud Creek, Big Chico Creek, Lindo Channel, Little Chico Creek, Butte Creek, and/or Little Dry Creek.

Goal SPEC20: Improve habitat connectivity for green sturgeon.

Objective SPEC20.1: Remove at least five impediments to upstream and downstream passage for covered and other native fish in Pine Creek, Rock Creek, Mud Creek, Big Chico Creek, Lindo Channel, Little Chico Creek, Butte Creek, and/or Little Dry Creek.

Goal SPEC21: Maintain or increase the distribution of occupied valley elderberry longhorn beetle habitat in the Plan Area.

Objective SPEC21.1: Protect 8,282 acres of modeled valley elderberry longhorn beetle habitat (riparian land cover types plus grasslands within one quarter mile of riparian land cover types or perennial streams), according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Goal SPEC22: Maintain or increase populations of vernal pool tadpole shrimp.

Goal SPEC23: Maintain or increase populations of Conservancy fairy shrimp

Objective SPEC23.1: Of the total 21,400 acres of grassland with vernal swale complex protected (Table 5–5), include 150 acres that support the three known occurrences of Conservancy fairy shrimp habitat within the Vina Plains Recovery Core Area (Cascade Foothills CAZ) according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC23.2: Protect at least five new occurrences of Conservancy fairy shrimp within 5 years of their discovery.

Objective SPEC23.3: Within the 21,400 acres of grassland with vernal swale complex protected (Table 5–5), reestablish Conservancy fairy shrimp in at least two vernal pools from which status surveys indicate the species has been extirpated.

Goal SPEC24: Maintain or increase populations of vernal pool fairy shrimp.

This goal does not have specific objectives because acquiring necessary habitat (as described in Table 5–16) meets natural community goals NACO2.1, NACO2.2.

Goal SPEC25: Maintain or increase populations of Ferris' milkvetch.

Objective SPEC25.1: Of the total 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include 650 acres of Ferris' milkvetch habitat according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC25.2: Protect at least five new occurrences of Ferris' milkvetch, if present in the Plan Area, within 5 years of their discovery.

Goal SPEC26: Maintain or increase populations of lesser saltscale.

Objective SPEC26.1: Protect at least five new occurrences of lesser saltscale within 5 years of their discovery.

Goal SPEC27: Maintain or increase populations of Hoover's spurge.

Objective SPEC27.1: Of the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include least 13,675 acres Hoover's spurge habitat within the Oroville and Vina Plains Recovery Core Areas. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC27.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include the one known occurrence of Hoover's spurge (see Table 5–17, *Known Covered Plant Species Occurrences and Protection Status*).

Objective SPEC27.3: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect at least five new occurrences of Hoover's spurge, if present in the Plan Area, within 5 years of their discovery.

Objective SPEC27.4: Within the 21,400 of protected grassland with vernal swale complex (Table 5–5), establish or reestablish Hoover's spurge in at least two extant vernal pools on soil types from which surveys indicate that the species has been extirpated.

Goal SPEC28: Maintain or increase populations of Ahart's dwarf rush.

Objective SPEC28.1: Of the 21,400 of protected grassland with vernal swale complex (Table 5–5), include least 465 acres Ahart's dwarf rush habitat within the Honcut Recovery Core Area. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC28.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect the 15 known occurrences of Ahart's dwarf rush (see Table 5–17).

Objective SPEC28.3: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect at least five new occurrences of Ahart's dwarf rush, if present within the Plan Area, within 5 years of their discovery.

Objective SPEC28.4: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), establish or reestablish Ahart's dwarf rush in at least two extant vernal pools on soil types from which surveys indicate that the species has been extirpated.

Goal SPEC29: Maintain or increase populations of Red Bluff dwarf rush.

Objective SPEC29.1: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect 10 known occurrences of Red Bluff dwarf rush (see Table 5–17).

Goal SPEC30: Maintain or increase populations of Butte County meadowfoam.

Objective SPEC30.1: Of the 21,400 acres of BRCP protected grassland with vernal swale complex (Table 5–5), include 6,002 acres of primary and 1,202 acres of secondary modeled Butte County meadowfoam habitat according to the distribution in Table 5–18, *Acreage of Modeled Butte County Meadowfoam Habitat that will be Protected by Population Grouping* and Figure 5–6. These acreage targets are inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC30.2: Within the 6,002 acres of primary and 1,202 acres of secondary modeled Butte County meadowfoam habitat, establish the Chico Butte County Meadowfoam Preserve, consisting of 2,402 acres of primary and 310 acres of secondary modeled habitat according to the distribution in Table 5–18 and Figure 5–6. The Chico Butte County Meadowfoam Preserve will be acquired within 10 years of BRCP implementation.

Objective SPEC30.3: Within the 6,002 acres of primary and 1,202 acres of secondary modeled Butte County meadowfoam habitat, include 3,600 acres of modeled primary and 305 acres of secondary habitat in the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings according to the distribution in Table 5–18 such that all known occurrences of Butte County meadowfoam in these locations are protected.

Goal SPEC31: Maintain or increase populations of veiny monardella.

Objective SPEC31.1: Within the total 13,441 acres of protected grasslands (Table 5–5), protect the eight known occurrences that comprise the only known population of veiny monardella in the Plan Area (see Table 5–17) located in the Neal Road Drop-Off and Recycling Facility UPA (Cascade Foothills CAZ) according to the distribution in Table 5–8.

Objective SPEC31.2: Within the total 13,441 acres of protected grasslands (Table 5–5), protect at least four new occurrences of veiny monardella, if present in the Plan Area, within 5 years of their discovery.

Goal SPEC32: Maintain or increase populations of hairy Orcutt grass.

Objective SPEC32.1: Of the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include least 13,650 acres of hairy Orcutt grass habitat within the the Oroville and Vina Plains Recovery Core Areas. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC32.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect at least eight new occurrences of hairy Orcutt grass, if present within the Plan Area, within 5 years of their discovery.

Objective SPEC32.3: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), establish or reestablish hairy Orcutt grass in at least two extant vernal pools on soil types from which surveys indicate that the species has been extirpated.

Goal SPEC33: Maintain or increase populations of slender Orcutt grass.

Objective SPEC33.1: Of the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include least 7,035 acres of slender Orcutt grass habitat within the Vina Plains and/or Palermo Recovery Core Areas. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC33.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect the two known occurrences of slender Orcutt grass in the Plan Area (see Table 5–18).

Objective SPEC33.3: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect at least eight new occurrences of slender Orcutt grass if present in the Plan Area.

Objective SPEC33.4: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), establish or reestablish slender Orcutt grass in at least two extant vernal pools on soil types from which surveys indicate that the species has been extirpated.

Goal SPEC34: Maintain or increase populations of Ahart's paronychia.

Objective SPEC34.1: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect four known occurrences of Ahart's paronychia (Table 5–17).

Objective SPEC34.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect at least five new occurrences of Ahart's paronychia, if present within the Plan Area, within 5 years of their discovery.

Goal SPEC35: Maintain or increase populations of California beaked rush.

Objective SPEC34.1: Protect the seven known occurrences of California beaked-rush (Table 5–17) according to the distribution in Table 5–8.

Objective SPEC35.2: Protect at least five new occurrences of California beaked-rush, if present in the Plan Area, within 5 years of their discovery.

Goal SPEC36: Maintain or increase populations of Butte County checkerbloom.

Objective SPEC36.1: Within the 6,437 acres of protected oak woodland and savanna, 19,605 acres of grassland, and 1,730 acres of riparian land cover types in the Cascade Foothills CAZ (Table 5–5) and according to the distribution of protected Butte County checkerbloom habitat (Table 5–8), protect 65 known occurrences of Butte County checkerbloom.

Objective SPEC36.2: Within the 6,437 acres of protected oak woodland and savanna, 19,605 acres of grassland, and 1,730 acres of riparian land cover types in the Cascade Foothills CAZ (Table 5–5) and according to the distribution of protected Butte County checkerbloom habitat (Table 5–8), protect up to 20 new occurrences of Butte County checkerbloom north of the Big Chico Creek drainage within 5 years their discovery.

Goal SPEC37: Maintain or increase populations of Butte County golden clover.

Objective SPEC37.1: Of the 13,441 acres of protected grassland, 21,400 acres of protected grassland with vernal swale complex, and 2,862 acres protected blue oak savannah (Table 5–5), protect 3,700 acres of modeled Butte County golden clover habitat according to the distribution in Table 5–8. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC37.2: Within the 3,700 acres of protected modeled Butte County golden clover habitat (Table 5–8), protect three occurrences of Butte County golden clover (see Table 5–17).

Objective SPEC37.3: Protect at least five new occurrences of Butte County golden clover within 5 years of their discovery.

Goal SPEC38: Maintain or increase populations of Greene's tuctoria.

Objective SPEC38.1: Of the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), include at least 13,700 acres of Greene's tuctoria habitat within the Oroville, Vina Plains, and/or Richvale Recovery Core Areas. This acreage target is inclusive of mitigation requirements that, along with geographic distribution requirements, are summarized in Table 5–12.

Objective SPEC38.2: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), protect two known occurrences of Greene's tuctoria in the Plan Area (see Table 5–17).

Objective SPEC38.3: Within the 21,400 of protected grassland with vernal swale complex (Table 5–5), protect at least four new occurrences of Greene's tuctoria, if present in the Plan Area, within 5 years of their discovery.

Objective SPEC38.4: Within the 21,400 acres of protected grassland with vernal swale complex (Table 5–5), establish or reestablish Greene's tuctoria in at least two extant vernal pools on soil types from which surveys indicate that the species has been extirpated.

5.4 CONSERVATION MEASURES

This section presents the BRCP conservation measures (CMs) that will be implemented by the BRCP Implementing Entity to protect, enhance, and restore natural communities and the covered species habitats they support; improve the ecological function of natural communities; and provide for the conservation of covered species in the Plan Area. Implementation of the conservation measures will collectively achieve the BRCP biological goals and objectives (Section 5.3). Conservation measures address the protection, enhancement, and restoration of physical habitats that support covered species and reduce the effect of environmental stressors on covered species. Conservation measures were developed to address the needs of covered and other native species at each of three ecological scales: landscape, natural community, and species-specific. Landscape-level conservation measures are presented in Section 5.4.1, natural community-level conservation measures are presented in Section 5.4.2, and species-specific conservation measures are presented in Section 5.4.3. A summary list of BRCP conservation measures and the biological objectives they address is provided in Table 5–16.

5.4.1 Landscape-Level Conservation Measures

5.4.1.1 CM1: Acquire Lands

BCAG will protect[16] natural communities and covered species habitat within the Plan Area to build the BRCP conservation lands system. The required acreage of protection of existing natural communities within each CAZ and in total is provided in Table 5–5. The required acreage of protection of covered species habitat types within each CAZ is provided in Table 5–8. Within these protected lands or on additional protected lands, sufficient lands will be protected as is necessary to restore the acreage of wetlands and riparian habitats within the CAZs indicated in Table 5–7.[17] Habitat restoration requirements are described in CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans.

BCAG will protect lands using the acquisition mechanisms described in Section 5.4.1.1.3, *Approach to Land Acquisition*, to establish the BRCP conservation lands system. Conservation easements[18] will be used more frequently than other acquisition methods in the working landscape of agricultural lands and rangelands to maintain lands in current land uses that benefit covered species. In general, lands that are acquired through fee title will be those that have known occurrences of highly restricted covered species (e.g., Butte County meadowfoam) or that are intended for extensive changes in land use for habitat improvement such as habitat enhancement and restoration. Candidate lands for protection under voluntary permanent agricultural conservation easements include lands that support intact habitat for covered species and for which no substantial land use changes are required (e.g., no habitat enhancement or restoration needed) and lands needed mainly for ecological corridors. Use of permanent conservation easements is the preferred habitat protection method over fee title acquisition for rangelands and croplands for which the ongoing agricultural use is compatible with achieving the biological goals and objectives of the BRCP.

- This conservation measure provides the mechanism and guidance for the acquisition of lands and the establishment of the BRCP conservation lands system that will meet the natural community and covered species habitat protection biological objectives presented in Section 5.3. Protect and enhance areas of existing natural communities and covered species habitat;

[16] See the glossary for the definition of the term "protect/protection" as it is used in this document. All lands protected under the BRCP will have permanent conservation easements placed on them.

[17] Acreages presented in these tables (Tables 5–3, 5–5, and 5–7) represent the maximum acreage that will be protected and restored with full implementation of the BRCP covered activities (i.e., all protection and restoration for mitigation is implemented).

[18] See the glossary for the definition of the term "conservation easement" as it is used in this document and Appendix M, *Conservation Easement Template*, for a description of the minimum requirements for conservation easements under the BRCP.

- Protect and maintain occurrences of covered plant species with limited distributions and habitat areas occupied by specified covered wildlife species (see Section 5.4.3, *Species-Level Conservation Measures*);
- Provide sites for restoring natural communities and covered species habitat; and
- Provide habitat connectivity among the various land units within the conservation land system.

This conservation measure describes the land acquisition procedures, including pre-acquisition survey requirements, land acquisition methods, and land selection criteria that will be applied to ensure that the ecological attributes of the acquired lands will serve to achieve the biological goals and objectives.

5.4.1.1.1 Pre-Acquisition Surveys

BCAG (subject to USFWS, NMFS, and CDFW review and approval) will develop and implement protocols for assessing physical and biological resources and infrastructure present on lands being considered for acquisition to determine the degree to which they are suitable for achieving BRCP biological goals and objectives. In instances where land is being considered for acquisition to protect habitat occupied by a particular covered species, federal and state protocol-level surveys may be required to determine occupancy. Pre-acquisition surveys will be conducted by qualified biologists (see Appendix P, *Glossary*). Surveys will assess the following and any other relevant physical and biological attributes of the lands consistent with the conservation land assembly principles (see Section 5.2.3.4).

- The presence of covered species
- The extent and quality of existing covered species habitats
- Connectivity with other habitat areas
- Infrastructure supporting existing habitats or necessary to restore habitats
- Adjacent land uses and resources
- Potential constraints to long-term management and maintenance of habitats
- Other conservation-related opportunities and constraints

5.4.1.1.2 Site Selection Criteria

BCAG (subject to USFWS, NMFS, and CDFW review and approval, see Section 8.7.4) will apply, and revise when necessary, the following criteria, based on the conservation land assembly principles described in Section 5.2.3.4 for evaluating and prioritizing acquisition of natural communities (non-cultivated lands) for achieving habitat protection targets. The criteria are intended to be used as a set for assembling a conservation lands system rather than as a rank ordered list for acquiring any one parcel.

- Level of benefits the acquisition will provide for covered species.
- Presence and abundance of covered species and life history functions (e.g., presence of nesting Swainson's hawk, white-tailed kite, peregrine falcon, bald eagle, and western burrowing owl; greater sandhill crane and bald eagle roost sites; or other covered species).
- Presence of plant species of highly limited distribution (e.g., veiny monardella, hairy Orcutt grass, slender Orcutt grass, Butte County checkerbloom, Butte County golden clover).
- Presence of uncommon specialized ecological conditions (e.g., alkali soils, seeps, vernal pools larger than 0.01 acre) required by covered species with a narrow range of habitat requirements.
- Likely effects of adjacent land uses on the ability to maintain or improve desired ecological functions into the future.
- Habitat patch size relative to the minimum habitat patch size requirements of the covered species intended to benefit from the habitat.
- Opportunities for effectively implementing management actions to enhance ecological functions.
- Level of contribution for maintaining local and regional ecological processes.
- Level of connectivity provided between and among existing PEHL habitat areas.
- Level of contribution for protecting natural environmental gradients.
- Level of contribution towards establishment of large units of conserved lands.
- Likely effects of climate change on future ecological functions.
- Role in maintaining and complementing the habitat functions of adjoining natural communities for covered and other native species.
- Role in protecting watershed functions for a covered species (e.g acquisition of oak savanna and woodland and grassland natural communities that provide watershed protection for salmon and steelhead spawning habitat in Butte Creek and Big Chico Creek.)
- For achieving cottonwood-willow and valley oak riparian forest targets, areas that are, or have the potential to become, mature riparian forests over time, with priority given to patches along stream corridors that are 300 feet or more in width.
- Level of contribution towards protection of a heterogeneous mix of natural communities and native species, including native grasses and forbs.
- Effectiveness in contributing towards achieving multiple biological goals and objectives.

BCAG (subject to USFWS, NMFS, and CDFW approval, see Section 8.7.4) will apply, and revise when necessary, the following criteria for evaluating and prioritizing acquisition of agricultural habitats for achieving habitat protection targets.

- Proximity to active Swainson's hawk and white-tailed kite nesting territories.
- Proximity to greater sandhill crane roost sites.
- Occupancy by giant garter snake and western pond turtle and proximity to and connectivity with occupied giant garter snake habitat areas.
- Ability to support crops that provide high value Swainson's hawk and/or greater sandhill crane foraging habitat.
- Opportunities to preserve patches of other high value non-agricultural habitats (e.g., oak groves, wetlands, windrows, and hedgerows) that are located among farmed fields.
- Suitability for restoration of emergent wetland, greater sandhill crane roosting habitat, and giant garter snake habitat.

BCAG (subject to USFWS, NMFS, and CDFW review and approval, see Section 8.7.4) will apply, and revise when necessary, the following criteria for evaluating and prioritizing acquisition of lands for achieving natural communities and covered species habitat restoration targets.

- Ability to achieve biological goals and objectives (e.g., location relative to existing habitat occupied by target covered species; the ability to develop as habitat for target covered species).
- Suitability (e.g., soils, hydrology, topography) and cost effectiveness for restoring target habitats, including water sources for managed wetlands and restored emergent wetlands.
- Ability to meet the same patch size, shape, and connectivity criteria as identified for protection of existing habitats.
- Support the restored habitat over time.
- Level of management necessary to maintain desired ecological functions into the future.

Protection of vernal pools and other seasonal wetlands, natural emergent wetlands, riparian habitats, streams, and ponds must ensure sufficient watershed lands are present to support hydrologic requirements. Protection of managed wetland, some of the restored emergent wetland, and rice land cover types must also include securing (e.g., via water rights and/or contracts) the artificial water sources supporting these habitats.

To be credited as contributing towards achieving the biological goals and objectives, BRCP lands acquired for protection and restoration must be acquired within the CAZs indicated in Tables 5–3, 5–5, and 5–7, or as they may be amended in the future through the adaptive management process (see Section 7.3). The total existing extent of natural communities and

covered species habitats is presented in Tables 5–14 and 5–15, respectively, along with the extent found within existing protected lands (PEHL Category 1) and other PEHL (PEHL Category 2).

5.4.1.1.3 Approach to Land Acquisition

BCAG will establish a conservation lands system that encompasses all lands protected and restored under the BRCP. Land may be acquired through the following mechanisms:

- Purchase in fee title by Implementing Entity or a Permittee and put under a permanent conservation easement (see Appendix M, *Conservation Easement Template*).
- Acquisition of voluntary permanent agricultural conservation easements (hereafter referred to as conservation easements) on private lands that meet BRCP habitat protection requirements (see Appendix M).
- Acquisition by conservation organizations (e.g., land conservancies and land trusts) that protect and manage lands in conformance with BRCP requirements.
- Protection of lands by state agencies that provide designations for those lands that meet BRCP protection and management requirements (would not apply to mitigation requirements, only conservation component.)
- Purchase of mitigation credits from private mitigation or conservation banks approved by USFWS and CDFW or U.S. Army Corps of Engineers (USACE) and meeting the protection and management requirements of the BRCP (see Section 8.7.6).

The BRCP conservation lands system benefits from and builds on the existing protected lands within and adjacent to the Plan Area (Figure 5–2). In addition, other PEHL (PEHL Category 2) support natural communities and covered species habitats that contribute to the overall conservation of the covered species and natural communities in the Plan Area (Figure 5–2).

Procedures and requirements for conservation easements are described in Appendix M. BCAG may acquire conservation 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 BRCP biological goals and objectives. The BRCP conservation lands system will be comprised of the following: 1) lands that are under direct ownership and management of BCAG; 2) private lands acquired through permanent conservation easements (these lands may be managed by other qualified entities); 3) lands owned and managed by other entities (state, local agencies and nongovernmental organizations such as land trusts and conservancies) that are enrolled into the BRCP and meet all BRCP protection and management requirements (see *Land Acquisition by Other Organizations or through Partnerships* below. It is anticipated that BRCP conservation lands will predominately be protected through use of conservation easements with fee title acquisitions being focused on protection of lands that would require substantial restrictions on existing land uses to provide the intended biological objectives (e.g., lands acquired for restoration of habitat).

It is anticipated that lands selected for habitat restoration and enhancement actions will primarily be acquired in fee title by BCAG because habitat restoration and enhancement actions would preclude other land uses, such as agriculture. Lands acquired for the protection and enhancement of existing habitat functions may be acquired through conservation easements that specify the range of permitted land uses and practices that will maintain the intended habitat functions of the acquired lands (Appendix M*).*

The BRCP natural community and covered species habitat species occurrence acquisition targets are presented in Tables 5–3 and 5–7, respectively. These targets represent the extent of natural communities and covered species habitats that will need to be acquired under the BRCP to achieve the biological goals and objectives for conservation of natural communities and covered species. These targets represent the minimum extent of land that will be acquired; the actual extent that will be acquired may be greater because acquired parcels may not be comprised wholly of habitat types that contribute towards achieving habitat target acreage (for example, many acquired properties may include developed and disturbed sites, that support little or no habitat function, along with intact natural communities and high-function habitat). Sites within acquired parcels where habitat has been removed or disturbed will often provide opportunities for habitat restoration (see CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans).

Acquisition of Irrigated Agricultural Habitats

The Plan Area is dominated by agricultural land use practices with irrigated agriculture accounting for 250,587 acres or 44 percent of the total Plan Area.[19] Rice and orchards (mostly almonds and walnuts) dominate the irrigated agricultural land use. Orchards and vineyards do not provide important habitat for any of the covered species or for native wildlife in general, were not included in any covered species modeled habitat, and are not a focus of the conservation strategy. In contrast, rice lands and irrigated pasture and cropland provide habitat for many wildlife species, including several covered species. Actions to ensure the long-term conservation of rice land and irrigated cropland for both mitigation and conservation components of the BRCP are described in this section.

Rice Land. During BRCP implementation, a certain proportion of rice lands that provide habitat for giant garter snake and greater sandhill crane will be protected and maintained in rice production (Table 5–5) through the purchase of conservation easements from willing sellers. This includes maintaining a total of 23,182 acres of lands in rice production in the Northern Orchards, Basin, and Sacramento River CAZs to achieve the biological objectives for giant garter snake and greater sandhill crane habitat. The primary natural habitat of giant garter snake is comprised of permanent wetland[20], which typically supports substantially higher densities of

[19] In BRCP terminology non-irrigated agriculture are the rangelands that are mainly within the grassland and oak woodland and savanna natural communities. Conservation measures addressing these natural communities would affect the rangelands in the Plan Area.

[20] BRCP land cover types that support aquatic giant garter snake aquatic breeding and movement habitat includes emergent wetland, managed wetland, and willow scrub (see Appendix A, *Covered Species Accounts*).

giant garter snake than rice land (Appendix A). The rice land protection objective for giant garter snake habitat complements the conservation provided by restoration of giant garter snake habitat (i.e., permanent emergent wetland) under CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans, and also serves to maintain hydrologic connectivity with occupied habitat areas that are designed and managed specifically as giant garter snake habitat.

Permanent Conservation Easements for Rice Lands Mitigation. BCAG will purchase permanent conservation easements with willing landowners to maintain 23,182, acres in rice production, including associated water conveyance and drainage infrastructure, as mitigation for impacts of the covered activities on giant garter snake and other affected covered species. Fee title acquisition to achieve rice land acreage targets would only be used if the biological objectives cannot be achieved using conservation easements or it is the desire of willing sellers.

Spatial and Management Requirements for Rice Lands. The minimum contiguous extent of rice land brought under easement with one or more landowners must, in its entirety or in combination with other contiguous BRCP protected lands, be sufficient to provide at least 160 acres of habitat to serve as greater sandhill crane habitat or 320 acres to serve as giant garter snake habitat (see Table 5–2). Smaller habitat patches may be protected with concurrence of USFWS and CDFW. Conservation easements will specify the range of rice farming and other land management practices (e.g., canal/drain maintenance activities) permitted on easement lands. The easement will allow only for changes in land use that resulted in restoration of a mosaic of open water, wetland, and upland habitat suitable for giant garter snake.

Fee Title Acquisition of Rice Lands for Habitat Restoration. BCAG will purchase rice lands in fee title from willing sellers including all water rights and contracts that run with those lands for the purpose of giant garter snake habitat restoration as described in the giant garter snake goals and objectives and CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans. Rice lands owned in fee title by BCAG will either be managed as high function rice habitat or restored in whole or in part to a mosaic of open water, wetlands, and upland habitat suitable for giant garter snake and other covered species (Table 5–7).

Permanent Conservation Easements for Irrigated Pasture and Irrigated Crops Mitigation. BCAG will purchase permanent conservation easements with willing landowners to maintain 3,780 acres of irrigated pasture and irrigated crops (e.g., hay, row, grain crops) to mitigated impacts of the covered activities on covered species (Table 5–9). Maintaining the working landscape of irrigated pasture and irrigated crops (e.g., hay, row, grain crops) serves to achieve, in part, the biological goals and objectives for Swainson's hawk, greater sandhill crane, giant garter snake, white-tailed kite, and western burrowing owl. To maintain these agricultural habitats for covered and other native species, BCAG will purchase permanent conservation easements with willing landowners to keep their lands in hay, grain, or row crop production to provide habitat for covered species. The minimum contiguous extent of irrigated cropland brought under easement with one or more landowners (or contiguous with existing BRCP

reserves) must, in its entirety or in combination with other contiguous BRCP protected lands, be sufficient to provide 160-830 acres of habitat (depending on species) to serve as protected habitat for the targeted covered species (see Table 5–2). Smaller habitat patches may be protected with concurrence of USFWS and CDFW. Conservation easements will specify the range of crop types permitted on easement lands as well as any necessary restrictions on pesticide use and other land management practices.

Acquisition Land by Other Organizations or through Partnerships

It is anticipated that substantial amounts of land acquisition will be acquired by Permittees such as. In other instances, agencies and organizations who are not Permittees such as local and county parks or land trusts (e.g., The Nature Conservancy) will acquire land in the study area that will help meet the goals and objectives of this Habitat Plan. In these cases, it may be appropriate that BCAG receive credit toward BRCP requirements if the acquisitions are made in partnership with BCAG, they are consistent with BRCP goals, and the lands are enrolled into the BRCP through placement of a conservation easement. It is expected that BCAG will be involved in many of the land acquisitions in the permit area during the permit term. However, BCAG may own little or no land itself. For example, if BCAG partners with other groups and provides matching funds, larger land acquisitions will be possible than if BCAG were to purchase the land on its own. Land acquired through partnerships with non-Permittees can be counted toward the BRCP conservation requirements (i.e., contribution to recovery) only if the acquisition meets the criteria described above.

Credit will be determined based on the purpose and location of the acquisition, the management of the land acquired, and consistency with the conservation strategy of the BRCP. The BRCP budget assumes that BCAG will always fund management and monitoring on land in the Preserve System; actual funding will be determined on a case-by-case basis. Land acquired through partnerships could be managed and monitored by BCAG or by other groups or agencies as long as a contract or other binding agreement is in place to ensure that management and monitoring occurs according to the terms of the BRCP. All acquisitions credited toward the land acquisition requirements of the BRCP can be credited toward the Stay Ahead provision as discussed in Section 8.7.8 (Jump Start and Stay Ahead), regardless of who manages the property and regardless of the source of funding for acquisition or management.

