

**San Diego County Water Authority
NCCP/HCP**

Report of Independent Science Advisors

Prepared for

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Contents

1.0	Introduction.....	1
	1.1 Background.....	1
	1.2 The Science Advisory Process	4
2.0	Scope of the Plan.....	6
	2.1 Covered Species.....	6
	2.2 Natural Communities and Ecosystems	20
	2.3 Stressors and Threats.....	20
3.0	Conservation Strategy	22
	3.1 Guiding Conservation Principles for Plan Development.....	22
	3.2 Biological Goals and Objectives.....	22
	3.3 Feasibility of Restoration.....	24
	3.4 Conservation Evaluation of the Covered Species.....	24
	3.5 Protection of Ecosystem Processes and Critical Linkages/Connectivity	31
	3.6 Evaluation of the Seven Tenets of Reserve Design.....	31
	3.7 Evaluation of Mitigation Areas.....	32
4.0	Adaptive Management.....	36
	4.1 Fundamental Principles.....	36
	4.2 Collaboration with USFWS and CDFG	36
	4.3 Monitoring	37
	4.4 Responses to Changed/Unforeseen Circumstances	39
5.0	Literature Cited	41

Attachment A: Biographies of Advisors

Attachment B: Initial Questions Addressed by the Science Advisors

Attachment C: Workshop Agenda

1.0 Introduction

1.1 Background

The State of California's Natural Community Conservation Planning Act (NCCP Act) requires a process for including independent scientific review and input (California Fish and Game Code Section 2810(b)(5)). This process ensures that the NCCP is thoroughly reviewed and that a rigorous external assessment is provided that recommends the best available science. The Federal Habitat Conservation Planning process has guidelines for similar input.

The purpose of such input is to help plan participants incorporate the best available science into a plan, and help the California Department of Fish and Game (CDFG) make sound findings regarding the plan's adequacy in, for example, conserving covered species and natural communities. The NCCP Act specifically requires that the independent scientific input:

- recommend scientifically sound conservation strategies for species and natural communities proposed to be covered by the plan;
- recommend a set of reserve design principles that addresses the needs of species, landscape, ecosystems, and ecological processes in the planning area proposed to be addressed by the plan;
- recommend management principles and conservation goals that can be used in developing a framework for the monitoring and adaptive management component of the plan; and
- identify data gaps and uncertainties so that risk factors can be evaluated.

Note that most of the terminology used in these descriptions is not defined in the NCCP Act. Therefore, many plans define terms operationally for themselves (see Section 2.2.1 below for definitions).

Findings that CDFG must make at the end of the process to approve an NCCP and issue a permit are relevant to the charge of the Science Advisors. Information provided by our panel can help CDFG to make these findings. According to Section 2820(a) of the Fish and Game Code, CDFG must determine that:

- the plan integrates adaptive management strategies that are periodically evaluated and modified based on the information from the monitoring program and other sources, which will assist in providing for the conservation of covered species and ecosystems within the plan area;
- 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; and

- the development of reserve systems and conservation measures in the plan area provides, as needed for the conservation of species, all of the following:
 - conserving, restoring, and managing representative natural and semi-natural landscapes to maintain the ecological integrity of large habitat blocks, ecosystem function, and biological diversity;
 - establishing one or more reserves of other measures that provide equivalent conservation of covered species within the plan area and linkages between them and adjacent habitat areas outside the plan area;
 - protecting and maintaining habitat areas that are large enough to support sustainable populations of covered species;
 - incorporating a range of environmental gradients (such as slope, elevation, aspect, and coastal or inland characteristics) and high habitat diversity to provide for shifting species distributions due to changed circumstances; and
 - sustaining the effective movement and interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the habitat areas within the plan area.

Independent scientific input has become a regular part of all NCCPs prepared in California. To date, there have been at least 14 independent scientific reviews of NCCPs¹.

The San Diego County Water Authority NCCP/HCP

The San Diego County Water Authority (Water Authority) is preparing a combined NCCP and HCP (the Plan) to provide long-term “take” authorization for its capital projects, ongoing operations, and maintenance activities. The Plan is a stand-alone subregional NCCP within the coastal sage scrub region of Southern California. The Water Authority Plan is designed to be compatible with other subregional NCCPs through which it passes, including the San Diego Multiple Species Conservation Program (MSCP) and the San Diego Multiple Habitat Conservation Plan (MHCP). Both of these plans are exempt from the current NCCP Act’s new requirements, including independent scientific review (Section 2810(b)(5)(A) through (D))². The document reviewed by the Science Advisors was the September 2007 administrative draft Plan (San Diego County Water Authority 2007).

