Bay Delta Conservation Plan

Independent Science Advisors Report Concerning Non-Aquatic Resources

Prepared For

Bay Delta Conservation Plan Steering Committee

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1 Introduction

This report summarizes recommendations from a group of independent science advisors (ISA) concerning the treatment of non-aquatic species and communities by the Bay Delta Conservation Plan (BDCP). The intent of the ISA process is to ensure that the plan has access to the best available science. Our recommendations are not binding, and are not intended to either question or promote particular plan goals or policies, but are intended to help inform the planning process. Attachment A provides brief biographies of the advisors.

Contents of this report reflect discussion among the science advisors at a workshop held on September 30, 2008 (Attachment B) and their review of various draft plan documents (Attachment C). A previous ISA workshop and report (Reed et al. 2007) focused on the aquatic species and communities that have been the BDCP's highest priorities. This second workshop and report, by a different set of science advisors, focuses on non-aquatic species and communities that could be affected by plan actions.

2 Covered Species

This section provides information concerning what non-aquatic species may be affected by BDCP implementation, either positively or negatively. The intent is not to recommend which species should or should not be covered by regulatory take authorizations or permits under endangered species regulations. It is up to the potentially regulated entities (PREs) to decide which species they wish to obtain permit coverage for, whether under Endangered Species Act Section 10 and the NCCP Act or under other regulations (e.g., Section 7 of the ESA or Section 2081 of the Fish & Game Code). Moreover, it is up to the fish and wildlife agencies to determine for which species permit coverage is ultimately warranted, under what regulations, and with what terms and conditions. We offer the following scientific information and advice to be considered as BDCP participants make decisions about species coverage and conservation actions.

2.1 Species Selection Process

The advisors generally concur with the evaluation criteria and process that was used to identify potentially covered species by the consulting team (Attachment C, Document #3). However, we have some questions and concerns about how the four evaluation criteria (listing status, occurrence in planning area, potential to be affected, and information sufficiency) were applied, and we suggest reconsidering the evaluation of certain species.

First, the advisors were unclear how the original list of 111 species that SAIC evaluated for coverage was derived, and are concerned that some at-risk species or subspecies that may occur in or near the planning area were not evaluated. For example, several birds that are California Species of Special Concern (SSC) (Shuford and Gardali 2008) are known or potentially occur in the planning area, but were apparently not evaluated, such as the Modesto song sparrow (*Melospiza melodia mailliardi*) and yellow warbler (*Dendrocia petechia*).

Listing Status. For some species, advisors question how the determination was made that they were unlikely to be listed, in light of myriad uncertainties and considering the proposed 50-year permit duration. We believe it is prudent to err on the side of caution in making such determinations, because an unexpected listing can be disruptive to plan implementation[1]. In particular, the advisors note that there is an inherent circularity in the logic to not cover some SSC on grounds they are unlikely to be listed. Inclusion on the California SSC list indicates that a species meets some or all criteria for California Threatened or Endangered status, and that highlighting this at-risk status may help prevent the need to list the species by encouraging conservation and recovery actions for it (Shuford and Gardali 2008). The advisors therefore recommend treating SSC as if they are likely to be listed. If the planning area is important to viability of an SSC, the plan should evaluate whether implementation may adversely affect it and therefore warrant coverage.

Occurrence in Plan Area. The advisors note that survey coverage in the plan area is sparse for many species, and that it is difficult to assume absence on the basis of existing data, such as CNDDB records. This is particularly true for plants and invertebrates. Some species occurring in the vicinity of the Bay Delta have been found outside their known geographic ranges after being listed and could occur in the plan area. We also note that species ranges are dynamic, and that shifts in response to climate change and other factors are being documented for numerous taxa in California and throughout the world (Moritz et al 2008, Parmesan 2006, Root et al. 2003). We therefore recommend carefully considering the potential for species to occur within the plan area over the proposed 50-year permit duration.

We understand that some plan actions may occur outside the planning area (the statutory boundary of the Delta) but that only species occurring inside the boundary were evaluated. We recommend identifying all at-risk species that may be affected by the plan (i.e., listed, SSC, or CNPS list species), whether inside or outside the plan boundary (e.g., by an around-Delta conveyance or by restoration actions in Suisun Marsh). We recognize that permits for BDCP effects on some species may be obtained via other regulatory means than BDCP take authorizations (e.g., project-specific Section 7 or 2081 authorizations), but it seems wise to anticipate the full range of potential effects to inform such decisions as early as possible.

Potential to be Affected by Plan Actions. The advisors also feel it is prudent to err on the side of caution when considering the potential for species to be affected by plan actions, whether positively or negatively, because the nature and extent of the plan's covered actions and conservation measures are not yet fully defined. For example, we understand that the consultants only considered an eastern alignment in determining whether species may be adversely affected by an around-Delta conveyance. It appears from maps and other information we reviewed that additional species could be adversely affected by other alignments, especially a western alignment. Until the conveyance alignments and other plan measures are more fully developed,

[1] For example, during development of the San Diego Multiple Species Conservation Plan (MSCP) the Quino checkerspot butterfly (*Euphydryas editha quino*) was considered unlikely to be listed and was not covered. The butterfly was listed as Endangered one year after MSCP approval, triggering project delays and a costly plan amendment.

we recommend keeping an inclusive list of potentially affected species, and winnowing the list as decisions are made and uncertainties resolved.

Advisors question the assumption that siphoning aqueducts under tidal channels, streams, and sloughs can completely avoid impacts on riparian habitat or other floodplain habitats. While the impacts of siphons may be lower than alternative conveyance solutions, based on observations of existing siphons elsewhere in the Central Valley, advisors are uncertain whether all direct and indirect impacts associated with construction and maintenance of siphons can be completely avoided. We recommend not relying on this assumption in considering species for coverage until facility design is sufficiently advanced to remove such uncertainties.

Restoration actions intended to benefit aquatic species may positively or negatively affect habitat for or populations of terrestrial species. For example, restoration of tidal marshes in lowland portions of the plan area could flood habitats currently occupied by covered terrestrial plant and animal species, while increasing habitat potential for marsh species.

Even if plan actions do not directly affect habitats or populations of certain terrestrial species, they have potential to constrain conservation or recovery actions for these species by other plans. For instance the Antioch Dunes represent a rare sand dune habitat that supports a number of rare, endemic plants and animals, such as the federally endangered Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*), Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howelli*), and Lange's metalmark butterfly (*Apodemia mormo langei*). We agree that this community and its endemic species are not likely to be directly affected by BDCP actions. However, due to the extreme rarity and conservation importance of this community, we recommend analyzing whether any covered actions might constrain the possibility of future habitat restoration within this very limited geographic area by other entities, or whether BDCP conservation actions could contribute to recovery of these species.