5.4.1.1.4 Connectivity

In addition to the spatial distribution requirements among the CAZs for protection of natural communities, conservation lands will also need to be distributed within and among CAZs to protect elevation gradients and connectivity among natural communities and covered species habitats across the Plan Area. Four ecological corridors will be established within the locations shown in Figure 5–4 and described in landscape level objectives LAND3.3 through LAND3.6 (see Section 5.3.2.1, *Landscape-Level Goals and Objectives*).

Lands comprising each of the corridors may include agricultural lands, rural residential (no less than 10-acre lots), existing roads and utilities, and new roads and utilities that address movement of wildlife through design. It is expected that the corridors can be established through meeting the natural community conservation acreage protection targets presented in Table 5–5, but, depending on the availability of conservation lands, may require acquisition of additional land area. Conservation easements protecting corridor lands will specify the range of permissible land uses that are consistent with the ecological purpose of each corridor (e.g., allowable changes in crop types, etc). Land protection tools for habitat corridors are generally the same as for conservation lands described in Section 5.4.1.1.1, *Pre-Acquisition Surveys*; however, for agricultural lands that provide wildlife movement corridors, but not necessarily covered species habitat (e.g., orchards and vineyards), less restrictive agricultural easements (less restrictive to agricultural practices than conservation easements) may be used.

In addition to the criteria for the establishment of each of the ecological corridors described below, priority will be given to the acquisition of lands with no or minimal barriers to movement[21] of covered species and other native wildlife species and with high permeability for movement of wildlife through patches of non-habitat.[22] In assembling the ecological corridors, it is important to consider the permeability for safe movement of small mammals, amphibians and reptiles across linear anthropogenic structures (e.g., roads, railroads, and utilities) in BRCP established ecological corridors (Figure 5–4). Especially for giant garter snake and other snakes, roads pose a threat because snakes are attracted to roads for thermoregulation (i.e., basking). Research indicates that the combined ecological effects of roads may extend beyond 300 ft from the edge of the road, referred to as a "road-effect zone." Altered roadside habitats have been shown to modify amphibian and reptile behavior and movement patterns. Increased mortality and barriers to movement may influence species demography and gene flow, potentially resulting in impacts on overall population stability and persistence (see Jochimsen et al. 2004)

5.4.1.2 CM2: Develop an Invasive Species Control Program

BCAG will develop, with input and concurrence from USFWS and CDFW, a plan for the control of invasive animal and plant species. The comprehensive invasive species control plan will be implemented under CM5, Enhance Protected Natural Communities for Covered Species (see Section 5.4.2.2).

[21] Roads and highways represent one of the most important anthropogenic impacts on natural areas and contribute to habitat fragmentation because they are linear features that can inhibit animal movement along an ecological corridor (Forman and Alexander 1998; Trombulak and Frissell 2000; Forman et al. 2003). The road surface is a barrier for many species and central dividers and cement-lined road ditches create even stronger barriers for more species. Road traffic and vehicle strikes also create barriers, with higher traffic loads and greater speeds resulting in greater barriers to more species.

[22] If the ecological conditions of gaps between habitat patches are impermeable to species movement or do not sustain life history requirements of species, they effectively act as movement barriers or as population sink habitats (Debinski 2006; Fahrig 2003; Crooks 2002). The maximum inter-patch distance that an organism can traverse is inversely related to the habitat suitability of the gap; in locations with a high gap permeability and suitability, individual species may be able to traverse wider gaps than in locations where gap conditions are incompatible with the dispersing organism.

Elements of the plan will include the following:

- Protocols for periodically surveying for and assessing the abundance of nonnative predators and competitors on BRCP lands.
- Protocols for periodically surveying for and assessing the occurrence and abundance of invasive nonnative plants on BRCP lands.
- A brown-headed cowbird monitoring and control program (see discussion below).
- Methods for assessing degree of biological effect nonnative species have on covered and other native species within BRCP lands.
- Methods for assessing threats for establishment of nonnative animals and plants adjacent to lands onto BRCP lands.
- Methods for assessing threats for the spread of nonnative plants from BRCP 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.

Monitoring and control requirements that may be developed for specific conservation lands will be incorporated into management plans (see Section 5.4.2.2, CM5, *Enhance Protected Natural Communities for Covered Species*).

Current nonnative invasive plant species of concern include:

- Waxy mannagrass
- Italian ryegrass
- Barbed goatgrass
- Medusahead grass
- Yellow starthistle
- Himalayan blackberry
- Giant reed
- Parrot feather

Animal species that could degrade the habitat functions for covered species include:

- Feral domesticated animals (e.g., feral cat predation on ground-nesting birds)
- Wild feral pigs

- Brown-headed cowbirds

The brown-headed cowbird is a native species that has expanded its range substantially with conversion of historical Central Valley natural communities to agriculture uses. The brown-headed cowbird is a frequent brood parasite of yellow-breasted chat and other native birds and can affect local reproduction of yellow-breasted chat. On BRCP conservation lands that support nesting yellow-breasted chats, surveys will be conducted to identify and monitor brown-headed cowbird populations, the extent of brood parasitism of yellow-breasted chats, and the reproductive trend of nesting yellow-breasted chats. If it is determined that cowbirds are substantially affecting nesting success of yellow-breasted chats such that local populations are or could decline, cowbird control measures will be implemented to reduce local cowbird populations.

5.4.1.3 CM3: Identify High Priority Locations for Wildlife Passage Structures and Secure Funding

BCAG will assess the permeability for movement of small mammals, amphibians and reptiles across linear anthropogenic structures (e.g., roads, railroads, and utilities) in BRCP established ecological corridors (Figure 5–4). To conduct the assessment, BCAG will review CDFW, Caltrans, California Roadkill Observation System, and other relevant wildlife roadkill records for roads within BRCP ecological corridors and will coordinate with USFWS and CDFW to identify locations within the corridors where movement and migration of covered and other native wildlife may be substantially impeded by roads and other anthropogenic barriers. Based on results of the assessment, BCAG will identify high priority areas for implementing actions to improve wildlife passage across structures. BCAG will coordinate with entities with jurisdiction over the high priority structures to identify and secure funding for appropriate and cost effective structural solutions for improving passage and reducing the risk for road-kill and other associated sources of native wildlife mortality.

Permeability of roadways can be enhanced by bridges, underpasses, and culverts, especially if substrate conditions are conducive to animal movement (e.g., natural soils, vegetation, and rocks or coarse woody debris). Crossing tubes, pipes, and small culverts with drift fences and other associated structures may be sufficient for successful movement of smaller animals as well as for reptiles and amphibians that tend to move over short distances. Mata et al. (2005) showed that structural characteristics of crossing structures most influenced the species that used the structures. Circular and adapted culverts were used selectively by small mustelids (mammals in the weasel family), amphibians, reptiles and other small mammals (Mata et al. 2005).

BCAG will evaluate BRCP conservation lands within ecological corridors to identify and prioritize inter-habitat patch gaps that are unsuitable for the movement of covered and other sensitive native wildlife species or that create conditions for elevated risk of mortality. Wildlife movement through and mortality risk associated with inter-habitat patch gaps can be improved through habitat enhancements. BCAG will enhance habitat in designated high priority inter-

habitat patches through implementation of CM5: Enhance Protected Natural Communities for Covered Species (see Section 5.4.2.2). Examples of actions to enhance gap permeability include growing of vegetation and ceasing or reducing mowing. It is also important to recognize that the distance between habitat patches that an organism can traverse is inversely related to the habitat suitability of the gap; in locations with a high gap permeability and suitability, individuals may be able to traverse wider gaps than in locations where gap conditions are incompatible with the dispersing organism's capabilities.

5.4.2 Natural Community-Level Conservation Measures

5.4.2.1 CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans

Restoration of riparian vegetation, emergent wetland, and giant garter snake habitat will be conducted on BRCP conservation lands, will be designed to support habitat for covered species, and be dominated by native plant species that are typical of these riparian and wetland habitat types in the Plan Area.

BCAG will select restoration sites based on the following criteria:

- Historical presence of the natural community;
- Sufficiency of site soils and hydrology to support the restored natural community functions for covered species over the long term;
- Degree to which restoration at the site will improve connectivity among existing patches of the same and other natural community types;
- Proximity to habitat areas occupied by covered species associated with each of the restored land cover types;
- Degree to which restoration adjacent to existing patches of the natural community will increase the overall habitat functions of existing patches (e.g., increase interior and reduce edge; improve habitat mosaic of serial stages; habitat patch size relative to covered species habitat patch size requirements); and
- Ability to conduct the restoration with no or minimal impacts on existing natural communities and covered species habitat.

BCAG will develop and implement site specific restoration plans that may involve any of the following activities, depending on initial conditions on a site relative to success criteria defined in the restoration objective for a natural community.

5.4.2.1.1 Riparian Habitat

Cottonwood-willow riparian forest and valley oak riparian forest will be restored in patches of at least 25 acres and willow scrub in patch sizes of at 10 acres (Table 5–16), except where smaller patches are required to fill gaps to improve connectivity among existing patches of riparian habitat or will increase existing patches of riparian habitat to these patch sizes. In addition to supporting habitat for covered and other native species, priority will be given to restoring riparian habitat in locations that fill gaps between patches of existing riparian vegetation along stream channels. Cottonwood-willow riparian forest and valley oak riparian forest restoration projects will be designed to include sufficient plantings of elderberry shrubs to mitigate for impacts on elderberry shrubs that support valley elderberry longhorn beetle habitat (Table 5–12).

Activities necessary to restore riparian habitats may involve, depending on initial conditions on a site relative to success criteria defined in the restoration objective for a natural community, 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; and
- Control of weeds and herbivory of sufficient duration to establish riparian vegetation.

5.4.2.1.2 Vernal Pools and Swales

Restoration activities will establish vernal pool and interconnected swale systems within an intervening upland grassland matrix. The upland grassland matrix will provide sufficient micro-watershed conditions to support the vernal pools and swales and upland habitat for species important to vernal pool systems such as pollinators of vernal pool plants. Restored vernal pools and swales will be designed to support habitat for vernal pool-associated covered species. Restoration will be located on sites that historically supported vernal pools and that maintain soil and hydrologic characteristics such that the functions of vernal pool habitats can be restored and maintained over time. Restoration actions that include excavation or contouring will be conducted at sites where vernal pools were historically present and their characteristic visual signatures are still present to guide restoration efforts. Pool density, connectivity, and bathymetry of the restored pools will be based on best approximations of what was present on the site before the disturbance or modeled after an existing vernal pool terrain patterns on similar geomorphic positions. Restoration activities will only be conducted where the appropriate hydrology is present or can be restored with reasonable certainty. Propagule sources will be from the closest populations of covered vernal pool species without adversely affecting the source populations.

Activities necessary to restore vernal pool complex may involve, depending on initial conditions on a site relative to success criteria defined in the restoration objective for a natural community, the following actions:

- Site clearing of debris and existing vegetation;
- Site grading to improve micro-habitat conditions, hydrology, and planting/seeding conditions;
- Identification of propagule sources within the CAZ of impact that would not be adversely affected by the collection of seeds or soil containing seeds and vernal pool shrimp cysts;
- Collection of native vernal pool plant species seeds and soil containing seeds and vernal pool shrimp cysts for inoculating restored vernal pools;
- Planting and seeding of native plants in restored vernal pool complex uplands;
- Control of weeds and herbivory of sufficient duration to establish native vernal pool plant species;
- Recontouring of the upland component of a vernal pool or swale complex, if needed (e.g. site has been graded);
- Restoration of the grassland component of a vernal pool or swale complex, if needed (e.g. site has been cleared, fallowed, or abandoned) with a seed mixture that is representative of similar grasslands except for those species identified as invasive plants at CAL-IPC.org**:**

  Decompaction of soils in restored areas that have been subjected to earth moving, road building, scraping, or other severe soil disturbances.

5.4.2.1.3 Emergent Wetland

Restored emergent wetlands will be a minimum of 1 acre and larger if needed to meet the minimum habitat patch size or connectivity requirements to achieve habitat restoration objectives for target covered species. Restored emergent wetland will be designed to achieve a California Wildlife Habitat Relationships (CWHR) System habitat stage designation of 2D[23] at maturity. The 126 acres of restored emergent wetlands that address the mitigation of covered activities will be designed such that they are supported by un-assisted hydrologic inputs that maintain jurisdictional wetlands features.

Activities necessary to restore emergent wetland may involve, depending on site-specific conditions, the following actions:

[23] Under WHR: 2 = emergent vegetation greater than 12 inches in height; and D = dense cover, canopy closure 60-100 percent (Mayer and Laudenslayer 1988).

- 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.

5.4.2.2 CM5: Enhance Protected Natural Communities for Covered Species

BCAG will prepare and implement management plans with input from USFWS, NMFS, and CDFW for protected natural communities and covered species habitats supported by those communities. Management plans may be prepared for specific protected parcels or multiple protected parcels within a specified geographic area of the BRCP conservation lands. 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, BCAG 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.[24] See Section 7.2 for more detail on baseline surveys. Within one year of completing the assessment of ecological condition and function, BCAG will identify habitat enhancement actions that will be implemented to enhance habitat functions for the target covered species and any subsequent ongoing management actions that are necessary to maintain 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 monitoring (see Section 7.2).

The content of management plans will include, but not be limited to, a description of the following:

- The biological goals and objectives to be achieved with the protection and management of the parcels.
- Base ecological conditions (e.g., habitat maps, assessment of covered species habitat functions, occurrence of covered and other native wildlife species, vegetation structure

[24] Note that pre-acquisition biological surveys are required for all properties that are brought into the BRCP conservation lands system, but such surveys serve a different purpose and are not necessarily of the same type or level of detail as baseline surveys.

and composition, occurrence and extent of nonnative species, assessment of nonnative species abundance and effect on habitat functions, habitat and landscape connectivity).

- Vegetation management actions that benefit covered communities, habitats, and species and reduce fuel loads as appropriate and are necessary for implementing species-specific conservation measures.
- Current and historical livestock grazing management practices.
- The incorporation of a fire management plan developed in coordination with the appropriate agencies and to the extent practicable, consistent with achieving the biological objectives of the BRCP.
- Infrastructure, hazards, and easements.
- Existing land uses and management practices and their relationship to covered species habitat functions.
- Allowable recreational access and uses.
- Applicable permit terms and conditions.
- Terms and conditions of conservation easements when applicable.
- Management actions and schedules, including mosquito abatement monitoring and treatment methods and restrictions.
- Monitoring requirements and schedules.
- Established data acquisition and analysis protocols.
- Established data and report preservation, indexing, and repository protocols.
- The adaptive management approach.
- Any other information relevant to management of the protected parcels.

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, including applicable invasive control measures identified in the NHP invasive species control program (prepared under CM2, Develop an Invasive Species Control Program).

Management plans will be periodically updated to incorporate changes in maintenance, management, and monitoring requirements as they may occur over the term of the BRCP.

The following subsections provide examples of possible management actions to enhance protected natural communities for the benefit of multiple covered species.

5.4.2.2.1 Oak Woodland and Savanna

Protected oak woodland and savanna habitats will be managed to maintain and enhance functions for Swainson's hawk, white-tailed kite, and bald eagle (nesting habitat). Depending on site-specific conditions, appropriate management actions may include the following:

- Retaining snags and downed wood;
- Prohibiting tree harvest for firewood and other uses unless tree harvest is identified in the management plan as a method for achieving habitat enhancement objectives;
- Managing grazing to enhance tree survival and recruitment; and
- Protecting seedlings from herbivory.

5.4.2.2.2 Grassland Natural Community

Protected grassland will be managed to maintain and, where appropriate, increase the abundance of fossorial and other small mammals (e.g., ground squirrels) to increase the abundance of prey species of covered raptor species and other native predators and to increase burrow availability for western burrowing owl. 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 create habitat for small mammals and birds, and
- 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:

- Installing artificial nesting burrows for western burrowing owl to facilitate use of unoccupied areas.
- Using 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.
- Applying herbicides to remove heavy infestations of nonnative plants.
- Reseeding native plant species.
- Managing livestock grazing to improve the function of vernal pools and grassland swale complex as habitat for covered vernal pool shrimp and plant species.

BCAG will enhance existing vernal pool and swale complex habitats that have been degraded through anthropogenic activities (e.g., disking, damage from vehicles) to improve their habitat function for covered species and other native vernal pool species. Enhancement actions for vernal pools could also include modifying or removing structures that artificially increase or decrease inundation period and removing supplemental sources of water that increase the inundation period relative to historical conditions.

5.4.2.2.3 Riparian Natural Community

Protected riparian habitats will be managed to maintain and enhance habitat functions for Swainson's hawk, white-tailed kite, yellow-breasted chat, western yellow-billed cuckoo, foothill yellow-legged frog, western pond turtle, and valley elderberry longhorn beetle. Depending on site-specific conditions, appropriate management practices may include the following:

- Managing livestock grazing to maintain favorable habitat conditions for covered species;
- Controlling nonnative predators and invasive plant species;
- Planting native species to improve habitat structure and species composition; and
- Installing or maintaining woody debris in stream channels to create pools to increase the diversity of micro-habitats.

5.4.2.2.4 Wetland Natural Community

Protected emergent wetlands will be managed to maintain and enhance wetland function and hydrogeomorphic processes through site-specific management practices. Depending on site-specific conditions, management practices could include the following activities:

- Controlling nonnative species;
- Managing livestock grazing to maintain favorable habitat conditions for covered species;
- Increasing extent of native vegetation;
- Controlling human access and activities;
- Managing water sources supporting wetlands;
- Increasing or decreasing ponding capacity;
- Controlling erosion; and
- Maintaining or enhancing adjacent upland habitats to support habitat transitions and ecotones and protect watersheds.

Wetlands will be managed specifically to promote the development of habitat for covered species with management actions designed to enhance habitat value, including the following:

- Maintaining appropriate water depth;
- Establishing emergent vegetation;
- Installing fencing to manage access by livestock; and
- Controlling nonnative predators.

Management for restored and natural emergent wetlands will focus on providing essential life history prerequisites for covered species, primarily giant garter snake, western pond turtle and tricolored blackbird. Management activities to benefit these species will entail:

- 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;
- Managing exotic species that may compete with or prey upon covered species (e.g., bullfrogs, predatory fish);
- Regulating human recreational activities (e.g., fishing) to prevent disturbance; and
- Enhancing the habitat structure within the water column to provide underwater refugia, for prey species for giant garter snakes, and for western pond turtle juveniles.

Wetland seeps are small and of limited distribution in the Plan Area. To provide habitat for and increase populations of California black rail and California beaked-rush, occupied and suitable wetland seep habitat will be evaluated and managed within BRCP conservation lands. Management tools, such as the control of grazing, will be used to enhance the function of seeps as habitat.

5.4.2.2.5 Aquatic Natural Community

Stream channels and ponds within BRCP conservation lands will be managed to maintain and enhance habitat functions for covered fish, reptile, and amphibian species. Depending on site-specific conditions, habitat enhancement actions could include the following:

- Planting emergent vegetation along pond margins to increase habitat functions for the western pond turtle.
- Maintaining and improving pond water control structures and water supplies.
- Increasing or decreasing ponding (duration and frequency) to improve wetland functions.
- Controlling nonnative predators in ponds (e.g., bullfrog).
- Installing large woody debris along stream channels and channel banks to improve instream cover conditions for covered fish species.

- Coordinating with flood control entities to modify channel maintenance practices to maintain woody debris in channels supporting anadromous fisheries.

5.4.2.2.6 Agricultural Habitats

Cultivated agricultural lands within the BRCP conservation lands system will be managed to enhance habitat functions for covered species where such enhancements are consistent with achieving the primary objectives of the maintained agricultural habitats. Depending on site-specific conditions and the conditions of conservation easements on private lands, habitat enhancement and management actions could include the following:

- Reducing the use of herbicides and pesticides;
- Altering cultivation and harvest practices to increase forage and prey availability for covered and other native wildlife species;
- Planting hedgerows to provide rodent habitat to increase prey abundance for covered and other raptors; and
- Maintaining water in canals and ditches during the activity period (early spring through mid-fall) for the giant garter snake, western pond turtle, and other native wildlife species.

Management of rice lands supporting giant garter snake habitat may involve rotations with non-rice crop types or changes in agricultural practices. These activities are permissible provided that the following conditions are met:

- Conveyance channels customarily used for rice farming must be filled with water to provide habitat for giant garter snakes during the active season of the species (March through October);
- No more than 20 percent of the total rice conservation lands may be rotated to upland crops in any given year, contingent upon approval by BCAG;
- Parcels must be surveyed for evidence of reproducing giant garter snakes (e.g., presence of young of the year) in the year prior to the intended crop rotation. Parcels harboring young snakes are not eligible for crop rotation in the following year, (However, they may be fallowed according to customary agricultural practices without the approval of the Implementing entity);
- Except when necessary to allow for the cultivation of rice in the following season, berms, levees, and other potential hibernation habitat for giant garter snakes may not be removed, altered or otherwise compromised during the hibernation season (November through February) to avoid disturbance of hibernating snakes.
- Pesticide application must be approved by BCAG to ensure compatibility with giant garter snake conservation.

5.4.2.3 CM6: Maintain and Enhance Public and Easement Habitat Lands for Covered Species

Existing protected lands (Category 1 PEHL) and Category 2 PEHL within the Plan Area are not necessarily managed for the benefit of covered species, though they do provide natural community benefits (e.g., providing habitat for covered and other native species, maintaining habitat connectivity, and serving as ecological corridors) because they are protected from land conversion for development or agriculture. For example, the Gray Lodge Wildlife Area is managed by CDFW primarily for waterfowl use, but parts of the Wildlife Area could be managed to enhance habitat function for covered species such as giant garter snake. Under this conservation measure, BCAG will coordinate with federal, state, and local government agencies and other organizations and entities responsible for PEHL in the Plan Area that are identified in Figure 5–1 to attempt to implement actions that will maintain or enhance conservation provided for the following covered species:

- Active Swainson's hawk, white-tailed kite and peregrine falcon nest sites;
- Active bald eagle nest and roost sites;
- Active bank swallow nesting colonies;
- Occupied western burrowing owl nesting burrows;
- Giant garter snake and western pond turtle breeding and aquatic movement habitats; and
- Occurrences of Ferris' milkvetch,[25] Ahart's dwarf rush, Greene's tuctoria, Hoover's spurge, Butte County checkerbloom, California beaked-rush, Ahart's paronychia, Butte County meadowfoam, lesser saltscale, Butte County golden clover, and Red Bluff dwarf rush.

The following actions will be undertaken by BCAG.

- BCAG will coordinate and may enter into agreements (e.g., Memoranda of Agreement, Memoranda of Understanding, Cooperative Management Agreements) with federal and state agencies, land trusts, and other organizations and individuals that manage PEHL that support the covered species described above to implement additional or adjust existing management actions, if needed, to maintain or benefit these resources.
- BCAG will coordinate with and enter into agreements with Permittees (e.g., City and County agencies) to manage PEHL under their jurisdiction to similarly benefit these resources.
- Preparatory to entering into agreements, BCAG will coordinate with entities having jurisdiction over PEHL 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 PEHL, and (b) gather information necessary to describe the range of land management practices that are permissible on the protected lands.

- Based on information collected under action 3, BCAG 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 that will be implemented.
- For lands that are protected under existing conservation easements and for which modifications to existing land use practices are proposed by BCAG, BCAG 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 BCAG may provide funding necessary to implement prescribed management actions.
- Approximately 26 percent of non-rice irrigated cropland in the Plan Area is currently in PEHL under state or federal ownership or through existing conservation easements with private landowners. These protected agricultural lands may or may not be currently maintained in cover types suitable for covered species, such as giant garter snake upland aestivation and movement habitat and greater sandhill crane roosting habitat. BCAG will coordinate with the applicable state or federal wildlife agencies or non-government organizations that own and manage these lands to assess land use practices and ensure that goals and objectives on these agricultural lands are oriented toward managing for covered species and achieving BRCP biological goals and objectives. As described in Section 8.7.4 conservation actions implemented under this conservation measure can only be credited towards achieving the conservation component of conservation acreage targets if the actions meet all BRCP protection, management, monitoring, and adaptive management requirements.

5.4.3 Species-Level Conservation Measures

5.4.3.1 CM7: Create and Maintain Greater Sandhill Crane Winter Roosting Habitat

BCAG will create and manage 160 acres of sandhill crane winter roosting habitat in proximity to traditional upland use areas. Winter roosting habitat will be designed and managed to maintain a wetted pool area of at least 20 acres with water depths averaging approximately 4 inches and a surrounding upland area extending at least 500 feet from the wetted surface that supports no or low vegetation. Roosting habitat will be annually flooded from October 1 through March 15 or before March 15 if cranes have abandoned use of a site. Management actions to implement this conservation measure are anticipated to include:

- Irrigation management to maintain the required wetted surface and water depths that support crane roosting;
- Construction of berms or other infrastructure as need to maintain suitable roost site conditions; and
- Farming and vegetation management practices that maintain upland vegetation adjacent to the wetted roosting area in an open condition that is suitable for supporting crane use of roost sites.

5.4.3.2 CM8: Restore Giant Garter Snake Habitat

Restored giant garter snake habitat will include a mosaic of emergent wetland, open water, and upland habitat. Restored emergent wetland will be designed to achieve a CWHR System habitat stage designation of 2D[26] at maturity. Restored giant garter snake habitat will be a minimum of 20 acres; where rice agricultural fields are converted to habitat for giant garter snake, minimum acreage and geometry of restored wetlands will be prescribed by the size of rice fields. All restored emergent wetland in giant garter snake habitat sites must have a secure source of water for maintaining the intended restored habitat functions - either natural hydrology, a dedicated source of irrigation water and delivery systems, or a combination of the two - that maintains ponding and soil saturation at a frequency and duration sufficient to support hydrophytic vegetation typical of permanent emergent wetlands in the Plan Area.

Where emergent wetlands are restored within the range of giant garter snake, additional artificial inputs of water to enhance the extent and duration of ponding to support giant garter snake habitat will be included, as practicable, in the restoration design and implementation and long-term management.

The 500 acres of giant garter snake habitat restoration is expected to be located in the Basin CAZ which supports the center of the snake population in the Plan Area, however, BCAG may restore a portion of the giant garter snake habitat in the adjoining Sacramento River, Northern Orchards, and Southern Orchard CAZs where such restoration meets giant garter snake habitat requirements. (Table 5–7). The primary natural habitat of giant garter snake is comprised of permanent wetland,[27] which typically supports substantially higher densities of giant garter snake than rice land (Wylie et al. 2010). Restored habitats will be located such that they are hydrologically connected to occupied giant garter snake habitats to provide habitat corridors to support movement among habitat areas. It is anticipated that giant garter snake habitat will 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

[26] Under WHR: 2 = emergent vegetation greater than 12 inches in height; and D = dense cover, canopy closure 60-100 percent (Mayer and Laudenslayer 1988).

[27] BRCP land cover types that support aquatic giant garter snake aquatic breeding and movement habitat includes emergent wetland, managed wetland, and willow scrub (see Appendix A, *Covered Species Accounts*).

operating restoration-related equipment, habitat restoration activities will be conducted during the giant garter snake active period.