The Water Authority Plan is subject to the requirements of the current NCCP Act, with several exceptions. Section 2830(f)(2) narrows the scope of the independent scientific input, stating that the Water Authority must include independent scientific input:

¹ Most of these reports can be found at www.dfg.ca.gov/habcon/nccp/science.html.

² The 2002 NCCP Act expanded and completely replaced the original 1991 NCCP Act. Plans exempt from the new Act follow the requirements of the 1991 Act, as amended.

...in a manner that focuses on the covered species that are proposed for take authorization and that are not otherwise covered in the San Diego Multiple Species Conservation Program or the San Diego Multiple Habitat Conservation Program. The scientific input required by this paragraph shall be based on the best and most current scientific data generally available, and shall assure that documentation for coverage of all species is equal or greater than the San Diego Multiple Habitat Conservation Program.

Following this requirement, 33 out of 94 species are not covered by either the MSCP or the MHCP. Another 8 vernal pool species were added for consideration by the Science Advisors, bringing the total to 41. The vernal pool species were added in light of a recent court ruling that invalidated the City of San Diego's federal MSCP permit for vernal pool species. These 41 species are listed in Table 1.

Table 1. Species Proposed for Coverage by the Water Authority Plan Reviewed by the Science Advisors

Scientific Name*	Common Name
Plants	
<i>Adolphia californica</i>	California adolphia
<i>Allium munzi</i> ¹	Munz's onion
<i>Arctostaphylos rainbowensis</i>	Rainbow manzanita
<i>Centromadia parryi</i> ssp. <i>australis</i>	Southern tarplant
<i>Centromadia pungens</i> ssp. <i>laevis</i> ¹	Smooth tarplant
<i>Githopsis diffusa</i> ssp. <i>filicaulis</i>	Mission Canyon bluecup
<i>Navarretia prostrata</i> ¹	Prostrate navarretia
<i>Nolina cismontane</i>	Chaparral bear-grass
<i>Packera ganderi</i>	Gander's ragwort
<i>Salvia munzii</i>	Munz's sage
Invertebrates	
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp
<i>Euphydryas editha quino</i>	Quino checkerspot butterfly
<i>Lycaena hermes</i>	Hermes copper
Fish	
<i>Gila orcutti</i>	Arroyo chub
Reptiles	
<i>Eumeces skiltonianus interparietalis</i>	Coronado skink
<i>Coleonyx variegates abbotii</i>	San Diego banded gecko
<i>Charina trivirgata roseofusca</i>	Coastal rosy boa
<i>Diadophis punctatus similis</i>	San Diego ringneck snake
<i>Thamnophis hammondi</i>	Two-striped garter snake
<i>Crotalus ruber ruber</i>	Northern red diamond rattlesnake
<i>Eumeces skiltonianus interparietalis</i>	Coronado skink
Birds	
<i>Elanus leucurus</i>	White-tailed kite
<i>Accipiter striatus</i>	Sharp-shinned hawk
<i>Buteo lineatus</i>	Red-shouldered hawk
<i>Falco mexicanus</i>	Prairie falcon
<i>Asio otis</i>	Long-eared owl
<i>Lanius ludovicianus</i>	Loggerhead shrike

Scientific Name*	Common Name
<i>Eremophila alpestris californica</i>	California horned lark
<i>Dendroica petechia brewsteri</i>	Yellow warbler
<i>Ammodramus savannarum</i>	Grasshopper sparrow
Mammals	
<i>Perognathus longimembris brevinasus</i>	Los Angeles little pocket mouse
<i>Chaetodipus californicus femoralis</i>	Dulzura pocket mouse
<i>Onychomys torridus ramona</i>	Southern grasshopper mouse
<i>Neotoma lepida intermedia</i>	San Diego woodrat
MCSP Vernal Pool Covered Species	
<i>Eryngium aristulatum var. parishii</i>	San Diego button celery
<i>Navarretia fossalis</i>	Spreading navarretia
<i>Orcuttia californica</i>	California orcutt grass
<i>Pogoyne abramsii</i>	San Diego mesa mint
<i>Pogoyne nudiuscula</i>	Otay Mesa mint
<i>Branchinecta sandiegonensis</i>	San Diego fairy shrimp
<i>Streptocephalus woottoni</i>	Riverside fairy shrimp
<i>Athene cunicularia</i>	Burrowing owl

* Scientific names taken from Administrative Draft NCCP/HCP. Revisions to some of these names are recommended in this report.