Sufficiency of Information. The advisors were unclear about how this determination was made for each species, given uncertainties about the distribution of many species in the plan area and the preliminary nature of the covered actions and conservation measures. We assume that the determination focused on whether scientific understanding is sufficient to determine how covered actions and conservation measures might affect each species, provided the species is present in affected areas. We understand the rationale that there must be sufficient scientific understanding about how covered actions and conservation measures may affect a species to determine whether that species should ultimately be covered by take authorizations. However, where there is not sufficient information to make such a determination at this time, we believe it is prudent to keep the species on a comprehensive species list as the plan develops, in case sufficient information becomes available to make the assessment, rather than to remove such "uncertain" species from the list prematurely.

The explanation for this criterion (Attachment C, Document #3, Page 8) states, "A guide for this criterion is if the species is covered or proposed for coverage under other HCPs and NCCPs, which indicates a confidence that sufficient information is available to cover the species." We point out that the nature of BDCP covered actions and conservation measures differs considerably from that of most other HCPs and NCCPs, which usually involve trading off habitat

losses due to development, primarily in upland areas, with conservation and management of habitat preserves in other locations. In contrast, BDCP actions will likely result in complex and widespread changes in hydrodynamics, water qualities, etc., as well as potentially widespread habitat restoration projects, especially of wetland communities. Such actions may affect covered species in ways not addressed by other HCPs and NCCPs in the region. Moreover, how these changes may interact with climate change and other factors to influence habitat and populations of covered species is highly uncertain. We believe that where existing scientific information is not currently sufficient to determine plan effects on species, those species should be retained on the list of potentially covered species until sufficient information becomes available to determine that the plan is unlikely to have effects on them (e.g., until covered actions are more fully defined and more comprehensive surveys can be performed). These uncertainties about plan effects on diverse species reemphasize the critical importance of a solid adaptive management and monitoring program for the BDCP.

2.2 Potential Covered Species Additions

Based on the above review of the species selection criteria, we believe the following species should be considered (or reconsidered) for coverage, because they are listed or have potential to be listed as Threatened or Endangered and they could be affected by plan actions. These include some species not addressed in the consultants' evaluation, and others that were evaluated but determined unlikely to require coverage due to one or more of the evaluation criteria. For example, they include several SSC that we believe should be treated as likely to be listed, for reasons explained above. Finally, they include some species about which the consultants were uncertain for one or more of the evaluation criteria.

- **Riparian woodrat** (*Neotoma fuscipes riparia*[2]). The consultants' evaluation was uncertain about this federally endangered species' occurrence in the plan area and likelihood of being affected. Surveys are being performed for the species in appropriate habitats within the BDCP area, and we recommend awaiting results of those surveys before determining whether to pursue coverage. Before 2003 riparian woodrats were thought to survive only at Caswell Memorial State Park and a few other areas along the lower Stanislaus River. However, the species was found in 2003 at the San Joaquin River National Wildlife Refuge, just south of the planning area, and it may be more widely distributed than previously thought. Ongoing riparian habitat restoration efforts at the San Joaquin River NWR and elsewhere will likely lead to population and range expansion. In addition to loss of habitat, riparian woodrats are threatened by fires and floods, as evidenced by population reductions in San Joaquin River NWR following a wildfire there in 2004 and major flooding in 2006. Riparian woodrats are expected to respond favorably to riparian habitat restoration programs.
- **Northern harrier** (*Circus cyaneus*) has been a California Bird SSC since 1978 (Shuford and Gardali 2008). Recent declines throughout the Central valley have been attributed to habitat loss, intensified agricultural practices, and increases in nonnative predators (cats, dogs, and eastern red foxes). Harriers are known to breed regularly at the Cosumnes Reserve and were found in 69 widely scattered blocks in the Sacramento County Breeding Bird Atlas. The

[2] Taxonomic revision will likely result from studies that are presently ongoing by Marjorie Matocq at University of Nevada, Reno (P. Kelly).

nests of this ground-nesting species are highly vulnerable to disturbance from humans, dogs, livestock, and agricultural activities during the breeding season. Conservation measures, such as restoring wetland habitats in what are currently uplands, could adversely affect a small number of harriers. Further information on occupancy, persistence, and ideally nesting success in protected areas is needed.

- **Lesser sandhill crane** (*Grus canadensis canadensis*). This recent addition to the California bird SSC list (Shuford and Gardali 2008) winters in large numbers within the Delta (Christmas Bird Count data). Like the greater sandhill crane (which was included as potentially covered in the consultant's evaluation) the greatest threats to the species are changes in agricultural practices and habitat loss. Management actions, such as promoting late (February) discing of grain crops, managing grasslands with cattle, providing shallow wetlands, and preventing collision with power lines, will benefit both the lesser sandhill crane and the greater sandhill crane.

- **Least Bell's vireo** (*Vireo belli pusillus*) was not evaluated by the consultants, presumably because it has not been found in the plan area since before the species was listed as Endangered in the 1980s. Least Bell's vireo was restricted to a few small populations in southern California at the time of listing, but it has since been increasing in population and expanding northward within its historic range in the Central Valley. In recent years least Bell's vireos have nested as far north as Gilroy (Santa Clara County) and San Joaquin River National Wildlife Refuge (Merced County). Experts consider it likely to re-occupy riparian habitats in the BDCP area in the near future.

- **Yellow warbler** (*Dendroica petechia*) was not evaluated by the consultants. A California SSC since 1978 (Shuford and Gardali 2008) this species has declined significantly as a breeding bird throughout the state and in the Central Valley and may be close to extirpation (Heath 2008). Extensive surveys in the Bay Delta and San Joaquin valley in the late 1900s failed to locate breeding populations. Possible breeding records in Contra Costa County and a new expanding population on the San Joaquin River NWR (Hospital Creek) suggests high potential for this species to return to the delta in healthy numbers. An early seral-stage, riparian-dependent species, restoration programs that restore ecosystem processes (e.g., natural flood events), a mosaic of riparian habitat, and healthy understory will benefit this easily monitored species (Riparian Habitat Joint Venture 2004).

- **Modesto song sparrow** (*Melospiza melodia*, "Modesto" Population) was not evaluated by the consultants. This resident California bird was considered a valid subspecies (*M. m. mailliardi)* until 2001 (Patten 2001), and may be again under additional taxonomic research (Gardali 2008). Regardless of whether the "Modesto population" of the song sparrow is ultimately determined to be a valid subspecies, it is a California SSC that is endemic to the Sacramento Valley (Gardali 2008). The Bay-Delta is one of two areas with the highest population densities. Major loss (> 90%) of its preferred wetland and riparian habitat has led to a significant reduction in range and abundance. While it can be locally abundant along riparian corridors or small wetlands it is rare along irrigation canals, levees, and in mature riparian habitat. The protection and restoration of wetlands and dynamic riparian systems with understory and habitat mosaics will aid in this species' recovery.