Restored giant garter snake habitat will be designed to support a mix of native emergent vegetation and open water and upland edge configuration that provide maximum function, within site constraints. These functions include:

- Adequate water during the snake's active season (early spring through mid-fall) to provide food and cover;
- Emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season;
- Basking habitat of grassy banks and openings in waterside vegetation; and
- Higher elevation uplands for cover and refuge from flood waters during the snake's dormant season in the winter (USFWS 2006d).

Restored giant garter snake habitat will be managed 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. However, drawdown of water levels during winter will be managed adaptively to ensure residual habitat for prey species. In addition, bullfrog abundance will be monitored in restored wetlands and will be controlled 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. Uplands near restored emergent wetlands will be managed to provide small mammal burrows and soil crevices located above prevailing flood elevations throughout its winter dormancy period (USFWS 2006d). Adequate burrows are typically located in sunny exposures along south and west facing slopes.

Activities necessary to restore emergent wetland for giant garter snake 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; and
- Installation or modification of water irrigation and drainage infrastructure, including wells, pumps, water control structures and irrigation ditches.

5.4.3.3 CM9: Replenish Spawning Gravels for Salmonids

BCAG will place 30,000 cubic yards of spawning gravels of a suitable size for use by Chinook salmon and steelhead in suitable spawning locations within Big Chico Creek, Little Chico Creek, Butte Creek, Little Dry Creek, Rock Creek, and/or Mud Creek to increase the extent of salmonid spawning habitat. Anticipated actions to implement this conservation measure include, but are not limited to the following:

- Mapping the location of existing salmonid spawning habitats;
- Assessing the condition of existing spawning habitat areas to determine if their function could be substantially increased with augmentation of gravels;
- Mapping these creeks for other suitable locations for new nearby salmonid spawning habitat where it currently does not exist;
- Conducting assessments to identify suitable locations for restoring (if existing) or creating (if new) spawning habitat with placement of spawning gravels;
- Prioritizing locations for spawning gravel replenishment based on the likely biological benefits and practicability (e.g., the potential for adverse effects on flood control); and
- Placement of spawning gravel in the highest priority channel locations.

BCAG will monitor enhanced and restored spawning habitat to determine if they support salmonid spawning and to determine if additional replenishment may be required to maintain the habitats over time (see Section 7.2). Because placed spawning gravels may be transported downstream over time in some locations, BCAG may choose to allocate a portion of the 30,000 cubic yards of spawning gravel to maintain previously enhanced and restored spawning habitats.

5.4.3.4 CM10: Remove Impediments to Upstream and Downstream Fish Passage

BCAG will conduct an assessment of Pine Creek, Rock Creek, Mud Creek, Big Chico Creek, Lindo Channel, Little Chico Creek, Butte Creek, and Little Dry Creek to identify locations where passage of covered fish species is physically impeded. Impediments could include, but are not limited to, debris build-up, large boulders that have shifted, and existing non-functional fish ladders. BCAG will coordinate with NMFS, USFWS, and DFW to prioritize each of the identified locations for implementing actions to improve fish passage based on the likely magnitude of benefits for the covered fish species. Based on priority, BCAG will contact landowners where the impediments are located to enter into cooperative agreements to implement actions necessary to modify stream channels to improve conditions for fish passage. Depending on the type of impediment to fish passage, anticipated actions to remove barriers to fish passage includes use of hand tools and machinery in stream channels (e.g., backhoes) to dislodge and remove debris. BCAG will also assist in the acquisition of funds to support, along with other sources of funding, reconstruction of the Iron Canyon Fish Ladder along Big Chico

Creek. The existing fish ladder is nonfunctional and impedes the upstream movement of adult salmonids.

5.4.3.5 CM11: Remove, Modify, or Screen Unscreened Diversions

To reduce entrainment loss of juvenile salmonids, existing diversions will be modified along Big Chico and Butte Creeks in the Cascade Foothills, Northern Orchards, and Basin CAZs. BCAG will install fish screens, move, consolidate, or otherwise modify diversions that do not have fish screens to reduce entrainment loss of juvenile salmonids along Big Chico Creek and Butte Creek (Figure 5–5 [see separate file]). As of 1997, there were 59 diversions, excluding diversions along the Sacramento and Feather Rivers that are not known to be fitted with fish screens in the Plan Area (Figure 5–5; DFG 2001). Seventeen of these diversions are located on Sanborn Slough, which does not support any covered or local concern fish species. As a result, these 17 diversions will not be modified under this conservation measure unless covered fish species are found to inhabit Sanborn Slough in the future.

BCAG, in coordination with NMFS, USFWS, and DFW, will update the inventory of diversions in the Plan Area and develop criteria for and evaluate each diversion to identify and prioritize those that pose a substantial entrainment risk for covered fish species and that can be feasibly modified to reduce entrainment risk. If results of the evaluation indicate that fewer than 25 diversions should or can be modified, remaining funds allocated to this conservation measure will be reallocated to implement other measures as determined through the adaptive management process that will benefit the covered fish species.

5.4.3.6 CM12: Conserve Butte County Meadowfoam

Butte County meadowfoam is endemic to the Plan Area. This conservation measure is designed to achieve the BRCP biological goal to protect in perpetuity self-sustaining populations of Butte County meadowfoam throughout its full ecological, geographical, and genetic range by ameliorating or eliminating the threats that caused it to be listed.[28]

5.4.3.6.1 Establish the Chico Butte County Meadowfoam Preserve

BCAG will establish the Chico Butte County Meadowfoam Preserve (CBCMP), with specifically identified boundaries, that protects Butte County meadowfoam (BCM) known occurrences, primary habitat, and secondary habitat within the Chico A, B, and C population groups and additional lands necessary to conserve these populations and habitat as indicated in Table 5–18 and Figure 5–6. The preserve will be established by Year 10 of BRCP implementation. Existing protected lands that support meadowfoam occurrences and its habitat

[28] Achieving this goal will achieve the recovery goal for the Butte County meadowfoam in the Vernal Pool Species Recovery Plan (USFWS 2005). The BRCP objectives and conservation measures for Butte County meadowfoam differ from the specific approaches identified in the Recovery Plan, but achieve the overall goal of recovery through these alternative conservation mechanisms.

(Figure 5–6) will be integrated into the CBCMP and all of these lands will be managed as a single conservation lands unit under the BRCP. Occurrences and primary habitat of Butte County meadowfoam in the Chico A, B, and C population groups (see Appendix A, Figure A-30.3) that may be removed by future projects covered under the BRCP (Chapter 2, *Covered Activities*) are identified in Figure 5–6.

The identification of the CBCMP boundary was guided by the following ecological goals:

- Protecting known occurrences;
- Protecting primary habitat;
- Protecting primary and secondary habitat adjacent to known occurrences that support the hydrological conditions to maintain the ecological functions necessary to support the habitat occupied by known occurrences of Butte County meadowfoam;
- Providing connectivity between preserved lands, including connections between new and existing preserves, that provides opportunities for the natural dispersal of Butte County meadowfoam seed and pollen; and
- Protecting sufficient extent of habitats and other lands for species (e.g., insect pollinators) and land management (e.g., livestock grazing management) necessary to support Butte County meadowfoam survival.

The boundary of the CBCMP was drawn mainly along parcel boundaries or along clearly identifiable features on the landscape such that the boundary will be easily identifiable for acquisition and management purposes while meeting the above ecological goals.

The extent of Butte County meadowfoam primary and secondary habitat within existing protected lands and outside existing protected lands in the Plan Area is provided in Table 5–19, *Acreage of Existing Protected and Unprotected Modeled Primary and Secondary Butte County Meadowfoam Habitat by Population Grouping* (see separate file).

In addition to the Butte County meadowfoam habitat protected within the CBCMP defined above, secondary habitat associated with the Chico A, B, and C population groupings will be protected by establishment of additional preserve areas that will expand the CBCMP during Plan implementation using the following design rules:

- Protect at least 40 acres of remaining unprotected Butte County meadowfoam secondary habitat associated with the Chico A population grouping outside the CBCMP (Table 5–18).
- Protect at least 149 acres of remaining unprotected Butte County meadowfoam secondary habitat associated with the Chico B, population grouping outside the CBCMP (Table 5–18).

- Protect at least 398 acres of remaining unprotected Butte County meadowfoam secondary habitat associated with the Chico C population grouping outside the CBCMP (Table 5–18).
- Give priority to the protection of Butte County meadowfoam secondary habitat that is contiguous with occupied, primary, and secondary habitat inside the CBCMP.
- Include ecological connectivity that is suitable for Butte County meadowfoam seed and pollen dispersal between and among protected Butte County meadowfoam secondary habitat patches and the CBCMP.
- Give priority to the protection of secondary habitat in patches larger than 40 acres.
- Implement protection of Butte County meadowfoam secondary habitat associated with the Chico A, B, and C population groupings in conjunction with and as design sub-criteria to the conservation lands assembly under the BRCP conservation lands site selection criteria in CM1: Acquire Lands.

5.4.3.6.2 Protect Butte County Meadowfoam Occurrences and Primary and Secondary Habitat in the Rock Creek, Chico D, Gold Run Creek, and Table Mountain Population Groupings

All known currently unprotected occurrences of Butte County meadowfoam in the Rock Creek, Gold Run Creek, and Table Mountain population groupings will be protected. Modeled primary and secondary habitat for Butte County meadowfoam in the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings will be protected in the quantities indicated in Table 5–18.

A system of Butte County meadowfoam preserves will be established within the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings using the following set of preserve design rules:

1. Protect all existing known unprotected occurrences of Butte County meadowfoam (See Appendix A.30, *Butte County Meadowfoam*).
2. Priority will be given to protecting newly located unprotected occurrences of Butte County meadowfoam that are important to survival and recovery of the species, as determined through current data and surveys conducted under measure described in Section 5.4.3.2.3, *Detect and Protect Previously Unknown and New Occurrences of Butte County Meadowfoam*.
3. Protect currently unprotected occurrences and primary and secondary habitat in the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings in the quantities indicated in Table 5–18.
4. Protected primary and secondary habitat areas will be no less than 40 acres in size and will be configured so that no portion of any unit is less than 250 feet wide at its narrowest point

(Figure 5–7, *Conceptual Depiction of the Hierarchical Butte County Meadowfoam Preserve Design Rules Described in Conservation Measure 10,* subfigure A [see separate file]).

5. Locate protected habitat areas to maximize genetic and dispersal connectivity among Butte County meadowfoam occurrences within and among population groupings.
6. Locate protected habitat areas to maximize connections to existing protected areas of Butte County meadowfoam habitat.
7. The configuration of protected primary and secondary habitat areas will be designed to maximize the area conserved relative to the perimeter boundary of the protected Butte County meadowfoam occurrences or where either surface drainage patterns or subsurface hydrological gradients indicate that the quality or function of the habitat will be substantially increased using a different configuration (Figure 5–7, subfigures A and C).
8. If the primary and secondary habitat fully or partially encloses Butte County meadowfoam occurrences, then the protected habitat will be distributed to maximize the average distance between the margin of the occurrence and the outer margin of primary habitat. This rule will be applied unless either surface drainage patterns or subsurface hydrological gradients indicate that the quality or function of the habitat will be substantially increased using a different configuration (Figure 5–7, subfigures B and C).
9. If either surface drainage patterns or subsurface hydrological gradient data indicate that the quality or function of the habitat will be substantially increased by considering the flow path of water, then the area to be protected will be designed using that data. For example, if surface drainage patterns entering an area under consideration crosses an area that is relatively short compared to the depth of the potential protected area (e.g., the short dimension of an oval), then the protected habitat area will be designed to capture as much of the depth as possible. Likewise, if surface drainage patterns entering an area under consideration cross an area that is relatively long compared to the depth of a potential protected area (e.g., the long dimension of an oval), then the protected habitat area will be designed to capture as much of the length as possible (Figure 5–7, subfigure C).
10. If either surface drainage patterns or subsurface hydrological gradients are considered in the design of protected habitat, the configuration of the protected habitat will be designed to ensure that both entering and exiting flows are accommodated so that areas of artificial ponding are not created at the lower end of the drainages or hydrological gradient (Figure 5–7, subfigures C and D).

The Butte County meadowfoam preserves within the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings will be established within the larger context of the establishment of the BRCP conservation lands system, particularly for the grassland and grassland with vernal swale complex natural communities, and will be established in the timeframe described in Chapter 8, *Plan Implementation*.

5.4.3.6.3 Detect and Protect Previously Unknown and New Occurrences of Butte County Meadowfoam

BCAG will conduct surveys of primary and secondary habitat in the Rock Creek, Chico A-D, Gold Run Creek and Table Mountain population groupings (see Appendix A.30) to detect previously unknown and newly established occurrences of BCM. BCAG will also review BCM survey information provided by other entities to detect previously unknown and newly established occurrences. Surveys will be conducted by BCAG as part of its pre-acquisition land surveys and post-acquisition land surveys (see conservation measures CM1: Acquire Lands and CM5: Enhance Protected Natural Communities for Covered Species) and where permission may be otherwise granted by landowners. Primary and secondary habitat will be surveyed for BCM during the BCM flowering season for three consecutive continuous seasons to determine presence and estimate the numbers of individuals in any detected Butte County meadowfoam occurrences.

Previously unknown and new occurrences will be evaluated to determine if they are important and necessary for the continued survival and recovery of BCM and therefore need to be protected to conserve the species. Science-based criteria for determining whether or not an occurrence is important and necessary for the continued survival and recovery of BCM will be developed and applied by BCAG in coordination with USFWS and CDFW. These criteria will be subject to independent science review prior to use in BRCP implementation. The following criteria, recommended by independent science advisors, will be included in this process:

- Newly discovered populations that are large or close to other populations should be high priority for protection
- Populations that may be genetically unique (i.e., far isolated from other populations) should be high priority for protection.
- New occurrences that may be removed could be those that are very small, not genetically unique, and redundant with more significant, already protected populations.
- The removal of newly discovered populations must proceed cautiously and should only be done if there is evidence that BCM populations elsewhere are increasing or stable over time (Appendix G).

5.4.3.6.4 Manage Protected Habitat to Maintain and Enhance Butte County Meadowfoam Habitat Functions

BCAG will evaluate the baseline ecological conditions of protected BCM occurrences and habitat and identify and implement management actions to maintain and improve BCM population and habitat conditions.

Within one year of acquisition of properties to be included in BRCP conservation lands that support BCM occurrences and habitat, BCAG will initiate surveys to determine existing

environmental conditions, including vegetation associations and cover, hydrology supporting BCM habitat, soil conditions, floristic composition, species identity and cover of invasive and ecosystem-altering plant species, swale extent as determined by indicator species, vernal pool surface area at estimated maximum ponding depth, general ponding duration of pools (short, medium, long), and factors (including grazing practices) that may affect pool function (water quality, hydrology, etc.). The assessment of factors influenced by hydrologic conditions (e.g., ponding duration, vegetation) will be conducted over a period of years sufficient to assess conditions in dry, normal, and wet water years. Ongoing grazing management and other land use practices will also be documented and evaluated for their effects on BCM habitat conditions. Results of analyses of survey data will be used to guide the development and implementation of habitat enhancement and management measures and to provide the basis for assessing the effectiveness of enhancement and management measures.

Grazing management could be a major factor driving the persistence and BCM population viability on a site. In cases where the meadowfoam population appears healthy, then documenting the past management history of the site in order to continue it into the future is critical. Similarly, a site with a population that appears to be suffering from poor management or lack of management should have that management history clearly documented as well. The default should be to maintain the current management regime if habitat conditions for the population are good (i.e., the burden of proof should fall on any proposal to change management that appears to be working).

Based on results of baseline condition surveys and other site evaluation information (e.g., historic management practices), BCAG will identify habitat management actions to be implemented to maintain and enhance BCM habitat functions and any subsequent ongoing management actions that are necessary to maintain habitat functions over time.

The content of management plans, developed with input from USFWS and CDFW, will include, but not be limited to, a description of the following:

- The biological goals and objectives to be achieved with the management of the parcels;
- The baseline ecological conditions;
- Existing land uses and management practices and their relationship to BCM habitat functions;
- Management actions (e.g., vegetation management) and schedules including appropriate grazing regime;
- Monitoring requirements and schedules;
- The adaptive management approach; and
- Any other information relevant to management of the protected parcels.

BCM management plans will be periodically updated with input from USFWS and CDFW to incorporate changes in maintenance, management, and monitoring requirements as they may occur over the term of the BRCP. Existing protected lands that have occurrences of BCM will be considered as fully contributing to the conservation of BCM if they meet the requirements of this conservation measure.

Management plans specific to BCM will be integrated with and incorporated into the larger management plans developed for all species and natural communities in BRCP conservation lands (CM5: Enhance Protected Natural Communities for Covered Species) and with the monitoring and adaptive management programs (see Chapter 7, *Monitoring and Adaptive Management*).

5.4.3.6.5 Mitigate Impacts on Butte County Meadowfoam Habitat and Occurrences

Covered activities will have direct and indirect effects on BCM habitat and occurrences (Tables 4–8, 4–9, 4–10). The goal of the BRCP is to provide for the recovery of BCM and this conservation measure CM12, Conserve Butte County Meadowfoam, is designed to achieve that goal with the impacts of covered activities assumed to occur. Although this conservation measure is comprehensive and holistic, minimum mitigation targets and requirements are set for BCM in Tables 5–9 and 5–11.

Primary Habitat

All impacts on BCM modeled primary habitat must be mitigated through the protection of an equal acreage of modeled primary habitat of equal or greater function, whether the effected habitat is occupied or not by BCM. If the effected primary habitat is occupied, then the additional mitigation, described below, for mitigation of impacts on occurrences is required. Note that the mitigation for BCM primary habitat may be encompassed within the mitigation of grassland with vernal swale complex and grassland through application of land acquisition assembly rules and prioritization (Section 5.2.3.4).

Occurrences

All impacts on BCM occurrences must be mitigated through the protection of one or more occurrences that support at least three times the number of individual plants as the occurrence(s) removed. Impacts on BCM occurrences are limited to those identified in Table 4–10, *Butte County Meadowfoam Impact Analysis by Occurrence* within the areas labeled in Figures 4–46 through 4–46d and to newly discovered occurrences as described in Table 4–6, *Take Limits for Covered Species*. Some of the protection of occupied primary habitat with large numbers of plants within the CBCMP and in population groupings outside the CBCMP will serve to achieve this mitigation requirement.

Secondary Habitat.

Impacts on BCM modeled secondary habitat do not require mitigation, unless an occurrence of BCM is present. In which case, the mitigation for occurrences, described above, is required.

5.4.3.7 CM13: Conduct Surveys to Locate and Protect New Occurrences of Butte County Checkerbloom

Butte County checkerbloom is endemic to Butte County and nearly endemic to the Plan Area. BCAG will conduct surveys to locate new occurrences of Butte County checkerbloom during the appropriate time of year in suitable habitat in the Plan Area north of upper Bidwell Park. While a large number of occurrences of Butte County Checkerbloom are known in the Cascade Foothill CAZ south of Upper Bidwell Park, apparently suitable habitat Cascade Foothill CAZ north of the Park has not been extensively surveyed (see Appendix A.36, *Butte County Checkerbloom*). Surveys will be conducted on public lands and on private lands with permission of land owners. BCAG will also seek out occurrences that have been previously identified but not reported (e.g., unpublished survey reports). Based on the results of the surveys, BCAG will distribute the acquisition of natural communities in the Cascade Foothills CAZ (see Section 5.4.1.1) to protect up to 20 newly discovered occurrences.

5.4.3.8 CM14: Translocate Conservancy Fairy Shrimp, Hoover's Spurge Ahart's Dwarf Rush, Hairy Orcutt Grass, Slender Orcutt Grass, and Greene's Tuctoria

BCAG will implement actions to establish or reestablish occurrences of Conservancy fairy shrimp, Ahart's dwarf rush, Hoover's spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria in at least two BRCP protected vernal pools for each species. One or more species may be established in the same vernal pool. To implement this measure, BCAG will do the following:

- Evaluate protected vernal pools to determine their suitability (e.g., hydrology and soil conditions) for establishing Conservancy fairy shrimp, Ahart's dwarf rush, Hoover's spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria;
- Adopt techniques for establishing Conservancy fairy shrimp, Ahart's dwarf rush, Hoover's spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria;
- Harvest seed of Ahart's dwarf rush, Hoover's spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria and cysts of Conservancy fairy shrimp, from extant occurrences within or adjacent to the Plan Area. Propagule sources will be from the closest populations of each species without adversely affecting the source populations;
- Manage established occurrences to ensure their persistence over time;

- Monitor the effectiveness of Ahart's dwarf rush, Hoover's spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria establishment and management techniques to gather information necessary to improve establishment of new occurrences over time; and
- Monitor propagule sources to ensure that occurrences from which fairy shrimp or plant material is harvested to ensure that the occurrences remain viable.

5.4.4 BCAG Activities to Improve Urban Stormwater Water Quality

The BCAG will support the cities of Chico, Oroville, Gridley and Biggs in obtaining funding through federal and state grants and other sources to implement programs to support compliance with National Pollutant Discharge Elimination System (NPDES) stormwater permits for municipal separate storm sewer systems (MS4s)[29]. Funding will support actions from and in addition to the respective stormwater management programs of these cities that reduce the load or concentrations of contaminants that are toxic to covered fish species and other native fish and amphibians in urban runoff entering Big Chico Creek, Lindo Channel, Little Chico Creek, Sycamore/Mud Creek, Butte Creek and the Feather River. Common toxicants found in stormwater runoff that could have adverse effects on these species include pesticides, fertilizers, sediment, polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Effects of these toxicants on aquatic covered species include both lethal and sublethal effects. Sublethal effects include physiological effects, such as reductions in respiration ability; reproductive and developmental effects, such as reduced fecundity or delayed metamorphosis; and behavioral effects, such as the inability to migrate effectively. These toxicants and their effects on covered aquatic species will be reduced by this conservation measure. Actions, in addition to those in existing plans/programs, will be implemented if they are expected to benefit covered species.

Potential types of actions that could be funded under this measure include, but are not limited to the following:

- Construction of stormwater retention ponds for the capture of stormwater.
- Construction of stormwater retention irrigation holding ponds for the capture and irrigation use of stormwater.
- Design and establishment of vegetated buffer strips to slow runoff velocities and capture sediments and other pollutants.
- Design and construction of bioretention systems (grass buffer strips, sand bed, ponding area, mulch layer, planting soil, and plants) to slow runoff velocities and for removal of pollutants from stormwater.
- Construction of stormwater curb extensions adjacent to existing commercial businesses that are likely to contribute oil and grease runoff.

[29] See the EPA website: http://cfpub.epa.gov/npdes/stormwater/munic.cfm.

- Establishment of stormwater media filters to remove particulates and pollutants.
- Provisioning of funds for moisture monitors to be installed during construction of sprinkler systems at commercial sites that will eliminate watering when unnecessary.
- Providing support for establishment of on-site infiltration systems in lieu of new storm drain connections for new construction, such as pervious pavement in place of asphalt and concrete in parking lots and along roadways, and downspout disconnections to redirect roof water to cisterns on existing developed properties, including residential.

These actions would improve habitat conditions for aquatic covered species: Central Valley steelhead, Central Valley spring-run Chinook salmon, Central Valley fall/late fall-run Chinook salmon, Sacramento splittail, green sturgeon, river lamprey, yellow-legged frog, and western spadefoot by reducing the amount of toxic contaminants entering their habitat.

5.5 CONSERVATION PROVIDED FOR NATURAL COMMUNITIES

As an NCCP, the BRCP Conservation Strategy is designed to meet the NCCPA standard to contribute to the conservation of natural communities and covered species. This section describes how implementation of the Conservation Strategy contributes to the conservation of natural communities and the expected outcomes for each of the natural communities with implementation of the BRCP. The approach to conserving natural communities within the Plan Area focuses on protecting a sufficient portion of each natural community from future changes in land uses such that the extent, spatial distribution, and connectivity among existing and BRCP protected natural communities 1) contributes to the conservation of the covered species and 2) provides sufficient habitat to maintain the distribution, abundance, and provide for the movement and migration of native species dependent on natural communities of the Plan Area into the future. Furthermore, management of protected natural communities in combination with habitat enhancement actions are designed to maintain and improve the ecological functions and services of the natural communities that support the abundance and distribution of covered and other native species dependent of the communities.

Table 5–20a, *Expected Extent of Conserved Natural Communities in the Plan Area with BRCP Implementation* presents the overall Plan Area-wide conservation outcomes of implementing the BRCP covered activities and Conservation Strategy for each natural community and its associated land cover types. BRCP protection and restoration conservation outcomes for each natural community by CAZ are presented in Tables 5–20b to 5–20g. Figures O–1 to O–5 in Appendix O, *Conservation Outcome Figures* illustrates these outcomes for each natural community graphically in the form of pie charts.

Table 5–5 *Natural Community Protection Targets* presents the total protection targets for each natural community and its associated land cover type. Table 5–9 *Natural Community Conservation and Mitigation Targets for Protection and Restoration* distinguishes conservation from mitigation targets for both protection and restoration.

Table 5–16 presents all applicable biological objectives and conservation measures for each natural community.

5.5.1 Oak Woodland and Savannah

In California, oak woodland and savanna is one of the most biologically diverse communities. The oak woodland and savanna natural community is comprised primarily of mixed oak woodland (comprising about 48 percent of the community in the Plan Area), followed by blue oak woodland (comprising 38 percent of the community in the Plan Area; see Table 3–5, *Extent of Natural Communities and Other Land Cover Types in the Plan Area*). Blue oak-, the dominant oak species, are slow-growing and can live for several centuries.

Oak woodland and savanna in the Plan Area are predominantly found on private lands grazed by domestic livestock, thereby fostering and supporting working landscapes that harbor low-intensity agricultural uses such as ranching. Understory plant communities beneath oak canopies are often more productive relative to adjacent plant communities as a result of natural soil enhancement attributed in part to leaf fall and decomposition, greater carbon, nitrogen, and phosphorous reserves relative to adjacent open grassland sites. Additionally, oak woodland and savanna provides important watershed protection for Butte Creek and Big Chico Creek and other streams and water bodies in the Plan Area. Many important wildlife habitat elements occur in oak woodlands, including wetlands, riparian corridors, rock outcrops, dead and downed logs and other woody debris, brush piles, and snags. Oaks provide woody substrate for insect prey, important nesting and roosting habitat for birds, and buffered temperatures and cover from predators for bird, mammal, amphibian, and reptile species.

Several factors threaten the integrity of intact, functioning woodland and savanna communities. Oak woodlands and savannas are compromised by nonnative species, habitat fragmentation, poor sapling recruitment, and disruption of natural fire and grazing regimes. The lack of regeneration by oak species may pose a long-term challenge for maintaining the integrity and wildlife value of this habitat type (Swiecki and Bernhardt 1998). Tyler et al. (2006) reviewed published studies on the demography and recruitment of blue, valley and live oaks, but found little consistency among evidence for a decline in populations of these species. They suggest that the oak "regeneration problem" has largely been inferred from current stand structure and - when viewed over longer periods of time- the evidence for a regeneration problem in foothill oaks is mixed. Long term studies of blue oak do not suggest a decline in tree density, presumably because recruitment is sufficient to offset low rates of mortality of overstory trees. Evidence from the few available studies is more consistent in suggesting long-term declines in foothill populations of valley oak. Potential causes for low or lack of recruitment include acorn predation, browsing by deer and livestock, competition with nonnative annual grasses, and changes in fire regime, and climate conditions that are unfavorable for recruitment. Control of invasive species may be an important aspect of successful oak restoration. In addition, reducing fire frequencies, in particular fire suppression, may negatively affect oak regeneration.