¹ Covered in the Western Riverside County Multiple Species Conservation Plan (MSHCP)

1.2 The Science Advisory Process

Science Advisor Selection

Jones & Stokes was hired by the Water Authority to assemble and facilitate a panel of independent scientists to meet the requirements of the NCCP Act. Jones & Stokes compiled a list of 67 potential candidates, drawn from recommendations by CDFG, the U.S. Fish and Wildlife Service (USFWS), the Water Authority, RECON Environmental, Inc. (RECON, the Water Authority's Plan consultant), previous science advisory panels for NCCPs in Southern California, and professional networks of Jones & Stokes staff. The panel members were selected based on the following criteria:

- expertise in one or more of the species groups in Table 1;
- successful experience with previous NCCP science advisory panels;
- local expertise in ecology and conservation biology; and
- availability to participate in the science advisor workshop and produce a report on the schedule outlined by the Water Authority.

The five members selected to participate in this panel each met all of the four criteria. The selection also guaranteed that expertise for all species groups was represented (Appendix A presents biographies of each panel member). Dr. Matt Rahn was selected to chair the panel, and provided additional support to Jones & Stokes in compiling the report and soliciting additional input from the advisors following the workshop.

Science Advisor Meeting

In preparation for the panel meeting, a conference call was held with the advisors on November 5, 2007, to provide an orientation to the project, review the charge of the panel, and finalize the agenda for the panel meeting. Background material was provided to the advisors at this time: the Plan, general guidance from CDFG on the science advisory process for NCCPs (CDFG 2002), and a preliminary guidance memo from Jones & Stokes on the science advisory process with preliminary questions for the advisors to address. This memo was revised following the conference call and is included as Appendix D.

The Science Advisors agreed that primary responsibility for the species groups would be as follows:

- Plants—Dr. Mary Ann Hawke
- Birds—Phil Unitt
- Reptiles and Amphibians—Dr. Brad Hollingsworth
- Invertebrates and Fish—Dave Faulkner
- Mammals—Dr. Matt Rahn

A meeting of the Independent Science Advisory Panel (Science Panel) was held on November 19th, 2007 (See final agenda in Appendix C)³. This meeting was facilitated by scientists and NCCP experts from Jones & Stokes, who outlined procedures for engaging and formalizing the science advisors in the review process. This meeting also included a representative from the Water Authority, consultants preparing the Plan (RECON), and staff from CDFG and USFWS. The Water Authority and RECON presented overviews of the Plan and provided the Science Panel members an opportunity to ask questions. The advisory committee then met in closed session to review and discuss the Plan. A follow-up conference call was held on November 26 to coordinate preparation of the final report.

The Independent Science Advisory Panel's report is provided herein, as mandated for the Water Authority Plan. This review and discussion is being provided to assist the agencies in making sound findings that the Plan can adequately cover and conserve the covered species and natural communities. As described above, the Science Advisors focused on 41 of the 94 proposed covered species (Table 1). Given the unique nature of this particular Plan, the science advisors focused their review on addressing the scope of the Plan, the conservation strategy, species-specific review, and adaptive management and monitoring. Additional comments and questions from the Science Panel are also provided herein. The organization of this report follows these major topics.

³ Dr. Hollingsworth did not participate in the November 19 meeting.

2.0 Scope of the Plan

2.1 Covered Species

2.1.1 Covered Species Selection

2.1.1.1 Sources and Rationale for Inclusion

The Plan's original list of potential covered species contained more than 180 species, based on a number of factors. One of the original methods used to draw up the list was to include all species found in overlapping plans—the Western Riverside County Multiple Species Conservation Plan, the San Diego South County Multiple Species Conservation Program, the draft North County Multiple Species Conservation Program, and the North County Multiple Habitat Conservation Program. In addition to pulling from these other plans, all species that were determined to have the ability to occur and be mitigated for within the four conservation banks were included. The final method used was to include all species from the California Natural Diversity Database (CNDDDB) that were found within a one-mile buffer of the proposed impact area.