- **Western pond turtle** (*Clemmys marmorata*). The western pond turtle is a California state SSC. The turtle's habitat includes freshwater sloughs and marshes in the Delta (Zeiner et al.

1988-1990). Salt-water intrusion brought about by reducing freshwater flows into the Delta could have a negative effect on local populations.

- **California tiger salamander** (*Ambystoma californiense*) is a federally threatened species with recent sightings in the vernal pool habitats on the western edge of the project area. This area is included in designated Critical Habitat for the species (U.S. Fish and Wildlife Service 2004), and actions there, such as construction of a western around-Delta conveyance, have the potential to adversely affect the species. The consultants' evaluation was uncertain about the potential for plan actions to affect the species, presumably because covered actions are not yet fully defined.
- **California red-legged frog** (*Rana aurora draytonii*) is federally Threatened and a California SSC that is known to occur in the plan area. The consultant's evaluation concluded that plan actions were unlikely to affect the species. The advisors are unclear how this determination was made given that locations of covered actions and conservation measures have not yet been fully defined and that surveys sometimes find this species in unexpected locations. Red-legged frog could be adversely affected if covered actions occurred in or near occupied or potential habitat. We recommend including this as a potentially covered species pending further analysis as covered actions and conservation measures are better defined.
- **California black walnut** (*Juglans hindsii*) was considered by the consultants' evaluation to be unlikely to become listed. However, this California endemic is a CNPS list 1B.1 species (seriously endangered in California) and has a Natural Heritage Rank of G1/S1.1. It is known to hybridize with other species of walnuts. Although it has been widely planted and used for root stock, natural occurrences are limited, and only one confirmed natural stand appeared viable as of 2003 (http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi). We recommend considering covered status for this species if natural populations occur in the plan area that could be positively or negatively affected by covered actions.
- **Bristly sedge** (*Carex comosa*) is found along the margins of marshes, swamps, and in wet meadows. The consultants' evaluation was uncertain about this species' potential to be listed. We share this uncertainty, and believe there is a small potential for it to be listed in the next 50 years. We therefore agree with the consultants "undetermined" finding and suggest keeping this species on the list until uncertainty is reduced.
- **Various plant species** found in vernal pools, swales, or flats that could be adversely affected by plan actions, especially in combination with climate change, or have the potential to benefit from the plan's conservation actions. The consultant's evaluation determined that these species were unlikely to be affected by covered actions, or they were uncertain about the potential for effects. We are also uncertain about potential plan effects on these species, given that plan actions aren't yet fully described, and believe they should be retained until uncertainties are resolved.
    - Bogg's Lake hedge-hyssop (*Gratiola heterosepala*)
    - San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*)
    - Heartscale (*Atriplex cordulata*)
    - Brittlescale (*Atriplex depressa*)
    - Vernal pool smallscale (*Atriplex persistens*)

- Round-leafed filaree (*Erodium macrophyllum*)
- Fragrant fritillary (*Fritillaria liliacea*)
- Lesser saltscale (*Atriplex minuscule*)

We agree with the consultant's evaluation that the following species, which are associated with the extremely rare Antioch Dune community, are unlikely to be directly affected by the covered actions or conservation measures currently under consideration. However, as explained earlier, we recommend evaluating whether BDCP implementation could contribute to the recovery of these species or whether BDCP implementation might indirectly constrain potential conservation and recovery actions for these species by other entities.

- Delta green ground beetle (*Elaphrus viridis*)
- Lange's metalmark butterfly (*Apodemia mormo langei*)
- Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howelli*)
- Contra Costa wallflower (*Erysimum capitatum* spp. *angustatum)*

2.3 Potential Covered Species Deletions

The consultants' draft evaluation concluded that the following species should be considered for coverage, or stated that this conclusion was "undetermined." The advisors believe that these species are unlikely to require coverage, and they could be deleted from the list.

- **Snowy plover** (*Charadrias alexandrinus*, interior population). Since 1945 there are only three breeding records for this species in the Central Valley (all in Yolo County). Its extremely rare occurrence and preference for agricultural evaporation ponds and alkali playas in the Valley suggest that BDCP is unlikely to affect this species and that the delta is not an area in which to focus conservation efforts for it.
- **Coast horned lizard** (*Phrynosoma coronatum*) does not likely inhabit the plan area (Stebbens 2003) or areas likely to be affected by around-Delta conveyances.
- **Caper-fruited tropidocarpum** (*Tropidocarpum capparideum).* This species was believed to be extinct for several decades, but was rediscovered in Monterey County at Fort Hunter Liggett in 2000-2001. It primarily occupied valley grasslands, with some documented locations within the plan area. However, it has not been re-located in the plan area in recent years and is presumed extirpated.

2.4 Planning Species

The advisors are concerned that the plan focuses so strongly on species for which regulatory coverage is being sought (e.g., listed threatened and endangered species) that it might not adequately account for ecological processes and community interactions that are essential to all species in the area, including covered species. Some conservation plans identify additional "planning species" for which regulatory coverage may not be necessary, but that can serve as indicators of ecological conditions or processes in covered communities. Indicator species can be effective monitoring tools in adaptive management plans, especially where intensive monitoring of covered species is infeasible. We recommend considering whether some

additional planning species should be evaluated in the plan and included in the monitoring program to help meet BDCP goals.

One approach for identifying useful planning species is to identify groups of species whose vulnerability can be attributed to a common threat or stressor, such as loss of habitat area or alteration of a natural disturbance regime. For each group, one or more species are selected that are both highly sensitive to the threat category and relatively easy to monitor. Such species can thus serve as indicators for that group. We recommend that the plan identify what threat categories are most appropriate for non-aquatic communities in the BDCP area, systematically evaluate whether the proposed list of covered species already has sufficient indicator species for each threat category and each community type, and then supplement the covered species list as necessary to fill any gaps in this matrix with additional planning species.

One example system for identifying threat categories that has been applied in previous conservation plans is based on Lambeck (1997) who identified four groups of species. We suggest adjusting this general approach to the BDCP issues and area to identify planning species that may help attain plan goals and objectives. The following groups could be modified or supplemented with others, as appropriate for this purpose.