5.5.1.1 Conservation Approach and Expected Outcomes

The conservation approach for the oak woodland and savanna natural community involves the protection of large patches of oak woodland and savanna that are connected with existing protected patches of woodland and savanna and the protection of the north-south foothill environmental gradient and the elevation gradient of conditions from the foothills to the Valley floor.

The outcome of implementing the BRCP for oak woodland and savannah is illustrated in Appendix O, Figure O–1, *Oak Woodland and Savanna Habitat in the Plan Area with full BRCP Implementation*. land cover

Implementation of BRCP actions to protect, enhance, and manage the oak woodland and savanna natural community are expected to maintain and improve the habitat function of the oak woodland and savanna natural community in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, the oak woodland and savanna natural community would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of this natural community such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.5.2 Grassland

Grassland supports some of the most endangered species in the state, including the plants and vertebrate and invertebrate wildlife associated with vernal pools and vernal swales. The grassland natural community is comprised primarily of grassland land cover type, with only sparse occurrences of wetlands (comprising about 67 percent of the community in the Plan Area), and the remainder comprised of grassland with vernal swale complex land cover type.

Grassland in the Plan Area is predominantly found on private lands grazed by domestic livestock, supporting working landscapes that harbor low-intensity agricultural uses such as ranching. Valley grasslands are typically dominated by low-growing nonnative annual grasses interspersed with a diverse assemblage of native perennial grasses, nonnative forbs, and native forbs. Vernal pools and vernal swales found within the grassland matrix contain a unique and diverse vegetation community dominated by native species and distinct from valley grassland species composition. Organisms that thrive in this harsh habitat of winter ponding and summer desiccation co-evolved with the geologic and climatic conditions that formed vernal pools and vernal swales and, consequently, this habitat supports a high number of endemic and rare species of plants, animals, and invertebrates. Numerous native vernal pool plant species are associated with essential insect pollinators (mainly ground nesting bees) and protection of upland pollinator habitat in the grassland matrix maintains vernal pool plant populations. Native grasslands are typically found in isolated patches, smaller than the grassland mapping unit used for the BRCP, but contain higher resource values than nonnative grassland. Also included within grasslands are

streams with associated wetlands and riparian habitat and stock ponds that provide substantial wildlife benefits for species that require both the wetland and aquatic habitats and the adjacent terrestrial grasslands for their full lifecycle.

Several factors threaten the integrity of grassland communities. For example, the vast majority of native California grassland communities have been replaced by ones dominated by nonnative annual species. However, small areas that support high densities of native grasses and forbs can still be considered native California grasslands. Grassland in California has also been significantly modified as a result of agricultural conversion and loss and fragmentation from urbanization. Within the Central Valley, grasslands occur primarily around the perimeter of the valley at the interface between foothill oak woodland habitats and the agriculture dominated valley floor. These areas have been and continue to be subject to loss and fragmentation due to expanding urban and rural development and conversion to agriculture, most recently from the expansion of vineyards and olive orchards.

5.5.2.1 Conservation Approach *and Expected Outcomes*

The conservation approach for grassland is to protect large patches of grassland that are connected with existing protected patches of grassland and other natural communities (predominantly riparian and oak woodland natural communities) to protect the north-south foothill environmental gradients and the elevation gradient of conditions from the foothills to the valley floor.

The outcome of implementing the BRCP for Grassland is illustrated in Appendix O, Figure O–2, *Grassland and Grassland with Vernal Swale Complex Habitat in the Plan Area with full BRCP Implementation*. land cover

Implementation of BRCP actions to protect, enhance, and manage the grassland natural community and restore vernal pools and other seasonal wetlands embedded in grassland are expected to maintain and improve the habitat function of the grassland natural community in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, the grassland natural community would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of this natural community such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.5.3 *Riparian*

Riparian communities are considered the most important habitats to land bird species in California (Manly and Davidson 1993, Davidson 1995) and provide habitat for an estimated 83 percent of amphibians and 40 percent of the reptiles in California (Brode and Bury 1984). In the Plan Area, the riparian natural community is comprised primarily of cottonwood-willow riparian forest (comprising about 34 percent of the community), followed by dredger tailings riparian

forest and scrub-stream associated (comprising about 25 percent of the community) and valley oak riparian forest (comprising about 20 percent of the community) (see Table 3–5).

The largest areas of the riparian natural community in the Plan Area are associated with the Sacramento and Feather river systems. Land use in the riparian natural community in the Plan Area is primarily for provisioning of wildlife habitat for hunting and non-consumptive use, with about 20 percent of the natural community in the Plan Area already under protection. Due to their structural and relational diversity to other habitats, riparian ecosystems provide disproportionately higher ecosystem services and wildlife habitat functions relative to other terrestrial natural communities. It is estimated that over 80 percent of all wildlife species in the Sacramento Valley use riparian areas during a part of their life cycle. Generally, the riparian community is characterized by a variety of overstory and understory species and significant vertical structure. A typical characteristic of riparian communities is their long linear patch configuration along drainages that transect other natural communities such as oak woodlands and grasslands and also agricultural lands. The community provides spatial and functional integration between a diverse array of terrestrial and aquatic ecosystem components. Riparian systems function as important wildlife movement corridors, providing some of the last remaining overstory cover habitat in parts of the Plan Area.

Riparian habitats have suffered a dramatic loss in extent due to conversion and removal. Existing riparian land cover represents a small proportion of the historical distribution in the Plan Area with losses of riparian vegetation throughout California estimated at between 85 percent and 98 percent removed for agricultural, mining, and urban development (RHJV 2004). Loss of riparian habitat is directly linked to population declines and range reduction of many dependent species (RHJV 2004). Current threats include loss of diversity due to a regulated hydrology, reduced groundwater levels and altered flooding regimes due to groundwater pumping and stream flow regulation, conversion to agriculture or urban land uses, and invasive species. Giant reed, considered the state's most invasive riparian weed, can grow in dense monocultures, crowding out native species and causing changes to hydrologic regimes. Salt cedar is another invasive found in the Plan Area. Both of these highly invasive plants can cause channel changes and increases in fire danger. The introduced bullfrog has had a major impact on native frog populations in Butte County. In addition, feral cats can impact many native bird species in the Plan Area and nest parasitism by brown-headed cowbirds may reduce reproduction by many riparian obligate passerines.

5.5.3.1 Conservation Approach and Expected Outcomes

The conservation approach for the riparian natural community is to protect and restore corridors of riparian that are connected with existing protected patches of riparian habitat, grassland, oak woodlands and other natural communities to protect ecotones between riparian and other natural communities and the elevation gradient of conditions from the foothills to the valley floor.

The outcome of implementing the BRCP for riparian is illustrated in Appendix O, Figure O–3, *Riparian Habitat in the Plan Area with full BRCP Implementation* . land cover

Implementation of BRCP actions to protect, restore, enhance, and manage the riparian natural community are expected to maintain and improve the habitat function of the riparian natural community in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, the riparian natural community would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of this natural community such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.5.4 Wetlands

Wetlands support some of the highest concentrations of wildlife in the state. In the Plan Area, the wetlands natural community is comprised primarily of managed wetlands (about 80 percent of the community), followed by emergent wetland (about 14 percent of the community), and managed seasonal wetland (about 6 percent of the community); see Table 3–5. Note that vernal pools and other a seasonal wetlands are discussed under the grassland natural community.

Wetlands in the Plan Area are predominantly found on federal and state wildlife refuges in the western portion of the Plan Area, the vast majority of which is managed wetlands, though other wetlands are scattered in smaller patches throughout the Plan Area. Land use in these wetlands is primarily for the provisioning of wildlife habitat for hunting and non-consumptive use, such as recreational wildlife watching. Managed wetlands include delivery and drainage channels and pond areas that support a mix of open water aquatic, marsh, and riparian scrub and forest habitats. Water management typically involves winter flooding of most of the managed wetland landscape for migratory bird foraging and resting habitat followed by a slow drawdown of water to manage plant seed production. Emergent wetlands are in scattered locations throughout the Plan Area, generally near creeks, rivers, or areas that receive agricultural runoff. Wetlands perform a variety of ecosystem functions, including food web support, filtering of pollutants, carbon storage, water flow regulation (e.g., flood abatement), and groundwater recharge More waterfowl come to winter in the upper Sacramento Valley than anywhere else along the Pacific Flyway (Cowan 1999). Both natural and managed wetlands in the Plan Area provide valuable nesting, foraging, cover, and breeding habitat for many bird, reptile, amphibian, and mammal species.

Wetlands in California have been greatly reduced in quality and extent since the settlement of the region by European Americans. Approximately 90 percent of California wetlands that existed before European Americans settlement have been lost. Historically the most important threat to wetlands has been habitat loss and fragmentation due to human activities, especially agriculture, urbanization, and flood control projects. While current rates of wetland loss are much lower than in previous decades, wetlands continue to be threatened by development pressure. Invasive species such as the giant reed can also threaten wetlands by crowding out native species and

changing hydrological regimes, and feral cats prey on many native wildlife species, especially birds.

5.5.4.1 Conservation Approach and Expected Outcomes

The conservation approach for the wetland natural community is to protect and restore primarily emergent wetlands within the matrix of larger communities and particularly as habitat for giant garter snake.

The outcome of implementing the BRCP for wetlands is illustrated in Appendix O, Figure O–4, *Wetland Habitat in the Plan Area with full BRCP Implementation*.

Implementation of BRCP actions to protect, restore, enhance, and manage the wetland natural community are expected to maintain and improve the habitat function of the wetland natural community in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, the wetland natural community would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of this natural community such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.5.5 Aquatic

Aquatic habitats are essential to maintaining the diversity of wildlife and fish in the Plan Area. Most wildlife species use aquatic habitats at least incidentally for drinking water, some to meet essential life requirements, and others to meet all of their life requirements of breeding, foraging, and cover. Aquatic community is comprised of the rivers, streams, agricultural channels, canals, ponds, and reservoirs in the Plan Area. Some of the more notable natural streams in the Plan Area are the Sacramento River, Feather River, Big Chico Creek, Little Chico Creek, Butte Creek, and Little Dry Creek. The Sacramento River borders a portion of the western edge of the Plan Area but activities (covered activities or conservation measures) effecting the aquatic habitat of the Sacramento River are not addressed in the BRCP. In the western portion of the Plan Area much of the aquatic habitat consists of agricultural drainage and irrigation channels, but natural creeks flowing from the northeast/east portion of the Plan Area also found there.

The major rivers in the Plan Area are managed by public agencies, while smaller streams and canals and ponds are mostly on private lands. Aquatic communities in the Plan Area are used for water storage for irrigation, recreation, and fish and wildlife habitat. While the aquatic natural community by definition has little or no emergent vegetation, it typically borders and forms ecotones with emergent wetlands. Low flow areas, such as agricultural channels support dense emergent vegetation. Organic material carried into streams by runoff or by receding overbank provides nutrients that support plankton, zooplankton, and invertebrate production important to the food web that supports fish and wildlife. This production directly supports all covered fish species as well as many wildlife species, especially covered amphibians and reptiles.

Historically the aquatic natural community in the Plan Area has and continues to be greatly modified from natural conditions. River and creek flows are controlled by the management of dams, reservoirs and diversions, which control the volume and timing of flow of water through aquatic habitats and so affect the organisms associated with them. Stream and river have been diked, channelized, and stabilized, which has drastically changed the natural erosional and flood processes that many organisms and natural communities depend on. Diversions reduce the volume of water carried in rivers and creeks, while drainage channels transport pesticides and other contaminants from agricultural and urban areas into rivers and creeks. Nonnative invasive species are present in aquatic natural communities, and can adversely affect native species through predation and competition. Introduced bass, sunfish, and bullfrogs are particularly voracious predators that strongly influence the successful use of ponds by native amphibian species and the use of creeks and rivers by native fish species.

5.5.5.1 Conservation Approach and Expected Outcomes

The conservation approach for the aquatic natural community is protected perennial and intermittent stream channels and ponds for both mitigation and conservation components of the BRCP.

Implementation of BRCP actions to protect, enhance, and manage the aquatic natural community are expected to maintain and improve the habitat function of the aquatic natural community in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, the aquatic natural community would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of this natural community such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.5.6 Agriculture

Agriculture is the dominant land use throughout the Central Valley and the Central Valley portion of Butte County. The agriculture lands in the Plan Area produce rice, fruits, nuts, and other crops for the commercial market, and are comprised primarily of rice (comprising 48 percent of agriculture lands), orchard/vineyard (comprising 43 percent of agriculture lands), and irrigated pasture (comprising 8 percent of agriculture lands) (see Table 3–5).

Most agriculture within the Plan Area occurs where the soils and topography are most suitable for rice production and orchards. Rice production dominates the southwestern part of the Plan Area (Basin CAZ), while orchards and vineyards are concentrated in the northwest and south-central parts of the Plan Area (Northern Orchards and Southern Orchards CAZs). Agricultural lands in the Plan Area represent an extremely altered landscape that retains little resemblance to the historical (pre-European American settlement) condition. Formerly consisting of extensive wetlands, open grasslands, broad riparian systems, and oak woodlands, the conversion to agriculture has removed most of these native habitats. While generally supporting a less diverse

community of wildlife compared with most native habitats, some agricultural systems continue to support abundant wildlife and provide essential breeding, foraging, and roosting habitat for many resident and migrant wildlife species. Rice lands, for example, have become important "surrogate" wetland habitats for over 235 wildlife species in the Central Valley (Jones & Stokes 1995). Irrigated croplands support abundant rodent populations. Field edges, woodlots, and watercourses that support riparian habitat also provide breeding sites and refugia for prey species and other wildlife. Because of this abundance of food, the Central Valley supports one of the largest concentrations of raptors during the winter and breeding seasons. The primary ecological function of agricultural lands is to provide foraging habitat for agriculture-associated species and limited nesting, cover, and other habitat functions associated with habitats provided by riparian and other vegetation growing along ditch and field margins.

Rice, irrigated cropland, and irrigated pasture possess significant habitat value for many covered species, however, due to the types of species planted, structural uniformity, low species diversity, and disruptive management (application of chemicals, mechanized harvest, etc.) other types of agriculture in the Plan Area have little or no habitat value for covered species. Threats to agriculture, particularly agricultural types that provide important wildlife habitat values, include urbanization, which permanently removes agricultural land, and uncertain water availability, that can alter agricultural land use patterns and affect the distribution and abundance of agriculture-dependent wildlife species.

5.5.6.1 Conservation Approach and Expected Outcomes

The conservation approach for the agriculture is to protect and maintain the working landscape of rice, irrigated pasture, and irrigated crops, primarily through voluntary permanent agricultural conservation easements (hereafter referred to as conservation easements). Protected agriculture will be connected with protected large patches of grassland that are connected with existing protected patches of grassland and other natural communities (predominantly riparian and oak woodland natural communities) to protect the north-south foothill environmental gradients and the elevational gradient from the foothills to the valley floor.

The outcome of implementing the BRCP for agriculture is illustrated in Appendix O, Figure O–5, *Agriculture Habitat in the Plan Area with full BRCP Implementation*.

Implementation of BRCP actions to protect, enhance, and manage specific agriculture land cover types are expected to maintain and improve the habitat function of the agriculture lands in support of conserving the abundance and distribution of associated covered and other native species in the Plan Area. Under the BRCP, agriculture lands would be included within a larger conservation lands system that provides for a sufficient extent of protection, spatial distribution, and management of rice, irrigated cropland, and irrigated pasture such that ecosystem functions and biodiversity would be conserved within the Plan Area.

5.6 CONSERVATION PROVIDED FOR COVERED SPECIES

The Conservation Strategy is designed to meet the NCCPA standard to conserve covered species in the Plan Area in addition to the ESA section 10 standard to monitor, minimize, and mitigate the impacts of the covered activities on the covered species to the maximum extent practicable[30].

Table 5–21a, *Expected Extent of Conserved Covered Species Habitat Types in the Plan area with BRCP Implementation* presents the overall Plan Area-wide conservation outcomes of implementing the BRCP covered activities and Conservation Strategy for each covered species. BRCP protection and restoration conservation outcomes for each covered species are presented by CAZ in Tables 5–21b to 5–21g. Figures O-6 through o-31 in Appendix O illustrate these outcomes for each natural community graphically in the form of pie charts and maps.

Table 5–8, *BRCP Covered Species Modeled Habitat Protection Targets* presents the conservation targets for modeled habitat and occurrences for each covered species by CAZ. Table 5–10, *Covered Species Habitat and Mitigation Targets* distinguishes conservation from mitigation targets for both protection and restoration.

Table 5–16 presents all applicable biological objectives and conservation measures for each covered species.

5.6.1 Tricolored Blackbird

Tricolored blackbirds are nearly endemic to California. The overall range of the species is largely unchanged since the 1930s (Neff 1937, DeHaven et al. 1975, Beedy et al. 1991, Hamilton 1998). However, the number of tricolored blackbird nesting colonies in Butte County has declined substantially from 1931-1937 when over 30 colonies were reported supporting an estimated 159,000 adults (Neff 1937). Populations were dramatically reduced in subsequent decades – 52,500 by 1961 (Orians 1961); 25,000 by 1972 (DeHaven et al. 1975); and 6,500 by the mid-1990s (Hamilton 1998). Beedy et al. (1991) report only three extant colonies in Butte County by 1989. In 2001 only one active colony was located in Butte County along Lone Tree Road with an estimated 500 adult blackbirds (Humple and Churchwell 2002). Surveys of tricolored blackbird were conducted in 2008 in 35 California counties from San Diego County to Shasta County. At that time, a total of 395,321 birds were estimated statewide. A total of 2,541 tricolored blackbirds were observed in Butte County within the Plan Area during the 2008 survey, representing approximately 0.6 percent of the statewide total (University of California Davis 2008).

The primary threat to tricolored blackbird has been the historical loss of its wetland nesting habitat and associated stressors (e.g., increase vulnerability to nesting colonies from disturbances that cause nest or colony abandonment, increased predation in nesting colonies; Appendix A).

[30] 50 *Code of Federal Regulations* (CFR) § 17.22(b)(2)(B), 50 CFR § 222.307 (c)(2)ii).

The initial conversion of the Sacramento Valley from native landscapes to agriculture in the late nineteenth and early twentieth century removed vast wetland areas and caused initial declines in populations. The more recent conversion of agricultural lands that still supported some suitable nesting habitat to urban use has permanently removed breeding and foraging habitat for this species in those areas. As available habitat becomes increasingly limited and food resources become more concentrated, predation can have a substantially larger impact on nesting colonies. Nonnative predators, especially feral cats, can have a substantial impact on nesting colonies. Tricolored blackbird colonies are highly sensitive to human disturbances and close proximity to urban development can cause colonies to be permanently abandoned.

Tricolored blackbirds have three basic requirements for selecting their breeding colony sites: 1) open, accessible water; 2) a protected nesting substrate, including flooded or thorny/spiny vegetation; and 3) a suitable foraging space proving adequate insect prey within a few miles of the nesting colony. Tricolored blackbird foraging habitat includes annual grassland (preferably less than 15 cm [6 in] tall), vernal pools and other seasonal wetlands (both wet and dry phases), pastures, agricultural fields (primarily alfalfa and recently tilled fields), cattle feedlots, and dairies. They also forage occasionally in riparian scrub and marsh habitats. Proximity to suitable foraging habitat appears to be important for the establishment of nesting colonies because foraging occurs at least initially in the field containing the breeding colony.

5.6.1.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The conservation approach for tricolored blackbird is based on protecting and maintaining suitable wetland and other breeding habitat that is located near suitable upland habitat for foraging. This approach is consistent with and helps achieve the recovery goals of the Draft Recovery Plan for Giant Garter Snake (USFWS 1999) which includes tricolored blackbird as a primary ancillary beneficiary with implementation of its recommended habitat conservation measures. Lastly, maintaining and enhancing the natural functions of habitats, restoring habitats and reducing stressors, such as the adverse effects of nonnative species on nesting success, all contribute to a sustainable protection of the species throughout the BRCP Area.

Appendix O, Figure O–6, *Tricolored Blackbird Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled tricolored blackbird habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–6a, *Tricolored Blackbird: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit tricolored blackbird.

Implementation of the BRCP conservation actions within the BRCP conservation lands system, which is configured to provide large and ecologically connected habitat areas, will conserve tricolored blackbird in the Plan Area and mitigate the direct and indirect impacts of the covered activities.

5.6.1.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current population status and distribution of tricolored blackbird in the Plan Area. Recently, only one breeding colony has been persistently recorded in the Plan Area. As BRCP conservation measures and covered activities are implemented, monitoring and surveys will provide a better understanding of the distribution of the species and will reduce the uncertainty associated with the lack of population data. This, in turn, will result in a more focused and tactical implementation of conservation actions to benefit current populations and the protection of vulnerable patches of habitat. An important stressor on tricolored blackbird is the disturbance of active breeding colonies by humans and nonnative predators (Beedy and Hamilton 1999). A primary uncertainty associated with this threat is the effectiveness of nonnative species control measures in protected nesting colonies where predation by nonnative predators has been demonstrated to substantially reduce nesting success. To address this uncertainty, BCAG will coordinate and monitor any implemented control activities with USFWS, CDFW, and tricolored blackbird experts.

5.6.2 Yellow-Breasted Chat

Formerly a common summer resident throughout the Central Valley (Grinnell and Miller 1944), the yellow-breasted chat is currently reported as an uncommon resident in riparian habitats in the Plan Area and appears to have been extirpated from the San Joaquin and Sacramento valleys. There is little historical or current information regarding the distribution of yellow-breasted chats in Butte County. While no occurrences are reported in the CNDDB, several detections have been made in the foothill canyons of the Plan Area, including Big Chico Creek, Little Chico Creek, and Butte Creek (see Appendix A). Consequently, the majority of modeled yellow-breasted chat habitat is likely unoccupied. The available information indicates that the species occurs in low densities in the Plan Area; however, complete surveys of the Plan Area have not been conducted

The primary threat to yellow-breasted chat has been the historical loss and degradation of its riparian habitat and associated stressors (e.g., lack of habitat patches large enough to support breeding activity, increased nest parasitism and depredation; see Appendix A) (Remsen 1978, Rosenberg et al. 1991). While the destruction of riparian woodland has likely played a significant role, the absence of chats from some areas that still retain intact riparian woodland habitat indicates that some other factor may be involved in the decline of yellow-breasted chat populations, such as cowbird parasitism. While data are limited on the extent of cowbird parasitism on yellow-breasted chats, it could have a significant impact on the local reproductive performance of chats.

5.6.2.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement of large patches of yellow-breasted chat nesting and foraging habitats that are spatially distributed to provide landscape-level connectivity among protected habitats, to provide for the movement and genetic interchange among populations of covered species, and to preserve native biodiversity. The focus of the Conservation Strategy is on protecting habitat to accommodate potential future expansion of chat populations and immigration, as population distributions respond to changed environmental conditions (e.g., effects of climate change).

Appendix O, Figure O–7, *Yellow-Breasted Chat Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled yellow-breasted chat habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–7a, *Yellow-Breasted Chat: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit yellow-breasted chat.

Implementation of the BRCP conservation actions within the BRCP conservation lands system, which is configured to provide large and ecologically connected habitat areas, will conserve the yellow-breasted chat in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.2.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current population status and distribution of yellow-breasted chat in the Plan Area. To date, it is not clear if the species is breeding within the Plan Area, and only singing males have been observed in the recent past (see Appendix A). BCAG will integrate protection, restoration and management of habitat with active control of nonnative species to evaluate hypotheses why the species is either not present or not nesting certain locales. As BRCP conservation measures and covered activities are implemented, monitoring and surveys will provide a better understanding of the distribution and population structure of the species and will reduce the uncertainty associated with the lack of population data. This, in turn, leads to a more focused and tactical implementation of conservation actions to benefit current populations and newly discovered occurrences and the protection of vulnerable patches of habitat. Since one of the most significant stressor of the yellow-breasted chat (aside from habitat loss) is the aggressive brood parasitism by brown-headed cowbirds (Kilgo and Moorman 2003), the primary uncertainty associated with this threat is the rate at which these brood parasites species invade restored habitat, and the effectiveness of control measures. To address this uncertainty, BCAG will coordinate experimental control activities that may be undertaken with USFWS, CDFW, and brown-headed cowbird experts. The effectiveness of controlling nonnative species in existing and restored habitats will be monitored and necessary changes to the methodology or control action frequency will be implemented in an adaptive decision framework.

5.6.3 Bank Swallow

Suitable bank swallow habitat within the Plan Area is defined as banks along unleveed and unchannelized portions of the Sacramento and Feather Rivers and Big Chico and Butte Creeks and set-back levees associated with broad basins. However, known occurrences are restricted to sites along the Sacramento and Feather Rivers. Reports have identified 17 bank swallow colonies along the Sacramento River within or immediately adjacent to the Plan Area (nine on the eastern bank and eight on the western bank. However, these colonies have since undergone significant declines. An additional 23 colonies along the Feather River between the confluence with the Sacramento River and Oroville have been reported. Several of these colonies occur within the Plan Area and are considered extant. Bank swallow along the Sacramento River have suffered an estimated 47 percent reduction in the number of colonies between 1986 and 1994, followed by a gradual increase through 1999 when the number was similar to that found in 1986. Other reports estimate a 27 percent decline in the number of burrows along this stretch between 1986 and 1999, indicating that while the number of colonies rebounded to near 1986 levels, the number of burrows per colony decreased. Despite an apparent continuing decline in local populations, the Butte County stretch of the Sacramento and Feather Rivers remains a key area for the bank swallow nesting population in Northern California. Available bank swallow nesting habitat was substantially reduced in California due to channelization of streams, which eliminated nesting habitat and prevented formation of new nesting habitat by preventing natural erosion processes. Along the Sacramento and Feather Rivers and other Sacramento Valley nesting areas, the most significant current threat is the direct loss of suitable colony sites due to continuing bank protection and flood control projects.

5.6.3.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The focus of the BRCP long-term strategy for the bank swallow is protection of its habitat along Plan Area tributaries to the Sacramento and Feather Rivers. The Conservation Strategy provides for the protection and enhancement of large stretches of stream banks with natural erosion processes that are spatially distributed to provide landscape-level connectivity among protected habitats. Moreover, the criteria used to develop the bank swallow conservation approach are consistent with the goals of the California bank swallow recovery plan (DFG 1992), which include:

- Ensure that the remaining population does not suffer further declines in either range or abundance.
- Provide for the preservation of sufficient natural habitat to maintain a viable wild population in perpetuity.

Appendix O, Figure O–8, *Bank Swallow Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled bank swallow habitat in the Plan Area with full

BRCP implementation, and Appendix O, Figure O–85a, *Bank Swallow: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit bank swallow.

Implementation of the BRCP will conserve the bank swallow in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.3.2 Ecological Uncertainty

Uncertainty about the existence of additional colonies, the size of existing known colonies, the location of potential additional unknown occurrences, and the efficacy of protecting habitat and managing protected habitat is addressed through the BRCP monitoring and adaptive management program. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. Monitoring activities carried out by BCAG and others will complement and expand the current knowledge of the species' status in the Plan area and will identify areas of potential increase. The adaptive management process implemented under the BRCP will provide the vehicle for addressing ecological change or uncertainty associated with implementation of conservation measures (e.g., the removal of rip-rap to increase function of natural stream bank processes).

5.6.4 Western Burrowing Owl

Overall population trend throughout the subspecies' North American range is declining. Western burrowing owls are resident in relatively low densities throughout Butte County; all are reported in the western portion of the county (see Appendix A, Figure A.4-1). The most recent breeding season record, reported in 2000, is along Nelson Road just east of State Route 99 and just north of Thermalito Afterbay. Additional historical breeding season records from 1992 and 1993 are reported between just south of Highway 162 on the south to north of Chico (Appendix A, Figure A.4-1).