The Science Panel recommends that specific criteria be described in the Plan to justify the selection process for covered species. Criteria that seem to fit the current list, as well as the process used by RECON includes:

- species occurs within Water Authority right-of-way or is very likely to occur;
- species is listed by the state or federal wildlife agencies or is likely to be listed during the permit term;
- covered activities are likely to impact the species; and
- Water Authority can provide adequate conservation, management, and monitoring for the species (this presumes there is enough information known about the species to do so).

In its current form this Plan proposes 94 covered species, 41 of which would be evaluated by the Science Panel. This subset (Table 1) contains species that are not covered by the surrounding plans or are species for which additional information has been requested. All proposed covered plants and invertebrates appear to meet the criteria outlined above and should remain as covered species. Coverage of species in other groups is discussed below.

Plants

Justification for Seeking Coverage

There are 10 covered plant species under review by the Science Advisors and five MSCP covered species: *Adolphia californica*, *Allium munzii*, *Arctostaphylos rainbowensis*, *Centromadia*

parryi ssp. *australis*, *Centromadia pungens* ssp. *laevis*, *Githopsis diffusa* ssp. *filicaulis*, *Navarretia prostrata*, *Nolina cismontane*, *Packera ganderi*, *Salvia munzii*, *Eryngium aristulatum* var. *parishii*, *Navarretia fossalis*, *Orcuttia californica*, *Pogogyne abramsii*, and *Pogogyne nudiuscula*.

The San Diego Natural History Museum's (SDNHM) Botany Department can provide additional information about the documented locations of each of these species to help support their inclusion in the Plan.

Also, note the name change in *Opuntia californica* var. *californica* (Tables 6-1 and 6-2 of the Plan); this species has been transferred to the genus *Cylindropuntia*.

The following plants should be considered for coverage in the Plan and evaluated against the four criteria suggested above:

- *Brodiaea santarosae* is a new species described by Chester et al. (2007) that occurs in southwest Riverside County. The species is mentioned as occurring along pipelines, so it would be worth confirming the documented locations to ensure that it is not a consideration in the northernmost part of the Plan area.
- *Eryngium pendletonensis*, *Mondardella stoneana*, and *Ceanothus otayensis* (which used to be included with *Ceanothus crassifolius*) are other "new" species that possibly could be found near the Water Authority lands and should be considered.
- Cacti may be more of a concern as a result of recent fires (particularly *Cylindropuntia californica* var. *californica*) because they do not recover well from fire. If the recent fires destroyed populations of cactus then their current occurrence and distribution may not be well known.

Existing Data on Covered Species

The use of point localities from the San Diego County Plant Atlas and SDNHM herbarium databases would add important information to the conservation analysis. The Plant Atlas database includes 30,000 point locations for plant specimens collected in the past five years, and the herbarium database includes a similar set of data for historic plant collections. Inclusion of these data would help the Water Authority understand which species occur on their lands and in the mitigation banks they have chosen. These data would also help confirm and/or refine the information in Table 6-2 of the Plan (particularly elevations, habitat types, and blooming periods, all of which are typically included in plant specimen records). Data from CNDDDB is not verified and includes observation data which can potentially contain errors. The plants submitted to the Plant Atlas are all verified by the Curator of Botany and represent physical specimens collected from the site.

Ecological Profiles of Covered Species

Mission Canyon bluecup (*Githopsis diffusa* ssp. *filicaulis*)

Additional locations are now known for this species, besides those mentioned in the write-up in Appendix B of the Plan. The Curator of Botany at the SDNHM has collected and documented this species on Crestridge Ecological Reserve.

Prostrate navarretia *Navarretia prostrata*

Appendix B states that “a herbarium specimen examined is from the Miramar area” but does not specify which herbarium, nor does it give an accession number for the specimen.

Gander's ragwort *Packera ganderi*

New locations are also known for this species besides those mentioned in Appendix B (e.g., Potrero Park). It is included as “endemic or near endemic” in the 4th edition *Checklist of Vascular Plants of San Diego County* by Rebman & Simpson (2006).

Herpetofauna

Justification for Seeking Coverage

There are a total of 12 amphibian and reptile species included in the Plan. Six are not reviewed here, but have merit for their inclusion in the NCCP (western spadefoot, arroyo toad, Southern Pacific pond turtle, Belding’s orange-throated whiptail, coastal whiptail, and San Diego horned lizard) due to their listed status or their designation as a special concern species. Only the Coastal Whiptail lacks these designations, but its inclusion is merited due to the continued reduction of available habitat.