- *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, such as northern harrier. Although this category has proved useful in design of large-scale, terrestrial reserve systems, the advisors do not necessarily recommend selecting large, wide-ranging terrestrial species as good planning species for BDCP. However, it may be useful to identify species that require relatively large habitat patches or habitat mosaics as indicators of successful habitat restoration efforts, if covered species do not already meet this need for all communities.
- *Dispersal-limited species* are limited in their dispersal capacity, sensitive to particular movement barriers such as highways or canals, or are vulnerable to mortality when trying to move through a human-dominated landscape. Examples include salamanders, turtles, large snakes, flightless insects, and large-seeded herbaceous plants. The advisors believe that some of the potentially covered species may adequately cover this category for most communities (e.g., California tiger salamander, Valley elderberry longhorn beetle).
- *Resource-limited species* require specific resources or habitats that are very rare or at least occasionally in short supply. Classic examples include nectarivores, cavity-nesting birds, cliff-nesting birds, vernal pool species, or burrow-dwelling animals. The advisors recommend considering whether there are resource specialists in the planning area that could serve as useful indicators for rare ecological communities or resources that may not be adequately addressed by covered species. For example, tree swallows and possibly spotted sandpipers are good indicators of healthy floodplain environments, diverse aquatic insect communities, and fish breeding habitat (gravel bars).
- *Process-limited species* are sensitive to details of the disturbance regime (e.g., the frequency, severity, or seasonality of floods or fires) or other manifestations of natural processes, such as hydroperiod, salinity gradients, or fire-return intervals. Examples include riparian plants like sycamore and elderberry that establish following floods, or vernal pool species which

require seasonal flooding, such as Contra Costa goldfields (*Lasthenia conjugens*). Early seral species such as song sparrows and yellow warblers are good indicators of ecosystem processes such as periodic flooding (Chase and Geupel 2005).

To this list of four categories, we suggest adding one for invasive species that serve as indicators of where management intervention is required. For example, wetland margins are often highly invaded by non-native species like Lepidium; and black rats (*Rattus rattus)* seem ubiquitous in riparian habitat in the Central Valley. Rats are nest predators of birds, including the Modesto song sparrow (Hammond 2008), and unpublished data from the Endangered Species Recovery Program suggests that woodrat reproductive success is lower in areas with high *Rattus* densities (P. Kelly).

3 Covered Communities

Due to the BDCP's focus on conserving imperiled fish species, the plan currently includes three "covered communities" and seven "other communities."[3] We recommend considering whether the plan should add more covered communities, in recognition of the interdependences among ecological communities within a broader ecosystem context. We point out that (1) many of the potentially covered species are found in the "other communities" rather than in the covered communities; (2) some of the rarest communities in the plan area are disproportionately vital to imperiled species, such as inland dune scrub and seasonal wetlands; and (3) community types are interdependent in complex ways and should not be treated in isolation of one another. For instance, changes in water level, flooding period, or nutrient deposition from flooding in certain habitats will likely impact adjacent habitats and associated covered species. Moreover, many covered species require resources from multiple community types (e.g., amphibians that require wetlands and uplands). Even if all communities in the plan area are not treated as "covered communities," the advisors at least recommend describing and assessing all communities within the plan area with a comparable level of detail and care, and describing community interdependencies in an ecosystem context. We expand on this in our review of the Existing Ecological Conditions chapter in Section 4.1.

We further recommend that analysis and documentation of plan effects recognize the finer vegetation types or habitat conditions that exist within these broadly defined natural community types[4]. The plan documents we reviewed (e.g., Attachment C, Document #2) appropriately recognize these finer distinctions by providing cross-walk tables of the various plant associations and alliances (Hickson and Keeler-Wolf 2007, Sawyer and Keeler-Wolf 1995) within each natural community type. We recommend continuing to recognize these finer distinctions, especially where they are important to assessing plan effects on covered species. For example, the category "natural seasonal wetlands" includes diverse types of seasonal wetlands, from vernal pools to alkali flats, which differ tremendously in ecological conditions and in the suite of covered species each supports.

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[3] BDCP Planning Agreement: Attachment C, Document #1.

[4] Community types were defined based on the CALFED Bay-Delta Program Ecosystem Restoration Program Volume 1 and Multiple Species Conservation Strategy (CALFED 2000), which defined 18 "broad" natural communities, while recognizing that there are finer habitat types and vegetation communities within each of these.

The Antioch Dunes represents a unique ecosystem of critical conservation concern that lies entirely within the project area. The dunes once extended along a two-mile reach of the southern shore of the San Joaquin River immediately east of the town of Antioch (Powell 1983) and totaled approximately 190 acres. This unique, isolated ecological community supports a diversity of rare and endemic species of plants and insects. For example, the Antioch Dunes are the type locality for 27 insect species, including eight that are endemic to the Dunes, and four that are considered extinct (Bettleheim 2005). Today, only 55 acres of remnant aeolian dunes are protected within the Antioch Dunes National Wildlife Refuge, although an additional 12 acres of dunes are found on the adjacent Pacific Gas & Electric property. A comprehensive conservation plan was issued by the U.S. Fish & Wildlife Service in 2002, but few if any of the management needs have been fully addressed. The Antioch Dunes National Wildlife Refuge was identified as a potential area for habitat restoration under the Ecological Restoration Program of CALFED (1999).

As discussed earlier, we recognize that the Antioch Dunes community is unlikely to be directly impacted by BDCP covered actions, but in light of the extreme rarity of this community and its associated species, we recommend assessing whether BDCP actions may in any way constrain restoration and recovery actions within this community, or whether BDCP conservation actions could contribute to recovery actions (e.g., by including restored dune habitats as a possible component of BDCP restoration plans in appropriate locations).

Communities need to be considered not just in isolation but as interdependent communities of species that affect one another within mosaics and across gradients. This is important in assessing effects of covered activities and designing conservation measures (e.g., locating restoration areas). The goal should be to recreate and maintain natural transitions between communities along gradients (such as elevation, salinity, and moisture gradients) rather than creating isolated habitat types with "hard edges." For example, the unnaturally abrupt transitions from marsh vegetation to uplands that are created by dikes around marshlands provide no safe haven for rails and other species during flood events, subjecting them to high predation rates. Naturally connected and transitioning communities along elevation and moisture gradients will (1) benefit the covered fish species, (2) provide more natural habitat mosaics to support terrestrial and wetland species, and (3) create more sustainable conditions during climate change and sea-level rise.

Each community type has a characteristic set of species (of all kinds, not just plants). The advisors urge more consideration of the sets of species in each community and how they interact. As discussed in Section 2.4, it would be valuable to identify species that are indicators of particular communities. It may also be useful to identify common species associations or guilds typical of particular habitat types, plant assemblages, or limiting resources. Such species groups can provide useful indicators of biological integrity within ecological communities, which can be useful in adaptive management and monitoring.

4 Draft Plan Documents

In general, the advisors were impressed with the quality of documents and maps we reviewed. The following general comments are intended to improve what already appear to be thoroughly researched and thoughtfully prepared information products.

4.1 Existing Ecological Conditions

We recommend that the existing ecological conditions chapter begin with a broader treatment of the Bay-Delta ecosystem, natural communities, and processes, including those important to non-aquatic species. All communities in the study area should be described to a similar level of detail as the three covered communities. Currently, the three covered communities are treated fully, with detailed depictions of physical conditions, vegetation, fish and wildlife, non-native species, ecosystem processes, environmental gradients, and future conditions under a changing climate. However, the seven "other communities" have briefer descriptions of only the physical conditions, vegetation, fish, and wildlife, and these are more cursory than those for covered communities.