The major threats and stressor of the species in Butte County are loss of habitat and mortality due to vehicle strikes and other accidental deaths. Habitat loss is primarily related to urbanization, including residential and commercial development and infrastructure development (roads and oil, water, gas, and electrical conveyance facilities) that permanently removes habitat. Field conversion to incompatible crop types, such as orchards, vineyards, and other crops reduce available foraging habitat and lead to abandonment of traditional nesting areas. Levee stability practices for flood control, including vegetation removal, grading, and reinforcing with rock can destroy burrowing owl nesting habitat. Rodent control, particularly along levees and roadsides, can decimate ground squirrel burrow abundance. Collisions with vehicles have been cited as a significant source of mortality by several researchers (see Haug et al. 1993). Although western burrowing owls are relatively tolerant of lower levels of human activity, human-related impacts such as shooting and burrow destruction adversely affect this species.

5.6.4.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement of large patches of suitable western burrowing owl habitat, that includes available rodent burrows at breeding sites and wintering habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. Implementation of the conservation actions within the BRCP conservation lands system configured to provide large and ecologically connected habitat areas will mitigate the direct and indirect impacts of the covered activities on western burrowing owl and also contribute to the conservation of western burrowing owl.

The BRCP conservation measures integrate and implement the CDFW-recommended burrowing owl mitigation measures intended to offset the loss of habitat and slow or reverse further decline of this species (DFG 2012), including:

- Maintaining the size and distribution of BRCP Area burrowing owl populations.
- Increasing the distribution of burrowing owls into formerly occupied historical range where burrowing owl habitat still exists, or where it can be created or enhanced, and where the reason for its local disappearance is no longer of concern.
- Increasing size of existing populations where possible and appropriate.
- Protecting and restoring natural communities (e.g., fossorial rodents, grasslands) that support burrowing owls at a landscape scale requiring minimal long-term management.
- Minimizing unnatural causes of burrowing owl population declines (e.g., nest burrow destruction, chemical control of rodent hosts and prey).
- Augmenting or restoring natural dynamics of burrowing owl populations including movement and genetic exchange among populations.
- Engaging stakeholders, including ranchers; farmers; military; tribes; local, state, and federal agencies; non-governmental organizations; and scientific research and education communities involved in burrowing owl protection and habitat management.

Appendix O, Figure O–9, *Western Burrowing Owl Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled western burrowing owl habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–9a, *Western Burrowing Owl: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit western burrowing owl. Implementation of the BRCP conservation actions within the BRCP conservation lands system, which is configured to provide large and ecologically connected habitat areas, will conserve the western burrowing owl in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.4.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current status and distribution of western burrowing owl in the Plan Area. Data gaps regarding the distribution of the species, and the amount of actual occupied habitat could result in protecting large areas of unoccupied habitat. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. BCAG will also contribute to the existing knowledge about western burrowing owl distribution within the Plan Area through monitoring, pre-acquisition surveys, and other forms of collaborative monitoring (e.g., with Universities, local birders, ranchers and other landowners, and federal agency staff). The balance of habitat to be protected at the time new occurrences are discovered will be focused towards habitat supporting those occurrences. Uncertainty also exists regarding the effectiveness of practicable techniques (e.g., installation of artificial burrows, grazing management and protection of fossorial mammals) for improving habitat availability for western burrowing owl. To address this uncertainty, BCAG will evaluate effectiveness monitoring efforts and coordinate the design of such measures with USFWS, CDFW, and species experts.

5.6.5 Western Yellow-billed Cuckoo

Western yellow-billed cuckoo is a riparian obligate species; its primary habitat association being willow-cottonwood riparian forest. All studies indicate a highly significant association with relatively expansive stands of mature cottonwood-willow forests. There may be fewer than 50 breeding pairs of western yellow-billed cuckoo in California (Gaines 1977, Laymon and Halterman 1987, Halterman 1991, Laymon et al. 1997). The only locations in California known to currently sustain breeding populations include the Colorado River system, the South Fork Kern River, and isolated sites along the Sacramento River (Laymon and Halterman 1989, Laymon 1998). The largest portion of the current range of the western yellow-billed cuckoo along the Sacramento River as described by the CDFW California Wildlife Habitat Relationships Program occurs along the western border of the Plan Area. Breeding pairs have been reported the Sacramento River area long the western border of the Plan Area as well as the Feather River between Oroville and the Butte County border. At least four confirmed or probable breeding locations occur within this area along with numerous other detections. Breeding pairs have also been reported from portions of the Feather River between Oroville and the Butte County border. Historical declines have been due primarily to the removal of riparian forests for agricultural and urban expansion. The primary threat to western yellow-billed cuckoo has been the historical loss and degradation of its riparian habitat and associated stressors (e.g., lack of habitat patches large enough to support breeding activity, increased nest parasitism and depredation; see Appendix A) (Hughes 1999). Habitat loss continues as a result of bank stabilization and flood control projects, urbanization along edges of watercourses, agricultural activities, and river management that alter flow and sediment regimes. Nesting cuckoos are also sensitive to habitat fragmentation that reduces patches of otherwise suitable habitat to less than 325 feet by 1,000 feet. Predation is

a significant source of nest failure, and pesticides may pose a long term threat to western yellow-billed cuckoo.

5.6.5.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The focus of the Conservation Strategy is on protecting habitat occupied or potentially suitable for western yellow-billed cuckoo to ensure sufficient availability of habitat to accommodate potential future expansion of its population and immigration from the south and west, as population distributions respond to changed environmental conditions (e.g., effects of climate change). Within the context of the overall BRCP Conservation Strategy, western yellow-billed cuckoo mature riparian habitat will be protected within a larger connected system of conservation lands that will ensure the availability of high-quality functioning habitat.

Appendix O, Figure O–10, *Western Yellow-Billed Cuckoo Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled western yellow-billed cuckoo habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–10a, *Western Yellow-Billed Cuckoo: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit western yellow-billed cuckoo.

Implementation of the BRCP will conserve the western yellow-billed cuckoo in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.5.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current status and distribution of western yellow-billed cuckoo in the Plan Area. Actions to protect habitat include protection of currently known occupied habitat and protecting newly discovered nest sites within 5 years following first detection throughout the duration of the BRCP. However, data gaps regarding the distribution of occupied habitat could result in protecting large areas of unoccupied habitat. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. The balance of habitat to be protected at the time new occurrences are discovered will be focused towards habitat supporting those occurrences. Uncertainty also exists regarding the effectiveness of practicable forest management techniques (e.g., the management of riparian forests to increase and maintain the availability of mature trees and canopy structure) for improving nesting site suitability for western yellow-billed cuckoo. To address this uncertainty, BCAG will coordinate the design of such structures with USFWS, CDFW, and western yellow-billed cuckoo experts.

5.6.6 Greater Sandhill Crane

An estimated 8,500 greater sandhill cranes belong to the Central Valley population (Littlefield and Ivey 2000). Although greater sandhill cranes do not breed in the Plan Area, the majority of

birds winter within the Sacramento Valley between Butte Sink and the Sacramento-San Joaquin River Delta (Delta). The Sacramento Valley (Chico/Butte Basin) greater sandhill crane wintering area extends from Chico to the Butte Sink between the Sacramento River and State Route 99 (Pogson and Lindstedt 1988). Littlefield (2002) estimates that the Butte Basin frequently supports up to 70 percent of the Central Valley crane population.

While declines in greater sandhill cranes are mainly associated with impacts on their breeding grounds, conditions on the wintering grounds may also be significant stressors on this population. Threats on the wintering grounds include changes in water availability; flooding fields for waterfowl, which reduces foraging habitat for cranes; conversion of cereal cropland to vineyards or other incompatible crop types; human disturbances; collision with power lines Tacha et al. 1978, Morkill and Anderson 1991, Brown and Drewien 1995, Janss 2000); and urban encroachment. Greater sandhill cranes are sensitive to the presence of humans and human activities, including low-level recreational disturbances (e.g., birding, photography; Lovvorn and Kirkpatrick 1981). Hunters accessing hunt areas during pre-dawn hours can keep cranes from roosting or foraging in an area (Littlefield and Ivey 2000, Ivey and Herziger 2003).

5.6.6.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement of large patches of greater sandhill crane roosting and foraging habitats of sufficient size and distance from sources of disturbance to allow cranes to forage effectively and shift among traditional and newly emerging foraging habitats, depending on crops, land use patterns and flooding. It also allows cranes to respond to localized temporary disturbances by shifting to less disturbed areas by selecting different roost or foraging sites.

Appendix O, Figure O–11, *Greater Sandhill Crane Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled greater sandhill crane habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–11a, *Greater Sandhill Crane: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit bank swallow.

Implementation of the BRCP will conserve the greater sandhill crane in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.6.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the efficacy of implemented conservation measures on the use and function of greater sandhill crane habitat in the Plan Area. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the distribution, seasonal use, best management practices and feasibility of crane conservation measures in the Plan Area.

5.6.7 California Black Rail

Up to 12 locations of black rails have been verified for Butte County (Richmond et al. 2008) Known populations within Butte County are located just north of La Porte Road southeast of Oroville (Appendix A, Figure A.7-1), but it is likely that additional subpopulations occur further north and possibly west into Butte County. Additional recent occurrences of California black rail are reported from seep spring sites in the eastern foothills of the Plan Area (P. Johnson and S. Huber pers. comm.), including sites at Upper Bidwell Park, Butte Creek Canyon, and at the Base of Table Mountain; in emergent marsh at the BCAG/Caltrans mitigation project site at the intersection of Highways 70 and 149; and a possible detection near the picnic grounds of Thermalito Forebay (J. Sterling pers. comm.).

The most significant historical threat was the draining of tidal marshes, which may be responsible for over 90 percent the population declines of this species, and which is still occurring in some areas, albeit at a slower rate. Throughout its range, the primary threat to the California black rail is the continuing loss and fragmentation of freshwater habitat from urbanization, flood control projects, agricultural practices, and hydrologic changes that affect water regimes. In the BRCP Area, California black rail is threatened by continued habitat loss, especially the reduction, drying and removal of shallow wetlands with dense emergent vegetation cover. This cover is essential, because the species is susceptible to predation by herons, egrets, northern harriers, short-eared owls, and several mammalian species. It has been suggested that the majority of black rail habitat within the Plan Area is likely created by leaky pipes, canals and seepage below bermed ponds used for livestock production (Richmond et al. 2010). Within the Plan Area, agricultural practices, improper livestock grazing, and urbanization may threaten individual subpopulations. Isolated subpopulations are also susceptible stochastic extinction events. Other potential threats include increased predation by domestic cats and by native predators; pollution and its effect on freshwater marshes; and collision with automobiles and utility lines.

5.6.7.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement all occupied and many potentially suitable patches of California black rail habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. The focus is on protection of habitat occupied by California black rail and unoccupied habitat that is connected to occupied habitat to ensure sufficient availability of habitat to accommodate potential future expansion of its population. Within the context of the overall BRCP Conservation Strategy, California black rail habitat will be protected within a larger connected system of conservation lands that will ensure the availability of habitat to accommodate potential future shifts in its distribution in response to changed environmental conditions (e.g., effects of climate change on the future distribution of California black rail habitat).

Implementation of the BRCP will conserve the black rail in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.7.2 Ecological Uncertainty

The California black rail is a secretive species that is rarely observed directly and therefore difficult to survey. The primary ecological uncertainty associated with implementation of the conservation measures is the current status and distribution of California black rail in the Plan Area. As this species becomes better studied, and monitoring programs are implemented and conducted over time it is likely that new occurrences will be discovered within the Plan Area. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. Uncertainty also exists regarding the effectiveness of practicable techniques for improving habitat stability and patch persistence. In many cases, California black rail habitat is maintained by leakages of irrigation conveyances, and replacing these with deliberate and reliable water supply is crucial in ensuring habitat permanence. To address this uncertainty, BCAG will coordinate the design and operational parameters of such structures with USFWS, CDFW, and California black rail experts.

5.6.8 American Peregrine Falcon

The peregrine falcon and its subspecies is the world's most widespread raptor and one of the most widely found bird species. American peregrine falcons are known to occur along the eastern edge or just east of the eastern Plan Area boundary. Altacal Audubon Society reports a breeding pair in upper Butte Creek Canyon, as well as recent activity in the Upper Bidwell Park area and on a suspension bridge across Lake Oroville. CDFW reports a nest site along the southern bluffs of Upper Bidwell Park. CDFW also reports activity along the western bluffs of CDFW's Table Mountain Ecological Reserve. The California Department of Water Resources (DWR) reports nest sites on three of the four bridges over Lake Oroville. These and other reports of peregrine falcon activity will be refined and updated through additional contact with local biologists.

Historically, organochloride pesticides presented the greatest threat to peregrine falcons. However, the risk is significantly reduced since the banning of dichlorodiphenyltrichloroethane, or DDT, and peregrine numbers have been increasing since the mid-1970s. Other potential threats to nesting peregrine falcons include urbanization resulting in the loss of foraging habitats and disturbance to nest sites; illegal shooting, egg collecting; and collision with vehicles, utility lines, and other structures. Urbanization of bluffs and ridges could alter available habitat or increase levels of human disturbance. Loss of wetland habitats within the Plan Area and any subsequent reduction of available water bird prey that may result could affect foraging opportunities for peregrine falcon.

5.6.8.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement of large patches of peregrine falcon habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. This, also benefits the falcon's prey species, such as waterfowl.

Appendix O, Figure O–12, *American Peregrine Falcon Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled American peregrine falcon habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–12a, *American Peregrine Falcon: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit American peregrine falcon.

Implementation of the BRCP will conserve the American peregrine falcon in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.8.2 Ecological Uncertainty

The primary uncertainty associated with implementation of the conservation measures is the current distribution and nesting activity of the species in the Plan Area. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. To address any uncertainties that may be related to the management of specific areas (e.g., nesting sites on bridges or buildings) BCAG will coordinate the design or management of such structures with USFWS, CDFW, and species experts.

5.6.9 Swainson's Hawk

Swainson's hawks are sparsely distributed throughout the Plan Area and surrounding lands (see Appendix A). Within the Plan Area, nesting Swainson's hawks occur primarily west of State Routes 70 and 99. Available nesting habitat is more abundant in this area, which includes portions of the Sacramento River, Feather River, Butte Creek, and other riparian corridors. It is likely that nesting Swainson's hawks also occur east of State Route 99, particularly in the grassland habitats along the edge of the valley. Remnant riparian forests along drainages contain the majority of known nests in the Central Valley (Estep 1984, Schlorff and Bloom 1984, England et al. 1997); however, this is a function of nest tree availability rather than dependence on riparian forest.

Declines in Swainson's hawk populations have been reported across much of the species' range, particularly in the Canadian prairies (England et al. 1997), California (Bloom 1980), Oregon (Littlefield et al. 1984), and Nevada (Herron et al. 1985). In California, Swainson's hawks are currently absent from much of their historical breeding range in the central and southern portions of the state, and overall may have declined by as much as 90 percent (Bloom 1980). In the Butte Valley, the population has been stable at 65–80 pairs since the mid-1980s (Woodbridge 1998). Large numbers of Swainson's Hawks still occupy the Central Valley (estimated 420 to 1,000 pairs,

Woodbridge 1998), but annual losses of territories to residential development and riparian habitat removal, and agricultural intensification are reported (DFG 1988, Estep 1989).

In California, the primary causes of Swainson's hawk population decline are believed to be the loss of nesting habitat (Schlorff and Bloom 1984) and the loss of foraging habitat to urban development and to conversion to unsuitable agriculture, such as orchards and vineyards (England et al. 1995, 1997).

5.6.9.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The conservation approach for Swainson's hawk is based on protecting and maintaining a mosaic of nesting and foraging habitat to ensure sufficient availability of habitat to maintain the current Plan Area population and to accommodate potential future expansion or distributional shifts of its population in response to changed environmental conditions (e.g., effects of climate change). Within the context of the overall Conservation Strategy, Swainson's hawk nesting and foraging habitat will be protected within a larger connected system of conservation lands that will ensure the availability of high-quality functioning habitat.

The Conservation Strategy provides for the protection and enhancement of large patches of peregrine falcon habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. This, also benefits the falcon's prey species, such as waterfowl.

Appendix O, Figure O–13, *Swainson's Hawk Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled Swainson's hawk habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–13a, *Swainson's Hawk: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit Swainson's hawk.

Implementation of the BRCP will conserve the Swainson's hawk in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.9.2 Ecological Uncertainty

The effectiveness of conservation actions that benefit Swainson's hawk is well understood (e.g., ecological requirements, techniques for managing habitat to increase foraging accessibility).

5.6.10 White-Tailed Kite

California is currently considered the stronghold for white-tailed kite in North America, with nearly all areas up to the western Sierra Nevada foothills and southeast deserts occupied (Small 1994, Dunk 1995). In the Sacramento Valley, kite populations have predominantly increased in irrigated agricultural areas where the California vole (*Microtus californicus*) often occurs (Warner and Rudd 1975). Observations of white-tailed kites in Butte County occur predominantly along the Sacramento River, Feather River, Butte Creek, Big Chico Creek, and at Gray Lodge Wildlife Area.

Factors influencing population trends directly or indirectly include: 1) conversion of natural or agricultural lands to urban sprawl or commercial properties, 2) clean farming techniques that leave few residual vegetation areas for prey, 3) increased competition for nest sites with other raptors and corvids, 4) drought, 5) increased disturbance at nests, and 6) removal of suitable nesting habitat (Dunk 1995). Within the Plan Area, the main threats include reductions in prey abundance and availability with changing agricultural practices such as the conversion of alfalfa, hay and irrigated pastures to row crops, orchards or vineyards.

5.6.10.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The BRCP conservation strategy focuses on protecting habitat occupied or potentially suitable for white-tailed kite to ensure sufficient availability of habitat to accommodate potential future expansion of its population as population distributions respond to changed environmental conditions (e.g., effects of climate change). Within the context of the overall BRCP Conservation Strategy, white-tailed kite nesting and foraging habitat will be protected within a larger connected system of conservation lands that will ensure the availability of high-quality functioning habitat.

The Conservation Strategy provides for the protection and enhancement of large patches of peregrine falcon habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. This, also benefits the falcon's prey species, such as waterfowl.

Appendix O, Figure O–14, *White-Tailed Kite Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled white-tailed kite habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–14a, *White-Tailed Kite: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit white-tailed kite.

Implementation of the BRCP will conserve the white-tailed kite in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.10.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current status and distribution of white-tailed kite in the Plan Area, especially the number of nesting pairs in the Plan Area. Actions to protect habitat include protection of currently known occupied habitat and protecting newly discovered nest sites within 5 years following first detection throughout the duration of the BRCP. BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of newly occupied nest sites in the Plan Area. Uncertainty also exists regarding the effectiveness of practicable management techniques (e.g., the management of riparian forests to increase and maintain the availability of mature trees and canopy structure) for improving nesting site suitability for white-tailed kite. To address this uncertainty, BCAG will coordinate the design of such structures with USFWS, CDFW, and white-tailed kite experts.

5.6.11 Bald Eagle

Currently, there are at least five documented breeding sites in Butte County that are outside the Plan Area, and two nesting territories within the Plan Area, one along the edge of the Diversion Pool approximately 1 mile downstream of the Oroville Dam and the other along the Feather River near the southeast end of the CDFW Oroville Wildlife Area (Appendix A, Figure A.11-1) (David Bogener, DWR pers. comm.). California Department of Water Resources also reports a recently discovered winter roost site near Lake Oroville that has been occupied by at least 60 individuals. All Pacific Recovery Plan goals (number of breeding pairs and production/active nests) have been met in Recovery Zone 27 (which includes Butte County) during the last two nesting seasons. Bald eagles regularly winter around the Plan Area, including at Lake Oroville, Thermalito Forebay and Afterbay, along the Feather and Sacramento Rivers, and in the wetlands associated with Llano Seco and the Gray Lodge Wildlife Area (Appendix A, Figure A.11-1).

The main threats identified in the Pacific Recovery Plan (USFWS 1986) for the Butte County area include disturbance to nest territories; loss of anadromous fishery, loss of riparian habitat, disturbance of forage areas, and shooting (Sacramento Valley and Foothills); and disturbance of wintering grounds, loss of potential nest habitat to logging, and development (Sierra-Nevada Mountains). Historically, the decline of the bald eagle coincided with the introduction of the pesticide DDT in 1947. Eagles contaminated with DDT were either unable to lay eggs or produced eggs with thin shells that broke during incubation. Shooting, egg collection, and trapping were other causes of decline.

5.6.11.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The BRCP conservation strategy focuses on protecting occupied habitat or potentially suitable habitat for bald eagle to ensure sufficient nesting and foraging habitat availability to ensure that the existing population is maintained, and to accommodate potential future expansion of the population, or shifts in distribution as the species responds to changed environmental conditions (e.g., effects of climate change). Within the context of the overall BRCP Conservation Strategy, bald eagle nesting and foraging habitat will be protected within a larger, connected system of conservation lands that will ensure the availability of high-quality functioning habitat.

The Conservation Strategy provides for the protection and enhancement of large patches of peregrine falcon habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. This, also benefits the falcon's prey species, such as waterfowl.

Appendix O, Figure O–15, *Bald Eagle Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled bald eagle habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–15a, *Bald Eagle: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit bald eagle.

Implementation of the BRCP will conserve the bald eagle in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.11.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current status and distribution of bald eagle in the Plan Area, especially the number of nesting pairs in the Plan Area. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of newly occupied nest sites in the Plan Area. The balance of habitat to be protected at the time new occurrences are discovered will be focused towards habitat supporting those occurrences. Uncertainty also exists regarding the effectiveness of practicable management techniques (e.g., the management of riparian forests to increase and maintain the availability of mature trees, large snags for perching and shallow gravel banks for foraging). To address this uncertainty, BCAG will coordinate the enhancement techniques of such structures with USFWS, CDFW, and bald eagle experts.

5.6.12 Giant Garter Snake

In the Plan Area, giant garter snake is restricted to the rice lands and wetlands within the Basin and Sacramento River CAZs, although it is occasionally found in natural streams, wetlands and water conveyance channels associated with other land uses. All reported occurrences are west of State Route 99, and the majority of occurrences are associated with the Butte Basin habitats in the southwest part of the Plan Area. Other recorded occurrences are scattered in the Llano Seco area. Reports of giant garter snake occurrences near Chico are from irrigation ditches near the water treatment plant (Appendix G.2, *Review of Conservation Strategy for Butte Regional Conservation Plan by the Independent Science Advisors*). Wylie et al. (2011) provide the most current and best available landscape level estimates of giant garter snake density in rice-dominated agricultural areas, based on captures and recaptures at 44 transects along linear canals within rice fields and in managed wetlands in Butte and Glenn County from 2008 through 2010.

Habitat loss and fragmentation, flood control activities, changes in agricultural and land management practices, predation from introduced species, parasites, and water pollution are the main causes for the decline of this species (USFWS 1999, Wylie et al. 1997, Hansen and Brode 1993, USFWS 1999, Wylie et al. 2004). Paved roads may pose the threat of traffic mortalities (Hansen and Brode 1993). Bullfrogs prey on juvenile giant garter snakes throughout their range (Treanor 1983, Dickert 2003, Wylie et al. 2003).

5.6.12.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of giant garter snake breeding, foraging and movement habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. The extent of giant

garter snake habitat that will be protected in the Plan Area and the conservation approach for the species are illustrated in Appendix O, Figures O-16, *Giant Garter Snake Habitat in the Plan Area with full BRCP Implementation* and O-16a, *Giant Garter Snake: Conservation Strategy Overview* (see separate files). The focus of the conservation approach is on protection and restoration of habitat occupied by giant garter snake and unoccupied habitat that is connected to occupied habitat to ensure sufficient availability of habitat to accommodate potential future expansion of its population. Giant garter snake habitat will be protected within a larger connected system of conservation lands that will ensure the availability of habitat to accommodate potential future shifts in its distribution in response to changed environmental conditions (e.g., effects of climate change on the future distribution of giant garter snake habitat).

The biological goals and objectives used to develop the BRCP conservation measures for giant garter snake (Section 5..3.2.3) are consistent with the objectives of the USFWS Draft Giant Garter Snake Recovery Plan (USFWS 1999): (1) stabilizing and protecting existing populations, and (2) conducting research necessary to further refine recovery criteria. Both recovery objectives will be supported through the Conservation Strategy, especially the protection and restoration of habitat, and active monitoring and surveys to detect and quantify giant garter snake populations in the Plan Area, and to determine status and trends over the duration of the BRCP. The Plan Area is part of one of four USFWS giant garter snake recovery units (i.e., the Sacramento Valley Unit, extending from the vicinity of Red Bluff south to the confluence of the Sacramento and Feather Rivers). Criteria for delisting that are specific to the Sacramento Valley Recovery Unit are:

- Monitoring shows that in 17 out of 20 years, 90 percent of the subpopulations in the recovery unit contain both adults and young.
- The three existing populations within the recovery unit are protected from threats that limit populations.
- Supporting habitat within the recovery unit is adaptively managed and monitored (USFWS 1999).

The conservation measures that contribute to the recovery of giant garter snake include provisions that are applicable to each of these three delisting criteria; and the monitoring and adaptive management plan implemented under the BRCP ensures that progress towards delisting is adequately tracked and adjustments are made adaptively as necessary. This approach to conservation reduces the ecological stressors and threats to the species associated with habitat loss, excessive predation by nonnative predators, and habitat and population fragmentation.

Figure O–16 depicts the status of giant garter snake habitat in the Plan Area with full BRCP implementation, and Figure O–16a presents an overview of BRCP actions that will benefit giant garter snake.

Implementation of the BRCP will conserve the giant garter snake in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.12.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current distribution of giant garter snake in the Plan Area. Significant data gaps exist regarding the Plan Area status and spatial distribution of the species, and the dynamics of its metapopulation. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, and species researchers regarding the discovery of new occurrences in the Plan Area, and will collaborate with ongoing efforts to characterize and measure the giant garter snake population within the Plan Area.

As indicated above, uncertainty also exists regarding the effectiveness of practicable techniques for managing and restoring emergent wetlands, and the maturation process of wetlands. Recent experiences in the Natomas Basin (ICF 2011) and elsewhere in the Central Valley (Wylie et al. 2002) suggest that restored wetlands do not rapidly develop the characteristics of suitable garter snake habitat. To address this uncertainty, BCAG will coordinate the design of restored wetlands with individuals experienced with the restoration and management of giant garter snake habitat and giant garter snake experts. Monitoring of the over 500 acres of wetlands restored under the BRCP will provide crucial data and understanding of wetland maturation and giant garter snake habitat development.

5.6.13 Blainville's Horned Lizard

Blainville's horned lizard occurs primarily in the south Coast Ranges and is rare in the Central Valley and in Northern California. There is only one known location within the Plan Area north of Oroville, on North Table Mountain, just east of Coal Canyon (see Appendix A, Figure A.13-1). Historically, this taxon was identified as most abundant in relict lake sand dunes and old alluvial fans bordering the San Joaquin Valley (DFG 2007). The conversion of alluvial fans and relict lake sand dunes to agriculture has resulted in the disappearance of this lizard in many areas. Primary threats to the species include the ongoing fragmentation and loss of habitat. Additional threats to the species include increased human presence in rural areas (which results in a direct loss of habitat), as well as the occurrence of domestic cats and other nonnative predators, increased use of pesticides which reduces available food supply, and introduction of Argentine ants that replace the native ant food base (Jennings and Hayes 1994, SDNHM 2007).