The remaining six species, reviewed here, have merit for inclusion within the Plan. Three of the six species reviewed (two-striped gartersnake, northern red diamond rattlesnake, and Coronado skink) are designated as special concern species. The remaining three (San Diego banded gecko, coastal rosy boa, and San Diego ring-necked snake), while not covered by either a listed or designation status, are species that have had substantial reductions in available habitat. These species are therefore warranted as covered species in the Plan.

Three species not included in the Plan, but likely to have distributions within the core Plan area, are the south coast garter snake, silvery legless lizard, and coast patch-nosed snake. Each is designated as a special concern species, but is excluded from the Plan. These excluded species have spotty collecting and reporting data, and less is known about their overall habitat requirements. They are less commonly seen but share similar characteristics in their apparent population declines. The Science Panel recommends that these species be considered for coverage in the Plan.

Existing Data on Covered Species

The Plan relies heavily on distribution information from the CNDDDB, which is neither complete nor accurate for many of the species covered. As a result, the number of records within the Plan's focal area is biased towards those species most often recorded in the CNDDDB. Another issue with the CNDDDB data is its reliability, as the records are difficult to track back to their source (often based on visual identifications). As a result, the Plan's maps greatly underestimate the occurrence of species within the covered area.

A number of additional data sources are available. The first is information from museum records, which have the advantage of being linked to their source material. Museum voucher specimens reveal that there are additional records for all six of the species under review that provide localities not covered by the data used to construct the maps. For instance, museum voucher specimens of *Diadophis punctatus* are present from Sweetwater Reservoir (CNDDDB Map 16). Museum voucher specimens are also available for *Crotalus ruber* and *Thamnophis hammondi* for this area. This same exercise shows the presence of the species within the core conservation areas of the Plan is more extensive than what is reported from the CNDDDB.

Mapping of the species outside the Plan's area indicates that these species occur throughout many cismontane habitats (coastal sage scrub, chaparral, riparian corridors, grassland, and oak woodlands) and have a high likelihood of occurring within the core conservation areas. With incorporation of additional information, it would be expected that sampling error would be further minimized. The Science Panel recommends that maps show the distributions of species outside the Plan area to put them into geographical context.

Such museum information is freely available to any user through a number of online search engines. For the herpetological community, the most convenient is the distributed information from HerpNet, a community of 52 institutions with data from over 5.5 million specimens worldwide. This includes the SDNHM's data, which has the greatest number of specimen records relevant to this Plan. The Department of Herpetology (SDNHM) has assigned latitude and longitude information to each museum voucher specimen using the point-radius method of geo-referencing, which includes spatial error estimates.

Another source of herpetological data comes from the United States Geological Survey (USGS), Biological Resource Division. The USGS should be consulted for additional information that would be useful in developing this Plan, including many of their agency reports.

Overall, maps in the Plan are fairly crude given current GIS capabilities. There are no indicators on the maps to distinguish between types of information. Did all the data come from the CNDDDB? If not, then the location points should be coded to indicate their data source. And, some data sources may include breeding information, population size estimates, and the type of observation. If so, these should be indicated.

Species accounts for reptiles and amphibians should include a discussion of mapped localities, in addition to the localities drawn from the literature (mostly Glaser 1970 and Klauber 1934).

Ecological Profiles of Covered Species

Literature citations from the Plan's Appendix B species accounts for reptiles and amphibians seem inadequate for the information presented. As a result, the accounts appear more authoritative than they really are and it is difficult to impossible to verify some of the biological claims. With that said, they generally portray the animal's biology accurately. (Suggested edits to these accounts have been provided separately to the Water Authority.) Species accounts for reptiles and amphibians should use standard citation formats and explicit statements concerning the source of the information, including those from personal communications and unpublished data. For the latter two, the source and date should be indicated. Although returning to the source data is usually the best policy, sometimes more general citations provide a conservative description of biological information. It is sometimes desirable to describe range-wide information for the species when specific information is not available for the region under consideration (see the use of Zweifel 1952). Therefore, the Science Panel recommends that Stebbins (2003) be consulted.

Generally, the Plan's species accounts for reptiles and amphibians are inconsistent. For example, in chapter 6 (page 6-8), the Plan states that the amphibian and reptile nomenclature follows Crother (2001) and Crother et al. (2003). However, the nomenclature does not appear to follow these authorities (as detailed in Tables 2 and 3).