Section 2.3.2 on existing ecosystem processes does a good job of describing the broad suite of physical, chemical, and biological processes occurring within the project area. Likewise section 2.3.3 describes well the physical processes, and 2.3.4 describes the covered communities. What is missing is an integration of community types to describe how they are arranged or interconnected in spatial mosaics, and how these mosaics work to provide ecosystem services and support covered species. For example, it would be useful to characterize patterns of adjacency and intergradation among different community types and whether the boundaries between communities are (1) natural vs. artificial (e.g., separated by dikes, roads, or ditches), or (2) gradual vs. abrupt (e.g., transitioning along natural gradients or having sharp, discrete edges). How different habitat types interact both physically and through the movement of organisms across habitat boundaries or gradients is important to understanding likely affects of plan actions and other changes on covered species. Physical interaction is likely through the interdependence of water levels in adjacent (undiked) habitats and fluxes of sediments and nutrients. In the absence of additional species-specific information, the adjacency of habitats is expected to provide a measure of the flux of organisms across habitat boundaries, and barriers of various kinds (dikes, roads, railroads, etc.) may hinder the movement of certain species. Conservation measures should strive to create habitat mosaics with natural transitions between adjacent communities along gradients. Such mosaics will be more robust in the face of changes in hydrology and sea-level rise by allowing species, communities, and processes to adjust gradually over space and time. We expand on these concepts in Section 5.

4.2 Species Accounts

The draft species accounts that we reviewed were generally well researched, organized, and accurate. We recommend producing similar accounts for all potentially covered species, with perhaps shorter accounts for those species that were considered but not retained on the potentially covered list.

Below is a sampling of minor improvements that the advisors recommend for particular species. In Section 4.4 we provide additional information sources that should be consulted and referenced in the species accounts.

- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). It is important to note that, although this species has been proposed for delisting by the U.S Fish & Wildlife Service, it is still officially listed and should continue being treated as such. The delisting process is not yet final, and even once it is finalized, there will still be a required monitoring period of 5 years.
- The riparian brush rabbit account should be updated with the latest information developed by the Endangered Species Recovery Program (ESRP) at California State University – Stanislaus[5]. Note that the accounts currently available on the ESRP website are not particularly current, as results of recent and ongoing research are not yet incorporated. Surveys are being conducted within the BDCP plan area, the results of which should be used to update the account.
- An account should be prepared for the riparian woodrat using the latest information from ongoing surveys and research by ESRP[4]. As with the riparian brush rabbit, please note that the species account on the ESRP website is not particularly current. For example, recent unpublished data suggest that woodrat reproductive success is lower in areas with high black rat densities than in areas where black rats are systematically removed (P. Kelly). Riparian woodrats were first captured by ESRP in the San Joaquin River National Wildlife Refuge on March 26, 2003. Although they are captured periodically there, they are not abundant, especially since a wildfire in 2004 and major flooding in 2006. Woodrats usually build stick houses (also called nests, dens, or middens) on the ground, making them susceptible to flooding. However, they can also den arboreally in stick nests and cavities, which makes them somewhat less vulnerable to flooding than riparian brush rabbit populations. Fires may therefore be a more serious threat to riparian woodrats than flooding. As with the riparian brush rabbit, surveys are being conducted within the BDCP plan area over the next two years, the results of which should be used to update species information.

4.3 Species Habitat Models

We reviewed preliminary draft maps prepared by the consultants for a selection of covered species, to assess the general modeling approach they are using to predict habitat distribution for covered species. The approach has been to use available GIS layers (especially land cover types) and known or assumed habitat associations to depict the potential distribution of each species in the plan area.[6] This approach is fine when the relationships between species occurrence and mapped land-cover types (or other discretely mapped GIS polygons) are well established and reliable. However, errors of omission and commission are common, and their extent or frequency is difficult to assess. Overlaying available occurrence records onto these maps offers some additional information and a rough indication of model accuracy. However, when

[5] Please contact Pat Kelly at pkelly@esrp.csustan.edu for more information.

[6] The term "models" is somewhat misleading because the maps are more like compilations of information and expert opinion rather than being based on any graphical or mathematical algorithm.

occurrence records are sparse or spatially biased, for instance when based on ad-hoc reporting of occurrences to CNDDB, they are not in themselves reliable indicators of model accuracy.

A more thorough approach to habitat modeling would be to use niche models to statistically quantify the relationship between occurrence (or abundance) and habitat conditions (e.g., Guisan and Thuiller 2005, Elith et al. 2006), although we recognize that species occurrence records are too sparse for most covered species to build reliable statistical models. Regardless of the method used, all distribution maps must be applied and interpreted with great caution due to uncertainties.

Furthermore there is a need to consider more fully the likely distribution of habitat 50 years into the future based on climate change predictions. Habitat models can be coupled with climate envelope models to forecast changes in species ranges under different climate change models (e.g., Loarie et al. 2008).

4.4 Information Sources

We recommend considering the following information sources to bolster the scientific foundations of the plan and plan documents.

- California Riparian Habitat Restoration Handbook (Griggs 2008). This recent publication is based on years of experience designing, implementing, and monitoring riparian and riverine habitats in California, and serves as a practical "how-to" guide for planners and practitioners.
- California Bird Species of Special Concern (Shuford and Gardali 2008).
- California Mammal Species of Special Concern.[7]
- Contra Costa County Breeding Bird Atlas (http://www.flyingemu.com/ccosta/).
- State Wildlife Action Plan (Bunn et al. 2005).
- Antioch Dunes National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2002).
- The most recent publications and model results concerning climate change effects on species ranges and phenologies that pertain to the study area and species. For example, Loarie et al. (2008) assessed likely effects of climate change on California's flora, and predicted that about 2/3 of our endemic plant species will experience >80% range contractions over the next century, with major disassociation of current plant communities likely. Hijmans and Graham (2006) discuss the accuracy of predictions from widely used climate-envelope models, and Green et al. (2008) showed that such models are able to retroactively predict range shifts for bird species.
- ClimateWizard is a climate change modeling and analysis "toolbox" that should be ready for public use in the near future. It may be useful for investigating how climate change may

[7] Unfortunately, the most current version of this document has been under review for several years now and is not yet available. We recommend checking on the status with the California Department of Fish and Game. See also: http://www.dfg.ca.gov/wildlife/species/ssc/mammals.html

affect covered species and communities in the BDCP area. See http://faculty.washington.edu/girvetz/ClimateWizard/index.html for more information.

- PRBO Conservation Sciences has created predictive models of species distribution for 19 different bird species using a machine-learning algorithm called Maxent (Phillips et al. 2006, http://www.cs.princeton.edu/~schapire/maxent/). The models predict distributions based on species occurrence locations and GIS-based environmental data layers. This approach can significantly improve predictive ability over simple habitat suitability index (HSI) or wildlife habitat relationship (WHR) models, which are often based on broad-scale habitat associations that are not necessarily applicable throughout a species' range. CADC (http://www.prbo.org/cadc/) provides links to maps for 19 species of land birds the Central Valley that includes the delta region, including California Bird SSC and California Partners in Fight (http://www.prbo.org/cms/258) focal species. For more information on modeling methods: see http://data.prbo.org/cadc/tools/lip/background.php.