5.6.13.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The conservation approach for Blainville's horned lizard involves protecting at least 400 acres of suitable Blainville's horned lizard habitat through achieving conservation land protection targets for natural communities that support patches of this species' habitat along the eastern side of the Plan Area, where it is most likely to occur. Protection and enhancement of grasslands, oak woodland and savanna, and riparian natural communities is expected to maintain the existing

distribution and abundance of Blainville's horned lizard in the Plan Area and provide the opportunity for its future expansion.

Implementation of the BRCP will conserve the Blainville's horned lizard in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.13.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current distribution of Blainville's horned lizard in the Plan Area and the potential for discovering additional occurrences. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. The balance of habitat to be protected at the time new occurrences are discovered will be focused towards protecting habitat supporting those occurrences.

5.6.14 Western Pond Turtle

The western pond turtle has been reported from several locations in the Plan Area including drainages and ponds along the eastern side of the Plan Area, Big Chico Creek, and the Upper Butte Wildlife Area. The species likely occurs in most perennial streams in the Plan Area and in large ponds and other water bodies. However, the species is likely underreported, and probably occurs throughout the Plan Area in suitable aquatic and adjacent upland habitats. The main factors contributing to the decline of the western pond turtle population include loss of aquatic and nesting habitat from urban development and conversion of native habitats to agricultural lands; the increase of introduced nonnative predators (i.e., bull frogs, nonnative rats and wading birds). In addition, there is concern over competition for food and basking sites and disease transmission from liberated pet turtles and nonnative turtle species (predominantly red-eared sliders and painted turtles, see Appendix A).

5.6.14.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of western pond turtle aquatic and upland habitats that are spatially distributed to provide landscape-level connectivity among protected habitats. The focus is on protection and restoration of habitat occupied by western pond turtle and unoccupied habitat that is connected to occupied habitat to ensure sufficient availability of habitat to accommodate potential future expansion of its population. Western pond turtle will be protected within a larger connected system of conservation lands that will ensure the availability of habitat to accommodate potential future shifts in its distribution in response to changed environmental conditions (e.g., effects of climate change on the future distribution of western pond turtle habitat). In addition, criteria used to develop the giant garter snake conservation approach following the USFWS Draft Giant Garter Snake Recovery Plan (USFWS 1999) also apply to western pond turtle, since the giant

garter snake shares habitat with the western pond turtle. Thus, both species will benefit from the BRCP conservation approach, especially the protection and restoration of habitat, and active monitoring and surveys to detect and quantify populations in the Plan Area, and to determine their status and trend over the duration of the BRCP.

Appendix O, Figure O–17, *Western Pond Turtle Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled western pond turtle habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–17a, *Western Pond Turtle: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit western pond turtle.

Implementation of the BRCP will conserve the western pond turtle in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.14.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current distribution of western pond turtle in the Plan Area and the fact that the species may be more widely distributed and abundant than reported. Significant data gaps exist regarding the status and spatial distribution of the species, and the dynamics of its metapopulation in the Plan Area and beyond. Actions to protect habitat include protection of currently known occupied habitat, however, the distribution of occupied habitat could result in protecting large areas of unoccupied habitat, especially in the rice-dominated Basin CAZ. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. As indicated above, uncertainty also exists regarding the effectiveness of practicable techniques for managing and restoring emergent wetlands, and the maturation process of wetlands. Current experiences in the Natomas Basin (ICF 2011) and elsewhere in the Central Valley (Wylie et al. 2002) suggest that restored wetlands do not rapidly develop the characteristics of suitable garter snake and/or western pond turtle habitat. To address this uncertainty, BCAG will coordinate the design of restored wetlands with USFWS, CDFW, and western pond turtle experts. Monitoring of wetlands restored under the BRCP will provide crucial data and understanding of wetland maturation and habitat development.

5.6.15 Foothill Yellow-Legged Frog

Foothill yellow-legged frogs within the Plan Area have been observed in Big Chico Creek along the upper reaches of Upper Bidwell Park, and in Mud Creek and Rock Creek. At least one occurrence has been detected along Butte Creek. CDFW snorkel surveys have also identified juvenile, larval and breeding adults in Big Chico Creek, Butte Creek, and Feather River in almost every year of survey report from 2001 to 2006 (see Appendix A).

The primary factor in the decline of foothill yellow-legged frog in the Sierra Nevada is the introduction of nonnative predators (Hayes and Jennings 1996). Competition and predation by introduced bullfrogs and fish have greatly contributed to the decline of the species. Nonnative

centrarchid fishes readily eat frog eggs (Werschkul and Christensen 1977), and where introduced into foothill streams, could also contribute to the elimination of the species. Bullfrog populations that have invaded stock-ponds and other human-made ponds are a considerable threat to native amphibians (Moyle 1973) and bullfrog control is needed to maintain the benefits of these artificial habitats for foothill yellow-legged frogs and other native amphibians. Habitat loss and degradation, particularly in the Sierra Nevada foothills, have also been major factors in declining foothill yellow-legged frog populations. Habitat alterations have occurred as a result of dam and canal construction, agriculture, urbanization, mining, and grazing practices. Besides eliminating habitat, these alterations have resulted in reduced riparian habitat, decreases in suitable stream substrates, habitat fragmentation, elimination of travel corridors, and detrimental flow regimes. Low flows, in combination with loss of riparian habitat, tend to warm the water and foster nonnative predators. Prolonged droughts may have also impacted populations of these frogs.

5.6.15.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of a sustainable population of foothill yellow-legged frog within the Plan Area through the protection of modeled foothill yellow-legged frog perennial stream habitat and intermittent stream habitat. The habitat protection and enhancement actions are expected to be sufficient to maintain the current Plan Area population and provide opportunities for its future expansion.

Appendix O, Figure O–18, *Foothill Yellow-Legged Frog Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled foothill yellow-legged frog habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–18a, *Foothill Yellow-Legged Frog: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit foothill yellow-legged frog.

Implementation of the BRCP will conserve the foothill yellow-legged frog in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.15.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current distribution of foothill yellow-legged frog in the Plan Area and the small disjunct distribution in the Plan Area. Significant data gaps exist regarding the status and spatial distribution of the species, and the dynamics of its metapopulation in the Plan Area and beyond. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. As indicated above, uncertainty also exists regarding the effectiveness of practicable techniques for managing foothill yellow-legged frog habitat. To address this uncertainty, BCAG will coordinate the design of restored wetlands with USFWS, CDFW, and species experts. effectiveness (see Chapter 7, *Monitoring and Adaptive Management*).

5.6.16 Western Spadefoot Toad

The western spadefoot toad historically ranged from Redding in Shasta County, California, to northwestern Baja California, Mexico. The western spadefoot toad has been extirpated throughout most of the lowlands of Southern California (and from many historical locations within the Central Valley. Within the Plan Area, western spadefoot toad has been recorded in two locations: a small cluster of observations along Intermittent Creek within the Chico city limits and a single record from Wyandotte Creek south of Oroville (CNDDB 2011; Jackson Shedd, pers. comm. 2007).

The main factors contributing to the decline of the western spadefoot toad population include loss of habitat from urban development and conversion of native habitats to agricultural lands, the increase of nonnative predators (e.g., mosquitofish and bullfrogs which consume western spadefoot toad eggs and larvae), and stochastic events that particularly impact small, isolated populations.

5.6.16.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of western spadefoot toad aquatic and upland habitats that are spatially distributed to provide landscape-level connectivity among protected habitats.

Appendix O, Figure O–19, *Western Spadefoot Toad Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled western spadefoot toad habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–19a, *Western Spadefoot Toad: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit western spadefoot toad.

Implementation of the BRCP will conserve the western spadefoot toad in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.16.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current distribution of western spadefoot toad in the Plan Area and the fact that the species may be distributed in small, disjunct populations, where environmental variability can threaten population persistence. Significant data gaps exist regarding the status and spatial distribution of the species, and the dynamics of its metapopulation in the Plan Area and beyond. Actions to protect habitat include protection of currently known occupied habitat, however, the distribution of occupied habitat could result in protecting large areas of unoccupied habitat, especially in the rice-dominated Basin CAZ. To minimize this uncertainty, BCAG will maintain regular communications with USFWS, CDFW, species researchers, and stakeholders regarding the discovery of new occurrences in the Plan Area. As indicated above, uncertainty also exists regarding the effectiveness of practicable techniques for managing and restoring vernal pool

habitats, and the maturation process of these habitats. To address this uncertainty, BCAG will coordinate the design of restored vernal pool complex with USFWS, CDFW, and western spadefoot toad experts. Monitoring of vernal pool complex restored under the BRCP will provide crucial data and understanding of vernal pool maturation and habitat development.

5.6.17 Central Valley Steelhead

Central Valley steelhead have been observed in the Feather River, Little Dry Creek, Butte Creek, Little Chico Creek, Big Chico Creek, Lindo Channel, Mud Creek, and Rock Creek. Spawning occurs in all of these waterways except Lindo Channel and Rock Creek. Adults migrate through Lindo Channel but, despite vast amounts of suitable gravel, do not spawn within the channel. Rock Creek is used by steelhead as a juvenile rearing location only. Critical habitat for the Central Valley steelhead was designated throughout the Central Valley in 2005.[31] Critical habitat was further characterized in the Federal Register Final Rule for steelhead in 2006.[32] Critical habitat for the species is divided into 22 hydrologic units by watersheds. Of these, two occur in Butte County and include the Marshville and Butte Creek Hydrologic Units. These units include the Feather River through Oroville and Little Chico, Butte, Little Butte, and Little Dry creeks near Paradise.

There are many factors believed to limit the population of steelhead in the Plan Area. The construction of dams, such as Oroville Dam on the Feather River, has eliminated access to historical upstream spawning habitat. Smaller diversion dams, (e.g., at stream mile 18 in Rock Creek and between Ponderosa Way and Higgins Hole) prevent upstream movement of steelhead under lower flow conditions. Passage impediments, including debris and gravel build-up (e.g., Five Mile area just upstream of Big Chico Weir in Big Chico Creek), shifting of massive boulders (e.g., at Salmon Hole in Upper Bidwell Park in Big Chico Creek), and non-functioning fish ladders (e.g., in Iron Canyon on Big Chico Creek), prohibit upstream migration of steelhead individuals to suitable spawning habitat at low flows. Land-use activities associated with logging, road construction, urban development, mining, livestock grazing, and recreation have caused a decline in quantity and quality of fish habitat by changing streambank and channel morphology, altering water temperatures, degrading water quality, and blocking access to spawning areas (McEwan and Jackson 1996). Steelhead are affected adversely by elevated water temperatures that can occur in the Feather River during late summer and early fall as a result of inadequate carryover storage from Oroville Reservoir and warm agricultural runoff (McEwan and Jackson 1996).

[31] 70 FR 52488, September 2, 2005.
[32] 71 FR 834, January 5, 2006.

5.6.17.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the multi-pronged protection, restoration and enhancement of large stretches of suitable stream habitats (e.g., spawning gravels, natural banks, riparian vegetation) and the systematic reduction of localized stressors and threats of Central Valley steelhead in the Plan Area.

Appendix O, Figure O–20, *Central Valley Steelhead Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled Central Valley steelhead habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–20a, *Central Valley Steelhead: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit Central Valley steelhead.

Implementation of the BRCP will conserve the Central Valley steelhead in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.17.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the effectiveness of conservation measures in addressing current threats and stressors of Central Valley steelhead in the Plan Area. Actions to protect habitat include increasing the habitat functions and amount of suitable habitat accessible to the species. However, the rate at which Central Valley steelhead will use areas that were previously inaccessible for spawning is not clear. Furthermore, natural bank dynamics and spawning gravel availability may develop slower than anticipated, especially under changing flows in response to climate change. To minimize this uncertainty, BCAG will maintain regular communications with NMFS and CDFW, species researchers, and stakeholders regarding the expansion and effectiveness of passage and habitat enhancements in the Plan Area.

5.6.18 Central Valley Spring-run Chinook Salmon

Central Valley spring-run Chinook salmon spawn and hold in Butte Creek, Big Chico Creek, Lindo Creek, and the Feather River. Adults and juveniles migrate through these waterways, as well as through the Sacramento River. Juveniles rear in all of these waterways and in Big Chico Creek, Mud, Rock, Pine, and Singer creeks. Preliminary 2011 Butte Creek snorkel survey data indicate that there were 2,130 adult spring-run Chinook salmon in Butte Creek (DFG 2012). Prior to 2011, population size estimates had declined every year since 2005, in which 10,625 adults were observed in snorkel surveys.

There are many factors believed to limit the population of spring-run Chinook salmon in the Plan Area. The construction of dams, such as Oroville Dam on the Feather River, has eliminated access to historical upstream spawning habitat. Smaller diversion dams, (e.g., at stream mile 18 in Rock Creek and between Ponderosa Way and Higgins Hole) prevent upstream movement of

spring-run Chinook salmon under lower flow conditions. Although uncommon, passage impediments, including debris and gravel build-up (e.g., Five Mile area just upstream of Big Chico Weir in Big Chico Creek), shifting of massive boulders (e.g., at Salmon Hole in Upper Bidwell Park in Big Chico Creek), and non-functioning fish ladders (e.g., in Iron Canyon on Big Chico Creek), can prohibit upstream migration of spring-run Chinook salmon individuals to suitable spawning habitat during low flows.

5.6.18.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy combines habitat protection, restoration and enhancement of large stretches of suitable stream habitats (e.g., spawning gravels, natural banks, riparian vegetation) to maintain and improve natural habitats for Central Valley spring-run Chinook salmon. This will provide a systematic reduction of localized stressors and threats of Central Valley spring-run Chinook salmon in the Plan Area.

Appendix O, Figure O–21, *Central Valley Spring-Run Chinook Salmon Habitat in the Plan Area with full BRCP Implementation* depicts the status of spring-run Chinook salmon habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–21a, *Central Valley Spring-Run Chinook Salmon: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit spring-run Chinook salmon.

Implementation of the BRCP will conserve the spring-run Chinook salmon in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.18.2 Ecological Uncertainty

Central Valley spring-run Chinook in the Plan area have been declining rapidly in the past decade, despite efforts to reduce threats and stressors. Thus, a major ecological uncertainty exists regarding the effectiveness of past enhancement and conservation measures in addressing current threats and stressors of salmon in the Plan Area. The BRCP conservation approach is focused on increasing the habitat functions and amount of suitable habitat accessible to the species. However, the degree to which habitat availability is limiting Central Valley spring-run Chinook salmon compared to other factors prevailing outside the Plan area (e.g., mortality during outmigration of juveniles, ocean conditions, genetic dilution from hatchery stock, entrainment in downstream water diversions) is not clear. Furthermore, natural bank dynamics and spawning gravel availability may develop slower than anticipated, especially under changing flows in response to climate change. To minimize this uncertainty, BCAG will maintain regular communications with NMFS and CDFW, species researchers, and stakeholders regarding the expansion and effectiveness of passage and habitat enhancements in the Plan Area.

5.6.19 Central Valley Fall-/Late Fall-Run Chinook Salmon

Fall-run Chinook salmon are the most abundant run in the Central Valley (Moyle 2002). Central Valley fall-/late fall-run Chinook salmon adults spawn in and migrate through Rock Creek, Mud Creek, Big Chico Creek, Little Chico Creek, Butte Creek, and the Feather River. Juveniles migrate through and rear in these waterways. Adults and juveniles also migrate through the Sacramento River on the western boundary of the Plan Area. Further, juveniles rear in non-natal creeks of Big Chico Creek and Mud Creek.

There are many factors believed to limit the population of fall-/late fall-run Chinook salmon in the Plan Area. The construction of dams, such as Oroville Dam on the Feather River, has eliminated access to historical upstream spawning habitat. Smaller diversion dams, (e.g., at stream mile 18 in Rock Creek and between Ponderosa Way and Higgins Hole) prevent upstream movement of fall/late fall-run Chinook salmon under lower flow conditions. Passage impediments, including debris and gravel build-up (e.g., Five Mile area just upstream of Big Chico Weir in Big Chico Creek) prohibit upstream migration of fall-/late fall-run Chinook salmon individuals to suitable spawning habitat during low flows.

5.6.19.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The approach to conservation of Central Valley fall-/late fall-run Chinook salmon focuses on improving access to and quality of spawning and rearing habitat within the Plan Area by increasing natural physical processes, reducing passage barriers, and restoring natural habitat characteristics.

Appendix O, Figure O–22, *Central Valley Fall/Late Fall-RunChinook Salmon Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled Central Valley fall-/late fall-run Chinook salmon habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–22a, *Central Valley Fall/Late Fall-Run Chinook Salmon: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit bald eagle.

Implementation of the BRCP will conserve the Central Valley fall-/late fall-run Chinook salmon in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.19.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the effectiveness of conservation measures in addressing current threats and stressors of Central Valley fall-/late fall-run Chinook salmon in the Plan Area. Actions to protect habitat include increasing the habitat functions and amount of suitable habitat accessible to the species. However, the rate at which Central Valley fall-/late fall-run Chinook salmon will use areas that were previously inaccessible for spawning is not clear. Furthermore, natural bank dynamics and spawning gravel availability may develop slower than anticipated, especially under changing

flows in response to climate change. To minimize this uncertainty, BCAG will maintain regular communications with NMFS and CDFW, species researchers, and stakeholders regarding the expansion and effectiveness of passage and habitat enhancements in the Plan Area.

5.6.20 Green Sturgeon

Green sturgeon use the Sacramento River along the western boundary of Butte County, and several have been recorded in the Feather River up to the Thermalito Afterbay. Green sturgeon are large in size, mature late, have a low productivity and long life span, and are anadromous. All these characteristics make them vulnerable to habitat degradation and overexploitation. The primary threat to the southern DPS of green sturgeon is the reduction of the spawning area to one population in the Sacramento River. This reduction in range makes green sturgeon vulnerable to catastrophic events.

5.6.20.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

There are no conservation measures proposed for implementation in waterways currently known to be inhabited by green sturgeon. If present in waters enhanced by BRCP conservation measures, however, green sturgeon will benefit.

Appendix O, Figure O–23, *Green Sturgeon Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled green sturgeon habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–23a, *Green Sturgeon: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit green sturgeon. .

Implementation of the applicable measures in Chapter 6, *Conditions on Covered Activities* will avoid and minimize impacts of the covered activities on green sturgeon and implementation of conservation measures will benefit the green sturgeon should they occur in waters enhanced by the BRCP. As indicated in the green sturgeon impact assessment (Section 4.4.20, *Green Sturgeon*), implementation of the covered activities is not expected to result in adverse population-level effects on green sturgeon or adversely affect its distribution or abundance in the Plan Area.

5.6.20.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the presence of green sturgeon in the Plan Area. To minimize this uncertainty, BCAG will maintain regular communications with NMFS and CDFW, species researchers, and stakeholders regarding the distribution of the species in the Plan Area.

5.6.21 Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle has been recorded from several locations within the Plan Area. Most occurrences are along the Sacramento River with a few along Big Chico Creek, Butte Creek, and the Feather River. Occurrences, however, do not sufficiently represent the distribution of the species due to its life history and infrequent emergence of adults. Its host plant, the elderberry shrub, is a common species in riparian habitats throughout much of the Plan Area, and so the species may be more widespread. Adult beetles have been observed, along with numerous accounts of old and new exit holes from the stems of elderberry. No CNDDB recorded observations have been made (see Appendix A, Figure A.21-1).

Valley elderberry longhorn beetle is in long-term decline caused by human activities that have resulted in widespread alteration and fragmentation of riparian habitats, and, to a lesser extent, upland habitats, which support the beetle. The primary threats to survival of the beetle include: loss and alteration of habitat by agricultural conversion; inappropriate grazing; levee construction; stream and river channelization; removal of riparian vegetation; rip-rapping of shorelines; nonnative invasive species such as the Argentine ant, a predator of the early phases of the beetle; and recreational, industrial, and urban development. The beetle's distribution may be limited by the use of insecticide and herbicide in agricultural areas and along roadways. Declining quality and maturity of elderberry shrubs/trees as individuals and stands may be another cause of the beetle's limited distribution.

5.6.21.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection and enhancement of patches of valley elderberry longhorn beetle habitats that are spatially distributed to provide landscape-level connectivity among protected habitats, to provide for the movement and genetic interchange among populations, and to preserve native biodiversity.

Appendix O, Figure O–24, *Valley Elderberry Longhorn Beetle Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled valley elderberry longhorn beetle habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–24a, *Valley Elderberry Longhorn Beetle: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit valley elderberry longhorn beetle.

Implementation of the BRCP will conserve the valley elderberry longhorn beetle in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.21.2 Ecological Uncertainty

The primary ecological uncertainty associated with implementation of the conservation measures is the current population status and distribution of valley elderberry longhorn beetle in the Plan Area. To date, it is not clear how abundant and widespread the species is within the Plan Area,

(see Appendix A). BCAG will integrate protection, restoration and management of habitat with active control of nonnative species to evaluate hypotheses why the species is not present in certain locales. As BRCP conservation measures and covered activities are implemented, monitoring and surveys will provide a better understanding of the distribution and population structure of the species and will reduce the uncertainty associated with the lack of population data. This, in turn, leads to a more focused and tactical implementation of conservation actions to benefit current populations and newly discovered occurrences and the protection of vulnerable patches of habitat. Since one of the most significant stressor of the valley elderberry longhorn beetle (aside from habitat loss) is the aggressive invasion of argentine ants and European earwigs, the primary uncertainty associated with this threat is the rate at which these species invade restored habitat, and the effectiveness of control measures. To address this uncertainty, BCAG will coordinate experimental control activities with USFWS, CDFW, and other experts. The effectiveness of controlling nonnative species in existing and restored habitats will be monitored and necessary changes to the methodology or control action frequency will be implemented in an adaptive decision framework.

5.6.22 Vernal Pool Tadpole Shrimp

Vernal pool tadpole shrimp is distributed throughout the Central Valley of California and from one occurrence in the San Francisco Bay area (USFWS 2005). There are 17 known extant occurrences of vernal pool tadpole shrimp in Butte County (Table 4–8, *Maximum Extent of Permanent Direct Impacts on Modeled Covered Species Habitat Types and Known Occurrences within the Plan Area*). The main factors contributing to the decline of vernal pool tadpole shrimp populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.22.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of vernal pool tadpole shrimp habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–25, *Vernal Pool Tadpole Shrimp and Vernal Pool Fairy Shrimp Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled vernal pool tadpole shrimp habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–25a, *Vernal Pool Tadpole and Vernal Pool Fairy Shrimp: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit vernal pool tadpole shrimp.

Implementation of the BRCP will conserve the vernal pool tadpole shrimp in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.22.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of vernal pool tadpole shrimp in unsurveyed habitat of the Plan Area and the effectiveness of management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and vernal pool tadpole shrimp experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.25 Conservancy Fairy Shrimp

Conservancy fairy shrimp is distributed in vernal pools as disjunct populations in Butte, Glenn, Merced, Sacramento, Solano, Stanislaus, Tehama, Ventura, Yolo, and Yuba counties (USFWS 2005, 2006e). There are three known occurrences of Conservancy fairy shrimp in Butte County (Table 4–8; Appendix A, Figure A.23-1). The main factors contributing to the decline of Conservancy fairy shrimp populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.22.3 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection of grassland with vernal pools in the Vina Plains Recovery Core Area (Objective SPEC16.2). The protection of this grassland with vernal pools in this area will have the highest probability of protecting occupied Conservancy fairy shrimp habitat as the species is present there as well as immediately north of the Plan Area border in Tehama County.

Table 5–21a, *Expected Extent of Conserved Covered Species Habitat Types in the Plan area with BRCP Implementation* presents the overall Plan Area-wide acreage outcomes of implementing the BRCP covered activities and Conservation Strategy for each covered species.

Implementation of the BRCP will conserve Conservancy fairy shrimp in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.22.4 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Conservancy fairy shrimp in unsurveyed habitat of the Plan Area; estimating population sizes for this species that is distributed in small, disjunct populations, that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Conservancy fairy shrimp experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.23 Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp is distributed in vernal pools from southern Oregon southward throughout California's Central Valley and Central and South Coastal areas (USFWS 2005). There are 29 extant occurrences of vernal pool fairy shrimp in Butte County (Table 4–8). The main factors contributing to the decline of vernal pool fairy shrimp populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.23.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration, and enhancement of large patches of vernal pool fairy shrimp vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Figure O–25 depicts the status of modeled vernal pool fairy shrimp habitat in the Plan Area with full BRCP implementation, and Figure O–25a presents an overview of BRCP actions that will benefit vernal pool fairy shrimp.

Implementation of the BRCP will conserve the vernal pool fairy shrimp in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.23.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of vernal pool fairy shrimp in unsurveyed habitat of the Plan Area and the effectiveness of management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and vernal pool fairy shrimp experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.24 Ferris' Milkvetch

Historically, Ferris' milkvetch was known to occur in and adjacent to the Northeastern Sacramento County Vernal Pool Region in Butte, Colusa, Glenn, and Sutter counties and in the Solano-Colusa Vernal Pool Region in Solano and Yolo (USFWS 2005). Eight historical occurrences of Ferris' milkvetch have been recorded in Butte County, but all are extirpated (see Appendix O, Figure O–26, *Ferris' Milkvetch Habitat in the Plan Area with full BRCP Implementation* and Appendix O, Figure O–26a, *Ferris' Milkvetch: Conservation Strategy Overview* [separate files]). The main factors contributing to the decline of Ferris' milkvetch populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.24.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Ferris' milkvetch vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Figure O–26 depicts the status of modeled Ferris' milkvetch habitat in the Plan Area with full BRCP implementation, and Figure O–26a presents an overview of BRCP actions that will benefit Ferris' milkvetch.

Implementation of the BRCP will conserve the Ferris' milkvetch in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.24.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Ferris' milkvetch in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Ferris' milkvetch experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.25 Lesser Saltscale

Lesser saltscale, a California endemic, is known from 27 documented occurrences, primarily in the southern San Joaquin Valley. The occurrences in the Plan Area are the most northern, and are about100 miles from the next most northern documented occurrence in Stanislaus County. Lesser saltscale is found in two occurrences in the Plan Area both of which are on the CDFW Gray Lodge Wildlife Area, which is managed for waterfowl and upland game hunting. One occurrence is located just east of the headquarters buildings, and the other near Rutherford and Levee roads. The former was visited in 1993 and the habitat was reported in good condition (no census data was reported). The latter occurrence was visited in 1993 and 1998 and habitat was reported to be in good condition but there were only 20 plants observed in 1993 (see Appendix A).

Little has been reported on specific habitat requirements for lesser saltscale and its habitat was not modeled for the BRCP. Generally, it is found in intermittently inundated, alkaline soils at low elevations (less than100 meters), typically in slough systems and river floodplains, and occasionally bordering vernal pools. Vegetation communities associated with the species include valley sink scrub, valley sacaton grassland, and nonnative annual grassland.

Threats to lesser saltscale include the conversion of alkali sinks to agriculture; active wetland management for waterfowl; construction of flood control structures, such as levees and other water barriers; and changes in runoff, such as irrigation or construction of roads and culverts that result in changes in hydrology; and competition from invasive species. The occurrences in the Plan Area are reported from weedy fields.

5.6.25.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

Current distribution of lesser saltscale within the Plan Area is limited and all known occurrences are protected in the Gray Lodge Wildlife Management Area. Protected lesser saltscale habitat will be managed to maintain its habitat functions for lesser saltscale over time.

Implementation of the BRCP will conserve the lesser saltscale in the Plan Area.

5.6.26 Hoover's Spurge

Historically, Hoover's spurge was known to occur in the Northeastern Sacramento Valley, San Joaquin Valley, Solano-Colusa, and Southern Sierra Foothills Vernal Pool Regions (USFWS 2005). Of the 26 occurrences presumed to be extant, 14 occur in the Vina Plains area of Tehama and Butte counties within the Northeastern Sacramento Valley Vernal Pool Region, with the majority of these (12) in Tehama County. The remaining 12 occurrences are in Tulare, Glenn County, Stanislaus County, and Merced counties (USFWS 2005). Four occurrences of Hoover's spurge have been recorded in Butte County (see Appendix A, Figure A.27-1). The main factor contributing to the decline of Hoover's spurge populations has been the historical loss of its habitat (USFWS 2005).

5.6.26.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Hoover's spurge vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27, *Vernal Pool Plant Species Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled Hoover's spurge habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27a, *Vernal Pool Plant Species: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit Hoover's spurge.

Implementation of the BRCP will conserve the Hoover's spurge in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.26.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Hoover's spurge in unsurveyed habitat of the Plan Area and the effectiveness of management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Hoover's spurge experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.27 Ahart's Dwarf Rush

Ahart's dwarf rush is known to occur in Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba counties (CNDDB 2012). Seventeen occurrences of Ahart's dwarf rush have been recorded in Butte County (Table 5–8; Appendix A, Figure A.28-1).

The main factors contributing to the decline of Ahart's dwarf rush populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.27.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Ahart's dwarf rush vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27depicts the status of modeled Ahart's dwarf rush habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27a presents an overview of BRCP actions that will benefit Ahart's dwarf rush.

Implementation of the BRCP will conserve the Ahart's dwart rush in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.27.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Ahart's dwarf rush in unsurveyed habitat of the Plan Area and the effectiveness of management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Ahart's dwarf rush experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations..

5.6.28 Red Bluff Dwarf Rush

Red Bluff dwarf rush is known to occur in Butte, Placer, Shasta, and Tehama counties (CNDDB 2012). Thirty-two occurrences of Red Bluff dwarf rush have been recorded in Butte County (Table 5–8 Appendix A, Figure A.29-1). The main factors contributing to the decline of Red Bluff dwarf rush populations are development, grazing, vehicles, industrial forestry, and agriculture (CNPS 2012).

5.6.28.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Red Bluff dwarf rush vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27 depicts the status of modeled Red Bluff dwarf rush habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27a presents an overview of BRCP actions that will benefit Red Bluff dwarf rush.

Implementation of the BRCP will conserve the Red Bluff dwarf rush in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.28.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Red Bluff dwarf rush in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations, that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Red Bluff dwarf rush experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes, and fluctuations of its populations.

5.6.29 Butte County Meadowfoam

BCM is endemic to Butte County and its distribution is fragmented with the largest populations clustered in central Butte County near the City of Chico (Appendix O, Figure O–28, *Butte County Meadowfoam Habitat in the Plan Area with full BRCP Implementation* [see separate file] and Appendix A, Figure A.30-2). Although never extensive in range, BCM populations have been substantially reduced in number and fragmented by development in the Chico area (USFWS 2006c, Keeler-Wolf et al. 1998). The USFWS has compiled BCM known population information from CNDDB data, available data from botanical surveys, and USFWS file data (USFWS 2011). The USFWS data are correlated with CNDDB occurrence data in Appendix A, Table A.30-1 and depicted in Appendix A, Figures A.30-1, A.30-2, and A.30-3. The compiled

USFWS occurrence data indicates that BCM occurs almost exclusively on three geological formations. Based on landscape characteristics that would tend to isolate genetic exchange between the occurrences (see Life History section of Appendix A.30), BCM occurs as seven discrete population groupings (Appendix A, Figures A.30-2, and A.30-3).

The main factors contributing to the decline of BCM include loss of habitat (from land development and conversion of native habitat to agricultural use), the negative effects of nonnative annual grasses, and incompatible grazing regimes (USFWS 2005).

5.6.29.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy is designed to achieve recovery of BCM. The Conservation Strategy is designed to achieve recovery of BCM and provides for the protection of 2,402 and 310 acres of primary and secondary, respectively, modeled habitat within specifically identified preserve lands east of the City of Chico (the Chico Butte County Meadowfoam Preserve [CBCMP]) and the protection of additional lands, 3,600 acres primary and 892 acres secondary modeled habitat, in the northern and southern portions of its range (Table 5–18; Figure 5–6 and Appendix O, Figure O–28a, *Butte County Meadowfoam: Conservation Strategy Overview* [see separate files]). Additionally, the conservation outcomes of each known population is described in Table 5–22, *Butte County Meadowfoam Conservation Outcomes by Occurrence* [see separate file]) and specific avoidance requirements are provided for Occurrences #22 and #25 (see Figure 4–46d and Appendix O, Figure O–28b, *Butte County Meadowfoam Avoidance Requirement for Occurrence #22* [separate files]).

Implementation of the BRCP will conserve and achieve recovery of the Butte County meadowfoarm in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.29.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of BCM in the Rock Creek, Chico D, Gold Run Creek, and Table Mountain population groupings of the Plan Area; estimating population sizes for this annual species that is distributed in small populations that experience significant annual population fluctuations; and identifying and implementing effective management measures. Significant data gaps exist regarding the status and spatial distribution of the species outside of the Chico A, B, and C population groupings. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and BCM experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.30 Veiny Monardella

Veiny monardella has been recorded from a relatively small area of Butte County and from Tuolumne County (CNDDB 2012). There are eight extant occurrences in the Plan Area (Table 5–8; Appendix A, Figure A.31-1). The main threats to veiny monardella are development, habitat fragmentation, and possibly competition with invasive plant species (Castro pers. comm.).

5.6.30.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection of the entirety of known veiny monardella occurrences and occupied habitat in the Plan Area (Table 5–8).

Implementation of the BRCP will conserve the veiny monardella in the Plan Area.

5.6.30.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of veiny monardella in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations, that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and veiny monardella experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes, and fluctuations of its populations.

5.6.31 Hairy Orcutt Grass

Historically, hairy Orcutt grass was known to occur along the eastern margin of the San Joaquin and Sacramento valleys from Tehama County south to Madera County but many of those occurrences have been extirpated (USFWS 2005). There is one known occurrence of hairy Orcutt grass in Butte County (Table 5–8; Appendix A, Figure A.32-1). The main factors contributing to the decline of hairy Orcutt grass populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.31.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of hairy Orcutt grass vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27 depicts the status of modeled hairy Orcutt grass habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27 a presents an overview of BRCP actions that will benefit hairy Orcutt grass.

Implementation of the BRCP will conserve the hairy Orcutt grass in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.31.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of hairy Orcutt grass in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations, that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and hairy Orcutt grass experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes, and fluctuations of its populations.

Implementation of the conservation measures are not expected to pose a risk to hairy Orcutt grass because they are directed at protecting and enhancing its habitat and will be implemented to avoid impacts on habitat and individuals.

5.6.32 Slender Orcutt Grass

Slender Orcutt grass has been reported from Butte, Lake, Lassen, Modoc, Plumas, Sacramento, Shasta, Siskiyou, and Tehama counties (USFWS 2005). There are two occurrences of slender Orcutt grass in Butte County and two vernal pools were casually seeded in 1978 but there are no follow-up data on the success of the seeding (USFWS 2005) (Table 5–8; Appendix A, Figure A.33-1). The main factors contributing to the decline of slender Orcutt grass populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.32.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of slender Orcutt grass vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27 depicts the status of modeled slender Orcutt grass habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27a presents an overview of BRCP actions that will benefit slender Orcutt grass.

Implementation of the BRCP will conserve the slender Orcutt grass in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.32.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of slender Orcutt grass in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations, that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and slender Orcutt grass experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes, and fluctuations of its populations.

5.6.33 Ahart's Paronychia

Ahart's paronychia is known to occur in Butte, Shasta, and Tehama counties (CNDDB 2012). Five occurrences of Ahart's paronychia have been recorded in Butte County (Table 5–8; Appendix A, Figure A.34-1). The main factors contributing to the decline of Ahart's paronychia populations are development, and possibly grazing, vehicles, and agriculture (CNPS 2012).

5.6.33.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Ahart's paronychia vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–27 depicts the status of modeled Ahart's paronychia habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–27a presents an overview of BRCP actions that will benefit Ahart's paronychia.

Implementation of the BRCP will conserve the Ahart's paronychia in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.33.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Ahart's paronychia in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations and that experiences significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Ahart's paronychia experts.

Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.34 California Beaked Rush

California beaked-rush has been recorded from Butte, Marin, Napa, and Sonoma counties (CNDDB 2012). There are seven extant occurrences in the Plan Area (Table 5–8; Appendix A, Figure A.35-1). The main threats to California beaked-rush in Butte County are reported to be development and heavy cattle grazing (CNDDB 2012).

5.6.34.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection of the entirety of California beaked-rush occurrences and occupied habitat in the Plan Area (Table 5–8).

Implementation of the BRCP will conserve the California beaked-rush in the Plan Area.

5.6.34.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of California beaked-rush in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and California beaked-rush experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.35 Butte County Checkerbloom

Butte County checkerbloom is endemic to Butte County (CNDDB 2012) where it is known from 127 occurrences in and just outside of the Plan Area (Table 5–8; Appendix A, Figure A.36-1). The main factors threatening Butte County checkerbloom populations are nonnative plants and possibly residential development and fire suppression (CNPS 2012).

5.6.35.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Butte County checkerbloom modeled habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O–29, *Butte County Checkerbloom Habitat in the Plan Area with full BRCP Implementation* depicts the status of modeled Butte County checkerbloom habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O–29a, *Butte County Checkerbloom: Conservation Strategy Overview* presents an overview of BRCP actions that will benefit Butte County checkerbloom.

Implementation of the BRCP will conserve the Butte County checkerbloom in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.35.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Butte County checkerbloom in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Butte County checkerbloom experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.36 Butte County Golden Clover

Butte County golden clover is endemic to a relatively small part of the Plan Area where 18 occurrences of have been recorded (Table 5–8; Appendix O, Figure O-30, *Butte County Golden Clover Habitat in the Plan Area with full BRCP Implementation* and Figure O-30a, *Butte County Golden Clover: Conservation Strategy Overview*). There are no specific threats to Butte County golden clover as it appears to always have been a rare species of very limited distribution, though highway expansion could affect some area of potential habitat.

5.6.36.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Butte County golden clover habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Figure O-30 depicts the status of modeled Butte County golden clover habitat in the Plan Area with full BRCP implementation, and Figure O-30a presents an overview of BRCP actions that will benefit Butte County golden clover.

Implementation of the BRCP will conserve the Butte County golden clover in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.36.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Butte County golden clover in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small populations that experience significant annual fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Butte County golden clover experts. Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.6.37 Greene's Tuctoria

Historically, Greene's tuctoria occurred from Shasta County south to Tulare County but has been extirpated from Fresno, Madera, San Joaquin, Stanislaus, and Tulare counties (USFWS 2005). There are four extant occurrences of Greene's tuctoria in Butte County and one extirpated occurrence (USFWS 2005) (Table 5–8; Appendix A, Figure A.38-1). The main factors contributing to the decline of Greene's tuctoria populations have been the historical loss of its habitat, adverse effects of invasive species, and the alteration of the hydrology supporting its habitat (USFWS 2005).

5.6.37.1 Conservation Approach and Expected Outcomes of the Conservation Strategy

The Conservation Strategy provides for the protection, restoration and enhancement of large patches of Greene's tuctoria vernal pool habitat that are spatially distributed to provide landscape-level connectivity among areas of protected habitat.

Appendix O, Figure O-27 depicts the status of modeled Greene's tuctoria habitat in the Plan Area with full BRCP implementation, and Appendix O, Figure O-27a presents an overview of BRCP actions that will benefit Greene's tuctoria.

Implementation of the BRCP will conserve the Greene's tuctoria in the Plan Area and mitigate the direct and indirect impacts of covered activities.

5.6.37.2 Ecological Uncertainty

The primary ecological uncertainties associated with implementation of the conservation measures include the current distribution of Greene's tuctoria in unsurveyed habitat of the Plan Area; estimating population sizes for this annual species that is distributed in small, disjunct populations that experience significant annual population fluctuations; and identifying and implementing effective management measures. To address these uncertainties, BCAG will coordinate the management actions with USFWS, CDFW, and Greene's tuctoria experts.

Additionally, the monitoring requirements of CMs listed above will provide crucial data and understanding regarding the extent, sizes and fluctuations of its populations.

5.7 CONSERVATION PROVIDED FOR JURISDICTIONAL WETLANDS AND OTHER WATERS

The conservation outcomes under the BRCP for wetlands and other waters of the United States (regulated under Clean Water Act [CWA] section 404) and streams and riparian habitats (regulated under California Fish and Game Code section 1602) are described in this section. BRCP impact avoidance and minimization measures, compensatory mitigation measures, and measures contributing to the conservation of streams, ponds, wetlands, and riparian habitats are identified for each wetland and aquatic resource.

The various types of jurisdictional wetlands in the Plan Area are described in Section 3.4.5, *Potential Jurisdictional Wetlands and Other Waters* and Tables 3–16, 3–17, 3–18, and 3–19. The Plan Area includes natural and non-natural wetland types. Natural wetlands are those wetlands that are dominated by native plant species and receive water predominately from runoff and groundwater not assisted by irrigation water. Natural wetlands include vernal pools and other seasonal wetlands (though some of these that are dominated by nonnative invasive plants are considered non-natural), permanent emergent wetlands, and riparian forest and scrub (see exception for non-stream-associated dredger tailings riparian forest and scrub, described below). Non-natural wetlands are those wetlands that are dominated by nonnative plant species or receive water predominately from irrigation systems. Non-natural wetland types in the Plan Area include wetlands within agricultural fields, managed wetlands, managed seasonal wetlands, and wetlands dominated by nonnative invasive plants. Riparian forest and scrub on dredger tailings, though resulting from secondary succession in an intensely modified substrate, is treated as a natural habitat where its origins are likely in the geographic location of historical riparian habitat areas. Riparian forest and scrub on dredger tailings not in the geographic location of historical riparian habitat, that was likely created by the excavation of abandoned stream beds and is no longer associated with an active stream, is treated as a non-natural habitat.

The goals of the BRCP for jurisdictional wetlands in the Plan Area are to:

- Increase the ecological functions provided by each of the natural wetland types.
- Maintain the ecological functions provided by non-natural wetland types, but not necessarily in-kind (i.e. mitigate impacts on non-natural wetlands with restoration of natural wetland types).

Avoidance of direct and indirect impacts on jurisdictional wetlands is the preferred conservation action where practicable (see Chapter 6, *Conditions on Covered Activities*). Following efforts to avoid and minimize impacts on jurisdictional wetlands in the planning stages of projects (see Section 8.7, *Process for BRCP Implementation*), the impacts of the project will be compensated through protection and restoration of like or similar wetland types of equal or higher function at

the ratios described in Table 5–10. Where non-natural wetlands are filled, compensatory mitigation is provided through protection and restoration of natural wetlands types. For example, the removal of wetlands within agricultural fields is compensated through the restoration of natural emergent wetland, and the removal of managed seasonal wetlands is compensated through the restoration of natural vernal pool and swale complex. Table 5–10 details the compensatory mitigation requirements for wetland and riparian habitats.

The existing extents of wetlands and other waters of the United States in the Plan Area are presented in Section 3.9, *Extent of Potential Jurisdictional Wetlands and Other Waters in the Plan Area*, using the methods to estimate existing acreage described in Section 3.4.5. Table 4–11, *Impacts Estimated for Potential Jurisdictional Wetlands and Other Waters in the Plan Area by Watershed Unit* provides a breakdown of the estimated impacts on jurisdictional wetlands and other waters by HUC 10 watersheds in the Plan Area. Table 4–12, *Impacts Estimated for Potential Jurisdictional Wetlands and Other Waters in the Plan Area by CAZ* provides a breakdown of the estimated impacts on jurisdictional wetlands and other waters by CAZ. The impact acreages in these tables are estimates for the purpose of assessing the regional impacts on and conservation of wetlands and other waters with full implementation of the BRCP over its 50-year development. The BRCP requires jurisdictional delineation of all proposed projects to assess actual impacts (see Section 6.2 and Section 8.7), and actual impacts will be calculated during BRCP implementation when specific projects are proposed. The BRCP includes measures that go beyond the mitigation of impacts on wetlands and riparian habitats and contribute to the conservation of these natural communities. These conservation measures include the protection of existing wetland and riparian habitats in excess of compensatory protection mitigation ratios; and for riparian forest, additional restoration acreage in excess of the restoration mitigation ratio (see Table 5–10). These measures that contribute to the conservation of wetlands and riparian habitats are required elements of the BRCP and must be achieved on a specified time table (see Tables 6–1 and 6–2).

Conservation outcomes for each of the wetland, riparian, and other waters habitat types are discussed below.

5.7.1 Vernal Pools and Other Seasonal Wetlands

Vernal pools and other seasonal wetlands are found predominantly in grasslands with vernal swale complex land cover type (Figure 3–14, *Distribution of Grassland Natural Community in the Plan Area*). Grasslands land cover type away from streams support scattered vernal pools and other seasonal wetlands, mainly other seasonal wetlands (Section 3.4.5.1, *Vernal Pools and Other Seasonal Wetlands*). Grasslands land cover type associated with streams support a higher density of seasonal wetlands, also very few of which are vernal pools (Section 3.4.5.1). A rough estimate of the total extent of vernal pools and other seasonal wetlands in the Plan Area is 4,003 acres, with approximately 605 acres of these wetlands classified as vernal pools (see Section 3.9 and Table 3–19, *Acreage of Vernal pools and Other Seasonal Wetlands within CAZs and UPAs* [see separate file]). The estimated permanent direct impacts on vernal pools and other seasonal

wetlands with implementation of covered activities in the Plan Area is 302 acres with approximately 38 acres of these wetlands expected to be classified as vernal pools (see Table 4-13, *Impacts on Vernal Pools and Other Seasonal Wetlands*), amounting to approximately 8 percent of vernal pools and other seasonal wetlands and 6 percent of vernal pools in the Plan Area. Most of the impacts on vernal pools and other seasonal wetlands would result from fill for the construction of residential, commercial, and industrial developments.

The potential impacts on vernal pools and other seasonal wetlands are minimized by strict impact limits set in the BRCP for each UPA and CAZ (Table 4–4, *Maximum Extent of Natural Communities and Land Cover Types Removed (Permanent Direct Effects) with Implementation of the Covered Activities in CAZs and UPAs*). The BRCP sets a limit on impacts on grassland with vernal swale complex and grassland land cover types based on the proposed future development under the county and cities' general plans and other regional plans. The GIS analysis estimated impacts based on development footprints of general plans and other regional plans of 1,923 acres for grassland with vernal swale complex (approximately 88 acres of vernal pools and other seasonal wetlands), however, the BRCP requires that these impacts be limited to 1,391 acres (approximately 63 acres of vernal pools and other seasonal wetlands) through avoidance planning in implementation of development under the general plans and other regional plans. In addition, the BRCP includes avoidance and minimization measures in Chapter 6, *Conditions on Covered Activities* to eliminate or reduce physical and water quality impacts on vernal pools and other seasonal wetlands, see specifically:

- AMM1, Conduct Planning Surveys (including delineation of wetlands)
- AMM4, Avoid and Minimize Impacts on Sensitive Wetland and Riparian Habitats
- AMM5, Avoid Siting of Construction Staging Areas and Temporary Work Areas in Occupied Covered Species Habitat
- AMM16, Install Erosion Control Barriers
- AMM19, Implement Wet Weather Erosion Control Plan
- AMM20, Implement Stormwater Pollution Prevention Plan
- AMM21, Implement Additional Avoidance and Minimization Measures and Best Management Practices

The BRCP includes specific conservation measures to ensure the mitigation of impacts on all vernal pools and other season wetlands and additional measures to conserve these wetlands types within the Plan Area, specifically through implementation of the following conservation measures:

- CM1: Acquire Lands
- CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans

- CM5: Enhance Protected Natural Communities for Covered Species

Impacts on vernal pools and other seasonal wetlands will be compensated through the acquisition and protection by conservation easement of three times the acreage of wetlands permanently removed (3:1 ratio or approximately 906 acres) and restoration of an equal amount of acres of vernal pool and swale habitat for each acre of vernal pool and other seasonal wetland permanently removed (1:1 ratio or approximately 302 acres). Restoration of vernal pool and swale complex as mitigation for other seasonal wetlands will result in higher ecological functions for covered species and biodiversity. For future projects in which new development causes the isolation of existing vernal pools and other seasonal wetlands the same mitigation requirements apply. Protected and restored vernal pools and swales must be of equal or greater function for covered species habitat and biodiversity than those removed by covered activities. Mitigation must be in the same CAZ as impacts with the following exceptions: impact in the Northern Orchards CAZ may also be mitigated in the Cascade Foothills CAZ, impacts in the Sacramento River CAZ may be mitigated in any CAZ, and impacts in the Basin CAZ may also be mitigated in Cascade Foothills CAZ. Mitigation requirements for vernal pools and other seasonal wetlands are summarized in Table 5–10.

In addition to the mitigation of impacts on vernal pools and other seasonal wetlands, BCAG is responsible for bringing under protection 17,229 acres of grassland with vernal swale complex (21,400 acres total protected – 4,171 acres for mitigation = 17,220 acres for conservation) that should protect an additional 782 acres of vernal pools and other seasonal wetlands (including about 191 acres of vernal pools). This additional protection would bring the impact to protection ratio to approximately 5.6:1. The protection of vernal pools and other seasonal wetlands within the required 5,747 acres of grassland land cover type (supporting a lower density of wetlands) protected for conservation would protect at least an additional 51 acres of vernal pools and other seasonal wetlands – and likely much more, since and the higher density stream associated wetlands (not estimated here) will be within these grasslands.

Overall, the BRCP will result in landscape-level conservation of large and interconnected areas of complexes of vernal pools and swales and other seasonal wetlands with a grassland matrix across 34,841 acres of land distributed on various geomorphic surfaces in the foothills of both the Cascades and Sierra Nevada. At completion of the BRCP conservation lands system, in combination with existing protected lands, 75 percent of the existing grasslands with vernal swale complex will be protected and managed for the highest level of ecological function of vernal pools and other seasonal wetlands (Table 5–26a). In addition to this protection of existing grasslands with vernal swale complex, 3,070 acres of grasslands with vernal swale complex will be restored for a combined protection and restoration of 84% of the baseline acreage (Table 5–26a).

5.7.2 Riparian Habitats

Riparian forest and scrub and herbaceous habitats are found across the Plan Area associated with perennial and intermittent streams and dredger tailings totaling 22,148 acres (Figure 3–16,

Distribution of the Riparian Natural Community in the Plan Area, Table 3–5). An estimate of the total extent of riparian forest and scrub habitats in the Plan Area is 20,491 acres (Table 3–5). See Section 3.5.3, *Riparian*, for a description of riparian natural community in the Plan Area. Riparian forest and scrub in the Plan Area include cottonwood-willow riparian forest, valley oak riparian forest, willow scrub, dredger tailings with riparian forest and scrub (stream associated and non-stream associated) land cover types (see Section 3.4.4, *Land Cover Type Descriptions*). Only portions of these riparian land cover types are expected to meet the USACE criteria for jurisdictional wetlands. All of these land cover types, except the dredger tailings with riparian forest and scrub not associated with streams, are expected to meet CDFW jurisdictional standards under section 1602 of the California Fish and Game Code. The estimated permanent direct impacts on riparian forest and scrub land cover types with implementation of covered activities in the Plan Area is 346 acres with 190 acres of this impact on CDFW jurisdictional riparian habitat (Table 4–12). Most of the impacts on riparian habitats would be on dredger tailings with riparian forest and scrub (242 acres, Table 4–12) with most of those impacts on non-stream associated forest and scrub (136 acres, Table 4–12). Impacts on cottonwood-willow riparian forest (27 acres) and valley oak riparian forest (46 acres) amount to less than 1 percent and about 1 percent of these habitats, respectively, in the Plan Area.

The potential impacts on riparian habitats are minimized by strict impact limits set in the BRCP for each UPA and CAZ (Table 4–4). The BRCP sets a limit on impacts on riparian forest and scrub based on the proposed future development under the county and cities' general plans and other regional plans. The GIS footprint of permanent direct effects on cottonwood willow riparian forest is 313 acres, but the allowable permanent direct effects are 27 acres. The GIS footprint of permanent direct effects on valley oak riparian forest is 212 acres, but the allowable permanent direct effects are 46 acres. The GIS footprint of permanent direct effects on willow scrub is 144 acres, but the allowable permanent direct effects are 11 acres. The GIS footprint of permanent direct effects on herbaceous riparian river bar is 31 acres, but the allowable permanent direct effects are 20 acres. The GIS footprint of permanent direct effects on dredger tailings with riparian forest and scrub is 713 acres, but the allowable permanent direct effects are 242 acres. See shaded grey cell in Table 4–4 for UPAs in which this avoidance of riparian habitats is required. In addition, the BRCP includes avoidance and minimization measures in Chapter 6, *Conditions on Covered Activities* to eliminate or reduce physical and water quality impacts on riparian habitats, see specifically:

- AMM1, Conduct Planning Surveys (including delineation of wetlands and riparian habitats)
- AMM4, Avoid and Minimize Impacts on Sensitive Wetland and Riparian Habitats
- AMM5, Avoid Siting of Construction Staging Areas and Temporary Work Areas in Occupied Covered Species Habitat
- AMM16, Install Erosion Control Barriers
- AMM19, Implement Wet Weather Erosion Control Plan

- AMM20, Implement Stormwater Pollution Prevention Plan
- AMM21, Implement Additional Avoidance and Minimization Measures and Best Management Practices

The BRCP includes specific conservation measures to ensure the mitigation of impacts on all riparian forest and scrub habitats and additional measures to conserve riparian forest and scrub habitats within the Plan Area, specifically through implementation of the following conservation measures:

- CM1: Acquire Lands
- CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans
- CM5: Enhance Protected Natural Communities for Covered Species

Impacts on cottonwood-willow riparian forest, valley oak riparian forest, willow scrub, and stream associated dredger tailings with riparian forest and scrub will be compensated through the acquisition and protection by conservation easement of two acres of these riparian habitats for every acre of riparian forest and scrub permanently removed (2:1 ratio or approximately 379 acres) and restoration of one acre of riparian forest and scrub for every acre of riparian forest and scrub permanently removed (1:1 ratio or approximately 189 acres). Protected and restored riparian forest and scrub must be of equal or greater function for covered species habitat and biodiversity than those removed by covered activities. Mitigation must be in the same CAZ as impacts. Impacts on non-stream associated dredger tailings with riparian forest and scrub will be compensated through the acquisition and protection by conservation easement of one acre of riparian forest and scrub habitat[33] for every acre that is permanently removed (1:1 ratio or approximately 136 acres).

In addition to the mitigation of impacts on riparian forest and scrub, BCAG is responsible for bringing under protection 5,157 acres of existing cottonwood-willow and valley oak riparian forest land cover types and protecting 697 acres of existing willow scrub land cover type to contribute to the conservation of covered species and the riparian natural community in the Plan Area (Table 5–8).