5 Conservation Measures

Based on our review of information provided by the consultants, the advisors offer some recommendations about how conservation measures under consideration to benefit aquatic communities and species may affect terrestrial communities and species, along with some additional recommendations for conservation actions specific to the terrestrial resources. Our discussions focused primarily on the following pragmatic questions:

- What potential positive or negative effects might the proposed conservation measures (Attachment 3, Documents 4-8) have on non-aquatic species and communities? How can potential negative effects be avoided, minimized, or mitigated, and how can potential positive effects be enhanced?
- How can restoration of floodplain, intertidal marsh, channel margin, and riparian vegetation designed to benefit covered fish species be implemented or refined to also benefit non-aquatic species?
- Is establishing appropriate hydrologic conditions sufficient to provide for the natural establishment of native woody riparian vegetation ("passive restoration") or is more active restoration, such as planting trees and shrubs, necessary?
- Will native species and communities naturally shift ranges in response to changes in hydrological regimes (e.g., upslope shifting of intertidal plants) or colonize restored habitats, or is more active intervention necessary (e.g., transplantation or reintroduction)?
- What additional conservation actions should be considered to benefit covered non-aquatic species, beyond those conservation measures already being considered to benefit aquatic species?
- Are there specific locations in the planning area that are essential to sustaining populations of covered terrestrial species, or "hotspots" where numerous species coexist, and that therefore should be focal areas or avoidance areas for conservation measures?

Based on these discussions, we have organized recommendations for BDCP conservation measures into the following sections on conservation design principles, recommended analyses,

locations of conservation concern, restoration recommendations, and species-specific conservation actions.

5.1 Conservation Design Principles

We recommend the following general principles be considered during the selection, design, and implementation of conservation measures:

- Plan conservation measures hierarchically, working from ecosystem to community to species-level considerations. Do not plan conservation measures for specific covered species or communities in isolation, without considering their relationships with other species and communities in the broader ecosystem.
- Design reserve or management areas to achieve mosaics of community types within areas large enough to support the most area-dependent covered (or planning) species and desired ecological services, and to accommodate future shifts due to climate change (e.g., sea-level rise, changing runoff patterns, shifting climate "envelopes").
- Strive for representation of all community types in habitat mosaics well distributed across the Delta, but considering site-specific conditions. Where possible, maintain or create "soft edges" or natural transitions along environmental gradients, as opposed to abrupt transitions or "hard edges" between community types.
- Bigger is better for habitat conservation and restoration sites, but don't ignore small areas that support rare communities or species. For example, small areas of seasonal wetlands, inland dunes, or alkali flats support disproportionate numbers of imperiled species.
- Seek to preserve and enhance natural heterogeneity in elevation, water depth, flooding frequency, nutrient conditions, vegetation types, and adjacency of different habitat types within and among the conserved, restored, or maintained habitat mosaics.[8]
- Enhance and preserve habitat connectivity where possible to maximize potential for natural range shifts, population expansions, escape from disturbance events (fires, floods), and maintenance of ecological processes, and to avoid isolating small populations of those species having limited dispersal abilities.
- Strive to create self-sustaining systems, but recognize that some communities and species may need active or perpetual management. For example, some invasive, nonnative species may require prolonged control efforts to sustain covered species or communities that they adversely affect.

5.2 Recommended Analyses

We recommend the following analyses be performed prior to finalizing the plan's conservation design, to assess likely effects of proposed covered activities and conservation measures on non-aquatic resources, and to inform how best to design and locate covered activities and conservation measures.

[8] A variety of observational studies demonstrate that species diversity is higher in heterogeneous habitats than in homogeneous habitats (Harman 1972; Abele 1974; Pollock et al. 1998; Williams et al. 2002).

- Do an overlay analysis for covered actions (e.g., facilities, conveyance alignments) and conservation measures (e.g., potential wetland restoration sites) with known and potential locations of covered species and communities. This should include an assessment of how changing hydrological regimes (water depth, flows, flooding, etc.) overlay onto existing ecological communities and species. Assess how the combination of changes will affect the conservation design principles discussed in section 5.1 (e.g., community representation, habitat patch size, environmental heterogeneity, natural gradients, maintenance of rare communities, and adjacency and connectivity of existing community types within mosaics). Pay particular attention to the potential for rare communities, such as seasonal wetlands and inland dune scrub, to be impacted. This should include consideration both of direct effects (e.g., flooding of rare upland habitats for wetland restoration) as well as potential indirect effects (e.g., constraining options for restoration efforts that could be carried out by other entities or under other plans).
- Assess for each covered species whether natural range shifts or colonization into restored habitat is likely to occur with changing conditions (e.g., hydrological and sea-level changes, restoration actions), or whether translocation/transplantation is required. For species not likely to shift naturally, prioritize avoidance of occupied areas and consider translocation/transplantation plans as part of the adaptive management program.
- Assess the distribution of "hard" vs. "soft" edges and determine where restoration actions can be used to soften edges. For example, determine where covered wetland or transitional plants are located at unnaturally sharp transitions to other physical conditions or habitat types that may constrain their ability to shift range over time in response to climate change and rising water levels. This analysis can inform where restoration actions could be prioritized to sustain ecological shifts due to water-level changes (including grading to create gradual elevation gradients and revegetation to create wetland-upland vegetation gradients).
- Use climate envelope models coupled with habitat models (Loarie et al. 2008, Hijmans and Graham 2006, Green et al. 2008) to identify potential effects on covered species over a 50-year horizon. This could inform where offsite conservation actions may be more effective in hedging against climate change for some covered species.

5.3 Locations of Special Concern

The advisors discussed whether there are certain geographic locations in the BDCP plan area that are of particular importance to at-risk species or communities, or to maintaining critical ecological processes. The following are a few key locations where impacts should be avoided or where additional conservation, restoration, and management may be beneficial. We realize that these locations and their importance are likely already well known to BDCP participants, but felt their importance was worthy of emphasis.

- **Staten Island** is a critical wintering area for sandhill cranes and other birds, due in large part to wildlife-friendly agricultural practices.
- **Franks Tract State Recreation Area**. In addition to its importance to aquatic resources, the marshes of Frank's Tract are a hotspot of bird diversity and support a variety of rare and imperiled species, including California black rail, yellow warbler, yellow-breasted chat, and song sparrow.

- Occupied areas for riparian brush rabbits, including **Stewart Tract**, and near Lathrop. Occupied areas should be better defined by surveys currently underway by ESRP.
- **Antioch Dunes** represent a small remnant of a very rare ecological community that supports numerous endemic and imperiled species (see Sections 2 and 3). Remaining dunes have become isolated by urban development, limiting potential for restoring or expanding habitat.