Overall, the BRCP will result in landscape-level conservation of large areas of riparian forest and scrub distributed among the CAZs along streams and in the large dredger tailings associated with the Feather River. At completion of the BRCP conservation lands system, in combination with existing protected lands, about 70 percent of the cottonwood-willow and valley oak riparian forests and about 50 percent of willow scrub in the Plan Area will be protected and managed for the highest level of ecological function (Table 5–26a).

[33] Protected riparian must be stream-associated dredger tailings with riparian, cottonwood willow riparian forest, or valley oak riparian forest land cover type.

5.7.3 Permanent Emergent Wetland

Natural perennial emergent wetlands (not associated with managed wetlands) are found across the Plan Area associated with all major land cover types (Figure 3–17, *Distribution of the Wetland Natural Community in the Plan Area*). A rough estimate of the total extent of emergent wetlands in the Plan Area is 4,440 acres, with the largest extent in the Sacramento River CAZ and the remainder rather evenly distributed among the other CAZs (Tables 3–5 and 3–18). The estimated permanent direct impacts on emergent wetlands with implementation of covered activities in the Plan Area is 35 acres (Table 4–12), amounting to less than 1 percent of emergent wetlands in the Plan Area. Most of the impacts on emergent wetlands would result from fill for the construction of residential, commercial, and industrial developments in the Oroville UPA.

The potential impacts on emergent wetlands are minimized by strict impact limits set in the BRCP for each UPA and CAZ (Table 4–4). The BRCP sets a limit on impacts on emergent wetlands based on the proposed future development under the county and cities' general plans and other regional plans. The GIS analysis estimated impacts based on development footprints of general plans and other regional plans of 81 acres for emergent wetlands, however, the BRCP requires that these impacts be limited to 35 acres through avoidance planning in implementation of development under the general plans and other regional plans (Table 4–4). In addition, the BRCP includes avoidance and minimization measures in Chapter 6, *Conditions on Covered Activities* to eliminate or reduce physical and water quality impacts on emergent wetlands, see specifically:

- AMM1, Conduct Planning Surveys (including delineation of wetlands)
- AMM4, Avoid and Minimize Impacts on Sensitive Wetland and Riparian Habitats
- AMM5, Avoid Siting of Construction Staging Areas and Temporary Work Areas in Occupied Covered Species Habitat
- AMM16 Install Erosion Control Barriers
- AMM19, Implement Wet Weather Erosion Control Plan
- AMM20, Implement Stormwater Pollution Prevention Plan
- AMM21, Implement Additional Avoidance and Minimization Measures and Best Management Practices
- AMM25, Minimize Take and Impacts on Habitat of Giant Garter Snake

The BRCP includes specific conservation measures to ensure compensatory mitigation of impacts on all emergent wetlands and additional measures to conserve emergent wetlands within the Plan Area, specifically through implementation of the following conservation measures:

- CM1: Acquire Lands

- CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans
- CM5: Enhance Protected Natural Communities for Covered Species

Impacts on emergent wetlands will be compensated through the acquisition and protection by conservation easement of one acre of emergent wetland for every acre of emergent wetlands permanently removed (1:1 ratio or approximately 35 acres) and restoration of two acres of emergent wetland for every acre of emergent wetland permanently removed (2:1 ratio or approximately 71 acres). Protected and restored emergent wetlands must be of equal or greater function for covered species habitat and biodiversity than those removed by covered activities. Mitigation must be in the same CAZ as impacts. Additional acreage of emergent wetlands will be restored as mitigation for loss of agricultural wetlands where irrigated croplands, pasture, and rice are removed for development (see Section 5.7.5, *Agricultural Wetlands*). Mitigation requirements for emergent wetlands are summarized in Table 5–10. In addition to the mitigation of emergent wetlands impacts, channels within rice land agriculture that support emergent wetlands that provide giant garter snake habitat will be protected at a 2:1 ratio as mitigation for impacts on giant garter snake habitat, amounting to 3,182 acres of rice land.

In addition to the mitigation of impacts on emergent wetlands, BCAG is responsible for bringing under protection 660 acres of emergent wetlands and to conduct the restoration of 500 acres of giant garter snake habitat, which would support roughly 150 acres of emergent wetland. This restoration of emergent wetlands for giant garter snake habitat would increase the total extent of emergent wetlands within the Plan Area. Additional conservation of emergent wetlands will come from the protection of 20,000 acres of rice land and the emergent wetlands supporting channels associated with rice agricultural to contribute to the recovery of giant garter snake.

Overall, the BRCP will result in landscape-level conservation of large areas of emergent wetlands distributed among the CAZ's but mainly within the Basin, Sacramento River, and Southern Orchard (associated with the Feather River) CAZs where emergent wetlands were historically most abundant. At completion of the BRCP conservation lands system, in combination with existing protected lands, about 57 percent of the emergent wetlands in the Plan Area will be protected and managed for the highest level of ecological function (Table 5–26a).

5.7.4 Managed Wetlands and Managed Seasonal Wetlands

Managed wetlands and managed seasonal wetlands are artificially created and maintained features found in the eastern and southern portions of the Plan Area (Figure 3–17). In the Plan Area, there are approximately 25,486 acres of managed wetlands in the Basin and Sacramento River CAZs and 2,097 acres of managed seasonal wetlands all in the Sierra Foothills CAZ (Tables 3–5 and 3–18). The estimated permanent direct impacts on managed wetlands and managed seasonal wetlands with implementation of covered activities is 12 acres (Tables 4–6 and 4–12), amounting to less than one tenth of one percent of these wetland types in the Plan Area.

The BRCP includes avoidance and minimization measures in Chapter 6, *Conditions on Covered Activities* to eliminate or reduce physical and water quality impacts on wetlands, see specifically:

- AMM1, Conduct Planning Surveys (including delineation of wetlands)
- AMM5, Avoid Siting of Construction Staging Areas and Temporary Work Areas in Occupied Covered Species Habitat
- AMM16, Install Erosion Control Barriers
- AMM19, Implement Wet Weather Erosion Control Plan
- AMM20, Implement Stormwater Pollution Prevention Plan
- AMM21, Implement Additional Avoidance and Minimization Measures and Best Management Practices
- AMM25, Minimize Take and Impacts on Habitat of Giant Garter Snake

The BRCP includes specific conservation measures to ensure compensatory mitigation of impacts on all managed wetlands and managed seasonal wetlands and additional measures to conserve emergent wetlands within the Plan Area, specifically through implementation of the following conservation measures:

- CM1: Acquire Lands
- CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans
- CM5: Enhance Protected Natural Communities for Covered Species

Impacts on managed wetlands will be compensated through the restoration of one acre of managed wetland or emergent wetland for every acre of managed wetland permanently removed (1:1 ratio or approximately 5 acres). Restored wetlands must be of equal or greater function for covered species habitat and biodiversity than the managed wetlands removed by covered activities. Mitigation must be located in the same CAZ as impacts. Mitigation requirements for managed wetlands are summarized in Table 5–10.

Jurisdictional wetlands portions of managed seasonal wetlands removed by covered activities will be compensated by restoration of vernal pool and swale wetlands at a ratio of 0.5 acre of restore vernal pool and swale for every 1 acre of impacted jurisdictional wetland within managed seasonal wetlands directly removed (ratio of 0.5:1 or about 3.5 acres restored vernal pools and swales for 7 acres of jurisdictional wetlands within managed seasonal wetlands). Restored vernal pool and swale will be of higher ecological function than the impacted jurisdictional wetlands. Mitigation must be in the same CAZ as impacts with the following exceptions: Northern Orchards may also be mitigated in the Cascade Foothills, Sacramento River may be mitigated in any CAZ, and Basin may also be mitigated in Cascade Foothills. Mitigation requirements for managed seasonal wetlands are summarized in Table 5–10.

Overall, the BRCP will result in the replacement of lost managed wetlands and managed seasonal wetlands with high function restored emergent wetlands and vernal pools and swales. The great majority of the managed wetlands and managed seasonal wetlands in the Plan Area are within existing protected lands (about 89 percent of managed wetlands and 97 percent of managed seasonal wetlands; see Table 5–14).

5.7.5 Agricultural Wetlands

Agricultural lands such as rice lands, irrigated croplands, and irrigated pasture may support jurisdictional wetlands, though typically artificial irrigation must be stopped to delineate the jurisdictional extent of wetlands within these lands. Impacts of covered activities on jurisdictional wetlands that may be found within rice lands are roughly estimated as 79 acres and within irrigated cropland and wetlands in pasture are roughly estimated at 22 acres (Table 4–12). Methods used to estimate density of wetlands within each agricultural type are provided in Table 3–16, *Potential Jurisdictional Wetlands and Other Waters in the Plan Area* (see separate file). Note that jurisdictional wetlands are estimated to be 5 percent of impacted rice lands and 1 percent of impacted irrigated cropland and pasture for the purpose of estimating impacts. Actual impacts will be determined at the time project applications are reviewed.

Impacts on rice lands that provide giant garter snake habitat will be compensated by the protection and maintenance of rice lands at 2 times the acreage removed and rice land that supports habitat for other species will be compensated at 1 times the acreage removed. Alternatively, creation of managed wetland designed as giant garter snake habitat at a ratio of 0.2 to 1 may be substituted for rice land habitat acreage to be protected. Jurisdictional wetlands portions of rice lands removed by covered activities will be compensated by restoration of emergent wetland at a ratio of 0.5 times the acreage of impacted jurisdictional wetland within the impacted rice land. Approximately 39 acres of emergent wetland restoration would serve to mitigate loss of jurisdictional wetlands within rice. Restored wetlands will be of higher ecological function than the impacted jurisdictional wetlands. Restoration must be located in the Basin or Sacramento River CAZ. Mitigation requirements for rice lands and wetlands within rice lands are summarized in Table 5–10.

Impacts on irrigated croplands and pasture that provide giant garter snake habitat will be compensated by the protection and maintenance of irrigated croplands or pasture at two times the acreage impacted supporting giant garter snake habitat (2:1 ratio). Impacts on irrigated croplands and pasture that do not support giant garter snake habitat will be compensated by the protection and maintenance of irrigated croplands or pasture at one times the acreage impacted (1:1 ratio). Jurisdictional wetlands portions of irrigated croplands and pasture removed by covered activities will be compensated by restoration of emergent wetland at a ratio of 0.5 times the acreage of impacted jurisdictional wetland within the impacted irrigated croplands and pasture. Restored wetlands will be of higher ecological function than the impacted jurisdictional wetlands. Approximately 11 acres of emergent wetland restoration would serve to mitigate loss of jurisdictional wetlands within irrigated cropland and pasture. Mitigation must be located in

the Basin or Sacramento River CAZ. Mitigation requirements for irrigated croplands and pasture and wetlands within irrigated croplands and pasture are summarized in Table 5–10.

Overall, the BRCP will result in the replacement of lost jurisdictional wetlands within agricultural lands with high function restored emergent wetlands and the protection of agricultural lands that will continue to support jurisdictional wetlands therein (Tables 5–3, 5–5, and 5–26a).

5.7.6 Non-Wetland Waters

Streams, drainage channels, ponds, and open water (mostly large reservoirs and major canals) comprise the non-wetland, "other waters of the United States" in the Plan Area.

5.7.6.1 Streams

Under the BRCP, no permanent direct impacts on natural permanent and intermittent streams are allowed. The BRCP includes avoidance and minimization measures in Chapter 6, *Conditions on Covered Activities* to eliminate or reduce temporary direct and temporary and permanent indirect physical and water quality impacts on streams, see specifically:

- AMM1, Conduct Planning Surveys (including delineation of waters of the United States)
- AMM5, Avoid Siting of Construction Staging Areas and Temporary Work Areas in Occupied Covered Species Habitat
- AMM16, Install Erosion Control Barriers
- AMM19, Implement Wet Weather Erosion Control Plan
- AMM20, Implement Stormwater Pollution Prevention Plan
- AMM21, Implement Additional Avoidance and Minimization Measures and Best Management Practices

The BRCP includes conservation measures to protect and enhance streams in the Plan Area, specifically through implementation of the following conservation measures:

- CM1: Acquire Lands
- CM4: Develop and Implement Site Specific Wetland and Riparian Restoration Plans
- CM5: Enhance Protected Natural Communities for Covered Species
- CM9: Replenish Spawning Gravels for Salmonids
- CM10: Remove, Modify, or Screen Unscreened Diversions
- CM11: Remove Impediments to Upstream and Downstream Fish Passage

Streams within the Plan Area will benefit not only from avoidance of direct and indirect impacts of individual projects, but also from the protection of large portions of their watersheds through the establishment of the BRCP conservation lands system of over 90,000 acres of land that when combined with existing protected lands (i.e., Category 1 PEHL) amounts to over 151,000 acres of land within the Plan Area (Table 5–26a).

5.7.6.2 Open Water (Reservoirs and Major Canals)

No permanent direct impacts on the reservoirs (e.g., Oroville Reservoir, Thermalito Forebay, and Thermalito Afterbay) and major canals (e.g., Cherokee Canal) are allowed under the BRCP (Table 4–4).

5.7.6.3 Ponds

Up to 52 ponds, of an estimated 465 ponds in the Plan Area, may be removed by covered activities under the BRCP (Tables 4–6 and 4–12). The BRCP requires mitigation of these impacts through the protection of one pond for each pond removed (1:1 ratio or 52 ponds). Protected ponds must be of similar size and of equal or greater function for covered species and biodiversity. Alternatively the creation of ponds may be substituted for protection of existing ponds on a per unit basis if protection of existing ponds is determined to be less practicable or effective for covered species. Mitigation ponds may be located in any CAZ that supports modeled western pond turtle or western spadefoot toad habitat. Mitigation requirements for ponds are summarized in Table 5–10.

In addition to the mitigation of impacts on ponds, BCAG is responsible for restoration of 500 acres of giant garter snake habitat, which would support roughly 150 acres of ponds with fringing emergent wetlands. This restoration of ponds for giant garter snake habitat would increase the total acreage of ponds within the Plan Area, since the average size of the 52 ponds removed by covered activities is about 0.48 acres[34] for a total of 25 acres of impact, well under the estimated 150 acres of pond habitat restored as part of giant garter snake habitat.

An additional 28 ponds will be protected under the BRCP to contribute to the conservation of covered species (Table 5–3) and large, but indeterminate, number of ponds will be protected opportunistically in the implementation of conservation measures CM1: Acquire Lands and CM5: Enhance Protected Natural Communities for Covered Species with the acquisition, protection, and management of riparian, emergent wetlands, grasslands, oak woodlands, and oak savanna natural communities.

[34] Average pond size was estimated at 0.48 acre per pond based on 30 random samples from aerial imagery.

5.7.7 Other Wetland Habitats – Seeps

Seeps are wetlands that form under unique conditions of groundwater discharge in the Cascade Foothills and Sierra Foothills CAZs. Seeps will be protected opportunistically and as a priority in the implementation of conservation measures CM1: Acquire Lands and CM5: Enhance Protected Natural Communities for Covered Species with the acquisition, protection, and management of grasslands, oak woodlands, and oak savanna natural communities.

5.8 FUTURE CONDITIONS WITH CLIMATE CHANGE

Global climate change resulting from increased atmospheric concentrations of "greenhouse gases" is occurring now and is expected to continue over the next century (Cayan et al. 2009). Globally, climatic change is predicted to cause an increase in air temperature, a decrease in the annual number of nights that reach freezing temperatures, and an increase in severity of extreme weather events (storms, droughts, heat waves). In turn, many of the predicted atmospheric and physical climatic parameters may cause secondary effects, including sea level rise, increased wildfire frequency and intensity, increased flooding frequency, and changes in species ranges and habitats. Because of the range of potential modeled futures and the different predictive abilities among various climate change models, carbon emission scenarios, output parameters, and spatial scales, any prediction of climatic change at a particular location contains a significant amount of uncertainty (Kueppers et al. 2005, Cayan et al. 2009, Ackerly et al. 2010). Regional climate change estimates predict increasing temperature and decreasing precipitation in the Sacramento Valley over the next century (DWR 2009).

Models of future climate change predict how climatic physical processes are anticipated to change, and do not incorporate the wide range of biological interactions known to be important in determining the distribution of species and ecosystems (Conservation International 2008, Littell et al. 2010). As the various climatic characteristics change across the landscape at different rates, a series of novel climates will occur that have no modern analogs, so it will be impossible to determine how species conservation elements will respond (Williams and Jackson 2007, Ackerly et al. 2010). This means that attempts to use static concepts such as climate envelope models or historical disturbance regimes to predict future species' ranges will become increasingly problematic in a dynamically changing climate that defies categorization (Mote and Salathé, Jr. 2010). Even larger changes may become apparent as thresholds that cause immediate and irreversible changes to ecosystems (Fagre et al. 2009).

Results of predictive climate change models indicate that California's summers will generally become hotter and drier, and winters will become warmer and wetter, over the next century (California Climate Change Center 2006). Warmer and wetter winters will result in a greater proportion of precipitation being received as winter rain rather than snow in the Sierra Nevada and these effects on the snow pack will be greatest at elevations between 6,500 and 9,000 feet (Maurer et al. 2007, Pierce et al. 2008, Pierce and Cayan 2012). Such a shift would result in less snow pack and earlier runoff from watersheds such that late spring and summer stream flows

could decline substantially (Maurer et al. 2007). Additionally, there is an increased likelihood of large flood events (Das et al. 2011, Dettinger et al. 2011).

Applications of future climate change models to natural systems have only been attempted for a few species and ecosystems in California. A number of ecological responses to climate change could have specific effects on species. For example, the timing of seasonal events, such as migration, flowering, and egg laying, may shift earlier or later (Walther et al. 2002; Forister and Shapiro 2003; Root et al. 2003; Root et al. 2005). Such shifts may affect the timing and synchrony of events that must occur together, such as insect emergence and nectar availability. Range and distribution of species and natural communities may shift (Parmesan et al.1999; Pimm 2001; Walther et al. 2002; Easterling et al. 2000). Range is the area over which a species occurs or potentially occurs, whereas distribution refers to where a species is located within its range. Range shifts are a particular challenge for narrowly distributed species that have restricted ranges due to urban growth, topography, soil type, and other factors. Historically, most species could shift their ranges across the landscape following natural gradients and ecological corridors. Today, urban and rural development form barriers to the movement of many species across the landscape. Species and natural communities that occur only within a narrow range of environmental conditions (e.g., BCM) are particularly vulnerable to changing climate because they likely have nowhere to move if their habitat becomes less suitable (Shainsky and Radosevich 1986; Murphy and Weiss 1992; Thorne 2006).

Ecological processes are also affected by climate change. Increases in disturbance events, such as fire and flooding are predicted to result from climate change and could affect the distribution of disturbance-dependent land cover types (Brown and Hebda 1998; Lenihan et al. 2003; Fried et al. 2004; California Climate Change Center 2006; Rogers and Westfall 2007). An increase in the frequency and intensity of disturbance could increase the likelihood that these events will injure or kill individuals of covered species, many of which are already rare. Events that occur with unpredictable or random frequency (called stochastic events) such as those describe above can have an inordinately negative effect on rare species.

Changes in ecological conditions resulting from climate change can affect the number and density of individuals found in a particular location; such change may be triggered in large part by changes in resource availability associated with an increase or decrease in precipitation (Martin 1998; Dukes and Mooney 1999; Walther et al. 2002; Lenihan et al. 2003; Millar et al. 2006; Pounds et al. 2006). Changes such as these may benefit one species at the expense of another.

Over much longer time periods, natural selection may result in changes to the outward appearance and behavior of species. Changes in climate may favor different adaptive strategies or physical traits that may lead to genetic shifts (Davis and Shaw 2001). An example of this would be a shift to smaller average body size of certain mammals to use limited food sources for maintenance rather than growth.

For natural communities and species, the effects of global climate change are highly uncertain due to different models producing estimates that differ in magnitude and direction and because the models do not take into account biological interactions or individualistic responses of species. However, despite the uncertainty in the predicted magnitude and direction of climate change, it is anticipated that beyond some climatic threshold that there will be significant but unpredictable changes in the distributions of communities and species. Though the specific changes to species distributions may not be predictable, there are well accepted principles of conservation biology that are applicable to a broad range of redistribution outcomes. The primary principles are the protection and management of large, interconnected units of conservation lands with the connectivity situated geographically to allow for species movement and redistribution along latitudinal and altitudinal gradients.

5.8.1 Stream and Riparian Habitat

Future climate change can affect the riparian forest natural community of the valley and foothills in a number of ways. Increased variability in precipitation will change the timing, duration, and magnitude of stream flows, resulting in more intense winter flooding and greater erosion of riparian habitats (Field et al. 1999, Hayhoe et al. 2004). Increased variability in precipitation can also produce prolonged droughts, making riparian vegetation more prone to fires.

The extent of riparian habitats will likely be reduced as duration, timing, and volume of stream flow are altered. As more precipitation in the mountains falls as rain rather than snow, and as the snowpack melts earlier, an increased number of flashflood and high-flow events would be expected, leading to earlier and more rapid runoff (California Climate Change Center 2006). This change in the precipitation patterns would result in alterations in the surface and groundwater hydrology of the streams and width of riparian corridors, as well as losses, or shifts in species composition, of riparian vegetation. Riparian vegetation associated with intermittent streams may be impacted if the stream no longer maintains sufficient water later in the season to support riparian vegetation. Fish and other wildlife species that rely upon a sustained period of available water will be impacted. Protection of large areas of riparian forest under the BRCP provides the opportunity to maintain this habitat in the face of potential adverse effects of climate change. Restoration of riparian forest as mitigation under the BRCP provides the opportunity to adjust restoration designs as more is learned about changes to stream and floodplain dynamics during implementation.

In relatively unregulated streams (e.g., Butte Creek, Big Chico Creek) alterations in stream flow could affect the extent and quality of habitat for resident and anadromous fishes. For example, if flows are reduced sufficiently during salmonid migration periods, upstream passage of adults to spawning beds could be impeded and water temperatures could become unfavorable for incubation of eggs and rearing of young. The abundance and movement patterns of fish in the Feather River and Sacramento River could also be affected by changes in dam operations that may be necessitated by altered timing of water supplies (Mehta et al. 2011). Protection and

enhancement of streams under the BRCP provides the opportunity to improve fisheries habitat in the face of potential adverse effects of climate change on stream habitats.

Grassland and Vernal Swale Complex

Grassland models that predict increased residual soil moisture due to early senescing of annual grasses do not consider the considerable effects of native and exotic summer-flowering annuals that are present within the grasslands (Gerlach 2004, Reever-Morghan et al. 2007). The most decisive factor determining grassland presence or absence is soil water accessibility (Bartoleme et al. 2007). In the Plan Area, precipitation greatly influences soil water level and accessibility at any given location. Large seasonal and annual variations in rainfall amount and pattern typify this region, and valley grasslands respond significantly to such stochastic fluctuations. For example, an area dominated by lush grasses in a rainy year may exhibit a vivid display of wildflowers the following spring. Increased incidence of fire in grasslands may result in changes to species composition in the grassland and in type conversion of oak woodland and savanna to grassland. It is expected that valley grasslands could be greatly influenced, perhaps in unexpected ways, by climate change.

Implementation of all BRCP goals and objectives for grassland, especially the creation of large, interconnected conservation lands, will substantially improve the flexibility and resilience of this natural community and contribute to its persistence.

Predictions for vernal pools are heavily caveated (Pyke 2004, 2005) and are products of direct precipitation models (Pyke 2004) that do not account for significant groundwater contributions in hard-pan vernal pools or the unique hydrology of clay-pan vernal pools (Environmental Science Associates 2005, Williamson et al. 2005, Rains et al. 2006, 2008). Changes in precipitation patterns and increased evapotranspiration resulting from increasing temperatures would be expected to result in vernal pools and swales supporting saturated and ponded conditions less frequently and for shorter duration in average years with greater variation among years. Since vernal pools are tied to unique soil conditions there is no space for shifting distribution of this natural community. Protection of large expanses of grasslands with vernal swale complex under the BRCP provides the best opportunity to ensure the persistence of this natural community and the species dependent on it. Restoration of vernal pools as mitigation under the BRCP provides the opportunity to adjust restoration designs as more is learned about changes to the regional climate during implementation.

5.8.2 Oak Woodland and Savanna

Modeled responses for blue oak woodlands in California are complex, with variation in effects resulting from the choice of model (Kueppers et al. 2005, Crimmins et al. 2011), microclimate (Ackerly et al. 2010), and competitive interactions (Conservation International 2008). Using a future climate scenario based on a regional climate model, Kueppers et al. (2005) found that potential ranges of blue oak and valley oak in California, shrink considerably (to 59% and 54% of current potential range sizes, respectively) and shift northward. The regional climate model

used in this study predicted greater warming and larger precipitation decreases during the growing season than the global climate model in these species' potential ranges. Blue oak, the dominant species of blue oak woodlands and savanna and a component of mixed oak woodlands, are sensitive to temperature and precipitation at many stages of their life history. Tree-ring data show greater growth in years with greater mean annual precipitation, but with geographic variation in the strength of this effect. Blue oak seedlings are sensitive to soil moisture availability, with higher mortality and lower growth where competition with annual plants leads more rapidly to growing season soil moisture deficits. (Kueppers et al. 2005).

Increased incidence of fire in oak woodland and savanna may result in changes to species composition within this community and in type conversion of oak woodland and savanna to grassland.

Protection of oak woodland and savanna in large and interconnected reserves under the BRCP provides the opportunity for shifting distributions of the species that make up this community within the Plan Area and to areas outside the Plan Area. The eastern boundary of the Plan Area generally delineates the upper limit of the current oak woodland communities and, therefore, upslope re-distribution of oak woodland communities or component species would result in new stands of oak woodland outside the Plan Area. Upslope areas immediately east of the Plan Area support mostly Ponderosa pine forest and chaparral and it is not certain where soil conditions and competition from species in these communities may prevent upslope redistribution of the oak woodland community.

5.8.3 Agricultural Habitats and Climate Change

Increased variability in precipitation is likely to reduce the reliability of water supply available for irrigating crops at critical times of the year; and crop types cultivated may change with elevated ambient temperatures. Climate change effects on agricultural systems include biological effects on crop yields and additional complexity related to land use planning, market-driven factors, and economic factors both regionally and globally (Jackson et al. 2009). For example, agricultural planning for Yolo County to adapt to climate change indicates that over the next 50 years, certain warm season crops (tomatoes, cucumbers, sweet corn, and peppers) are expected to diminish, while hot season crops (melons, sweet potatoes) are expected to increase (Jackson et al. 2009). Many other potential changes in farm management practices in response to climate change (increases in use of drip irrigation, cover cropping, low-tillage techniques, and organic production) could affect agricultural habitat conditions and, thereby, habitat conditions for covered species.

Rice, irrigated cropland, and irrigated pasture are the primary agricultural types that provide habitat for covered species in the Plan Area. Threat to irrigation water supply is the key impact of climate change on these crops, but increasing temperature may also affect cropping patterns. Protection under the BRCP of agricultural practices that provide habitat for covered species will ensure more areas for these species to shift their distributions in response to climate change.

5.8.4 Managed Wetland

Increased variability in precipitation is likely to reduce the reliability of water supply available for managed wetlands at critical times of the year. Potential reductions of and changes in timing of flows in local and regional distribution systems will likely reduce the amount of water available for managed wetlands and would adversely affect management actions, such as flooding at precise times of the season, to provide habitat and food for covered species and for waterfowl. BRCP actions to protect giant garter snake rice habitat will maintain the availability of these existing habitat areas and actions to restore habitat for giant garter snake will increase the extent of managed wetlands in the Plan Area and ensure more habitat for giant garter snake to respond to the effects of climate change.