5.4 Restoration Recommendations

- Recognize that restoration is a process, not a one-time action. We recommend following the restoration process designed by River Partners (Griggs 2008) for riparian and riverine restoration projects.
- Passive riparian restoration (just restoring semi-natural flooding regimes) is unlikely to be effective due to invasive weeds and insufficient colonization by dispersal-limited species. Some planting of woody vegetation, including both understory and overstory plants is recommended (Riparian Habitat Joint Venture 2004). Also, follow-up management to control invasives may be needed for up to 10 years post restoration to ensure success, and translocation may be necessary for some species.
- Given that water level changes will occur (due to conveyance changes, restoration efforts, and climate change), design and engineer plan facilities and structures in a manner that allows for control of water flows and depths to maintain diverse ecological conditions and particular species' needs. We recommend assigning a BDCP Work Group or Technical Team to evaluate the range of conditions desired to support the diverse requirements of covered species, communities, and processes in the plan area (terrestrial as well as aquatic). Recognize that optimizing how these metrics can best be manipulated to sustain covered species should be a focus of the systematic adaptive management and monitoring program.
- All else being equal, locate habitat restoration areas near existing habitat areas to expand or connect similar habitats, and to facilitate population expansions for covered species. For example, consult The Nature Conservancy's Cosumnes Watershed Plan and prioritize adjacent or nearby restoration sites. On the other hand, distributing restoration sites across the plan area will capture broader gradients in ecological conditions and may help spread the risk of restoration failures, maximize habitat diversity, and deal with uncertainties due to climate change and other dynamics.
- For floodplain restoration, consider leaving breached levees at least partially in place to provide physical habitat diversity and serve as refugia for species during floods ("bunny mounds"). Such physical features provide for habitat heterogeneity and increased bird diversity (Riparian Habitat Joint Venture 2004). However, it is important that old levees or other elevated areas be vegetated or revegetated with natural, local, plant palettes to provide escape cover during flood events as well as year-round habitat for diverse covered species.
- Also for floodplain and marsh restoration, meandering and dendritic channels are better than straight, undivided, and unbraided channels. Where floodplain areas are to be graded to create proper depths and drainage, consider leaving some permanent aquatic habitat (slightly deeper ponds or channels) to provide habitat for giant garter snakes, so long as these are configured to prevent fish stranding.

- Strive to create natural combinations of habitat types in mosaics that transition along physical gradients, rather than restoring single community types in isolation. For example, where tidal emergent marsh restoration is planned, also restore adjacent transitional and upland vegetation communities moving up the elevation gradient. This establishes the natural mosaic of habitat conditions required by many species, increases biological diversity and foodweb complexity for covered species (including fish), and will help accommodate ecological shifts due to changing climate and water levels.
- Use restoration to increase the rarest habitat types, if feasible. Seasonal wetlands (vernal pools) stand out as a rare habitat type that may be affected by project actions. Although vernal pool creation is controversial as a mitigation action, there may be opportunities for enhancing or restoring existing or former vernal pool areas in appropriate locations. If adverse impacts to vernal pools and associated species are unavoidable, offsite conservation of intact vernal pool systems may be preferable to attempting to create or restore vernal pools within the plan area. Inland dune scrub is also extremely rare. Although we do not anticipate direct negative plan effects on inland dune communities, BDCP actions have potential to create opportunities for restoring dune communities in some locations, perhaps to be implemented by other entities or plans.
- Use restoration to create "soft edges" between habitat types along ecological gradients. For example, many populations of potentially covered plant species occupy narrow bands of conditions along the elevation-tidal gradient, and many are currently up against "hard edges" (i.e., sharp transitions to other physical conditions or habitat types) due to dikes, levees, or other artificial features. This provides little or no opportunity for these populations to shift ranges with changing water levels or hydrological regimes. Where possible, restoration should be used to soften such edges via grading and/or revegetation to create opportunities for gradual range shifts and other adjustments to changing conditions.

5.5 Species-specific Conservation Actions

The advisors do not recommend relying on species-specific mitigation actions or structures (e.g., artificial burrows, nest boxes, nesting islands, "bunny mounds," created pools) as *primary* conservation tools. Conservation, maintenance, and restoration of intact habitat mosaics and ecological communities must be primary. However, the following specific mitigation actions should be considered as supplements to conservation and management of diverse habitats to enhance habitat value, particularly where covered species face specific life-requisite shortcomings despite habitat conservation and restoration:

- **Artificial burrows** are sometimes used by nesting burrowing owls, but have not been shown to increase owl populations in the long term. It is better to maintain natural burrow conditions and healthy prey populations (e.g., no ground squirrel control programs or insecticide use). Artificial burrows may be beneficial in certain situations where natural burrows are limiting as a supplemental mitigation measure.
- "**Bunny mounds**," or areas of ground elevated above the highest expected flood levels, are important in floodplain habitats to allow for escape by riparian brush rabbits and other species. These can be expensive to create from scratch, especially if fill has to be transported from other sites, but high mounds that are vegetated with brushy cover can contribute significantly to sustaining individuals and populations during floods, and create habitat

heterogeneity that also benefits diverse communities of birds and other taxa. Look for opportunities to get "free bunny mounds" such as, by leaving portions of the old levee as elevated ground when breaching levees for floodplain restoration. These should be revegetated with appropriate trees and shrubs, if necessary.

- **Nesting islands.** Creating or leaving some higher ground within subtidal and intertidal restoration areas can provide nesting islands for some shorebirds as part of an overall heterogeneity strategy.
- **Brown-headed cowbird trapping** (following guidelines of the North American Cowbird Advisory Council http://cowbird.lscf.ucsb.edu/) can benefit populations of songbirds that are adversely affected by nest parasitism by this species, such as least Bell's vireo and yellow warbler.
- **Contaminant control**, including control of herbicides, rodenticides, and light pollution may be an important management measure in conservation areas.
- **Vegetation management** on levees. We do not recommend burning, mowing, or herbicide use to control vegetation on levees.
- **Feral cat control** may be necessary in conservation areas or other areas important to covered species. Restrictions on maintaining feral or free-roaming cat populations should be enforced throughout the plan area.

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Attachment A – Advisor Biographies

Dr. Peggy L. Fiedler, Senior Botanist & Co-Director, Ecosystem Science and Natural Resources Management Services, WSP Environment & Energy, LLC. Dr. Fiedler has 30 years of experience in field research and teaching in conservation biology, ecology and evolutionary biology, and waters/wetlands ecosystem restoration. Her current interests are focused on designing plant community types in mega-diverse floras for ecosystem restoration, applying population viability models and metapopulation theory to the reintroduction of rare plant species, understanding demographic patterns of rare plants (including hybrid taxa) and improving monitoring protocol in waters/wetland ecosystem restoration.

Geoffrey R. Geupel, Director, Terrestrial Ecology Division, PRBO Conservation Science, Petaluma, CA. Geoff has over 28 years of experience in ornithological monitoring and conservation research in California. Recent publications and presentations have helped define bird monitoring protocols now used throughout North America. He has taught numerous technical workshops on bird monitoring and currently oversees more than 20 projects that use bird data to evaluate conservation actions. Current areas of interest include breeding and population biology, demographic monitoring, bird response to habitat restoration and management, and developing measurable populations metrics for conservation planning. He is currently Co-chair of California Partners in Flight and is formally involved with five of the six habitat joint ventures in the state.

Dr. Marcel Holyoak, Professor, Environmental Science and Policy, University of California at Davis. Dr. Holyoak is broadly trained as a population and community ecologist, with interests in conservation, biostatistics, and theoretical ecology. Much of his recent work addresses the responses of individual species and ecological communities to habitat fragmentation. His research group has conducted most of the work on the federally threatened Valley Elderberry Longhorn Beetle that has been performed in the last decade. He has a PhD. from the University of London (Imperial College) in ecology and biostatistics from 1992, and a BSc. in biology from the same university in 1989. He is acting Editor-in-Chief of a top-ranked ecology journal, *Ecology Letters*, and will become the new editor for this journal in January 2009.

Dr. Patrick A. Kelly, **Coordinator and Director of Endangered Species Recovery Program (ESRP) and Professor of Zoology, California State University, Stanislaus**. Dr. Kelly's main research interests are in mammalian ecology and conservation, and his current research focuses on the conservation and recovery of endangered mammals in California, including the riparian brush rabbit and riparian woodrat. He joined ESRP as Assistant Director in July 1993 and became Director in January 1996. Pat received a B.Sc. from University College Galway, Ireland, in 1981, and a Ph.D. from the University of California, Berkeley, in 1990.

Dr. Wayne Spencer, Senior Conservation Biologist, Conservation Biology Institute, San Diego, CA. Dr. Spencer is a conservation biologist and wildlife ecologist with expertise in conservation planning and endangered species recovery. He has worked on various regional NCCPs and HCPs in California as a consulting biologist, science advisor, and science facilitator. His research focuses primarily on rare and endangered mammal species, including the Pacific fisher, Stephens' kangaroo rat, and Pacific pocket mouse. He is also a Research Associate with

the San Diego Natural History Museum. He served as the Facilitator for this BDCP Non-aquatic resources workshop and report.

Dr. Glenn Wylie, **Research Wildlife Biologist, USGS Western Ecological Research Center, Dixon, CA**. Dr. Wylie is a wildlife biologist specializing in wetland ecology as is concerns migratory birds and listed species in California. In the last 10 years he has been researching the distribution, abundance, and ecological requirements of giant garter snakes. Dr. Wylie was a science advisor for the Recovery Team for giant garter snakes and has advised habitat conservation planning for the city of Sacramento. He is currently advising Solano County in developing a habitat recovery plan as well as participating in the Yuba/Sutter and Yolo County efforts in habitat conservation planning.

Attachment B – Workshop Agenda

AGENDA
Bay-Delta Conservation Plan
Independent Science Advisors' Workshop
Concerning Non-aquatic Resources

30 September 2008

Hawthorn Suites Hotel, Crocker Room
321 Bercut Road, Sacramento. 916-441-1200
(Exit Richards Blvd East off of I-5, take first left at Bercut)

0900 – 1030 Orientation Session (Science Advisors and Consultant Team)

0900 – 0915	Welcome, introductions, and logistics
0915 – 0930	Overview of science advisory process and workshop goals (Wayne Spencer)
0930 – 1000	Overview of BDCP conservation approach and issues (Pete Rawlings, John Gerlach, and Jim Estep)
1000 – 1030	Q & A session and open discussion
1030 – 1045	Break

1045 – 1600 Advisors Only Session

1045 – 1130	Review of proposed covered species list and process
1130 – 1200	Review of existing conditions documents (Existing Ecological Conditions, stressors summaries, species accounts, distribution maps, habitat measures)
1200 – 1300	Working lunch (provided) – continued discussion of existing conditions documents and maps
1300 – 1400	Principles for addressing data gaps and uncertainties
1400 – 1500	Principles for conservation, restoration, and management of species, communities, and ecological processes
1500 – 1515	Break
1515 – 1600	Outline report and writing assignments
1600	Adjourn

Attachment C – Documents Reviewed By Advisors

Advisors reviewed the following documents in preparing this report. All documents (accept Document 1, BDCP Planning Agreement) are unpublished Draft reports, memoranda, chapters, or handouts prepared by SAIC.

1. October 6, 2006. Planning Agreement regarding the Bay Delta Conservation Plan.
2. March 7, 2008. Draft existing ecological conditions chapter and covered species accounts (on CD).
3. May 22, 2008. Proposed covered species selection process and potential species for coverage under BDCP.
4. September 5, 2008. Steering Committee Handout 1. Summary table: Other Stressors Working Group recommended conservation measures for consideration by the BDCP Steering Committee.
5. September 5, 2008. Steering Committee Handout 2. Other Stressors Working Group recommended conservation measures for consideration by the BDCP Steering Committee.
6. September 5, 2008. Steering Committee Handout 3. Summary table: Draft other stressors conservation measures by working biological objectives.
7. September 19, 2008. Steering Committee Handout 1. Restoration Program Technical Team recommended conservation measures for consideration by the BDCP Steering Committee.
8. September 19, 2008. Steering Committee Handout 2. Summary table: Draft habitat restoration conservation measures by working biological objective.
9. September 19, 2008. Draft plant species accounts and associated distribution maps for the following species:
    - Alkali milk-vetch
    - Delta button celery
    - Delta mudwort
    - Delta tule pea
    - Heckard's peppergrass
    - Legenere
    - Mason's lilaeopsis
    - San Joaquin spearscale
    - Soft bird's beak
    - Suisun Marsh aster
10. September 19, 2008 Draft animal species accounts and associated distribution maps for the following species:
    - California black rail
    - California clapper rail
    - Conservancy fairy shrimp
    - Giant garter snake
    - Greater sandhill crane

- Longhorn fairy shrimp
- Riparian brush rabbit
- Salt marsh harvest mouse
- Suisun shrew
- Swainson's hawk
- Tri-colored blackbird
- Valley elderberry longhorn beetle
- Vernal pool fairy shrimp
- Vernal pool tadpole shrimp
- Western burrowing owl
- Western spadefoot toad
- Yellow-breasted chat

11. September 30, 2008. Poster-sized maps and PDFs of the following plan maps:

- BDCP natural communities
- Elevation-based restoration suitability categories
- Aerial imagery of the planning area
- DWR agricultural classes
- BDCP conveyance route options