Table 2. Common Names for Reptiles and Amphibians Covered by the Plan

NCCP/HCP	Crother (2001), Crother et al. (2003)
Western spadefoot toad	Western spadefoot
Arroyo toad	Correct
Southwestern pond turtle	Southern Pacific pond turtle
Coronado skink	correct
Belding's orange-throated Whiptail	correct
Coastal western whiptail	Coastal whiptail
San Diego banded gecko	correct
San Diego horned lizard	Coast horned lizard
Coastal rosy boa	correct
San Diego ringneck snake	San Diego ring-necked snake
Two-striped Garter Snake	Two-striped gartersnake
Northern red-diamond rattlesnake*	Red diamond rattlesnake

*Subspecies not recognized by Grismer et al. (1994)

Table 3. Scientific Names for Reptiles and Amphibians Covered by the Plan

NCCP/HCP	Crother (2001), Crother et al. (2003)
<i>Spea [=Scaphiopus] hammondii</i>	<i>Spea hammondii</i>
<i>Bufo californicus</i>	correct
<i>Emys [=Clemmys] marmorata pallida</i>	<i>Actinemys marmorata pallida</i>
<i>Eumeces skiltonianus interparietalis</i>	correct
<i>Aspidoscelis hyperythrus beldingi</i>	<i>Aspidoscelis hyperythra beldingi</i>
<i>Cnemidophorus tigris multiscutatus</i>	<i>Aspidoscelis tigris stejnegeri</i>
<i>Coleonyx variegates abbotti</i>	correct
<i>Phrynosoma coronatum blainvillii</i>	<i>Phrynosoma coronatum</i>
<i>Charina trivirgata roseofusca</i>	<i>Lichanura trivirgata roseofusca</i>
<i>Diadophis punctatus similis</i>	correct
<i>Thamnophis hammondii</i>	correct
<i>Crotalus ruber ruber</i>	<i>Crotalus ruber</i> *

*Subspecies not recognized by Grismer et al. (1994)

Birds

Justification for Seeking Coverage

White-tailed kite (*Elanus leucurus*)

This species occurs in the study area and shows evidence of decline in San Diego County since the early 1980s. Factors likely responsible for the decline are continuing, and the Plan could contribute to recovery, or at least stem the decline; therefore, coverage is justified.

Sharp-shinned hawk (*Accipiter striatus*)

The species occurs in the study area (as an uncommon winter visitor only), shows no evidence of significant change in numbers through history, uses urban areas as freely as natural habitat, and the Plan will have no effect on its numbers. Therefore, there is little or no chance of listing the sharp-shinned hawk, and coverage is not justified. The sharp-shinned hawk is no longer listed by the CDFG as a species of special concern, there being no concrete evidence for population decline.

Prairie falcon (*Falco mexicanus*)

This species is not on CDFG's current list of species of special concern (contrary to what is stated in the Plan). The species currently occurs in the Plan area (areas actually affected by the Water Authority's activity or infrastructure) as a rare migrant or winter visitor only. It may have bred in very small numbers in the past (one nest site known at Fortuna Mountain in 1980 is now abandoned). The Plan is unlikely to have any effect on the species numbers, given that the cliffs where the species nests or might nest are not likely to be affected by Water Authority activities or infrastructure, and foraging habitat would not be affected significantly either. The Water Authority should consider dropping this species from coverage or providing more rationale for why impacts are expected to occur.

Burrowing owl (*Athene cunicularia*)

This species currently occurs in the Plan area, if the report of a colony along an aqueduct in Riverside County is correct, as well as at Sweetwater Reservoir as the result of experiments at reintroduction. It was once widespread in the area but has suffered almost complete population collapse in coastal Southern California. The lack of records within the project area likely reflects their absence from the right-of-way. They are unlikely to colonize the right-of-way on their own due to declining populations regionally. There are also very limited or no opportunities to contribute to the recovery of the species at the three conservation banks. The Plan could have a positive effect on the species, if it includes experiments at restoration or provides habitat in which attempts at restoration would be appropriate (rights-of-way along aqueducts would be appropriate). However, the outcomes of such experiments are uncertain. The Water Authority should reconsider whether coverage for this is warranted given the lack of impacts and challenges in providing meaningful conservation to contribute to species recovery.

Long-eared owl (*Asio otus*)

The species probably occurs in the Plan area, although in very low numbers. It was once far more numerous in the Plan area and is now recognized as a species of special concern by CDFG. It is very unlikely that the long-eared owl would become federally listed because it has a transcontinental distribution. State listing is also unlikely. Based on information in the Plan, impacts on this species are unlikely within the right-of-way. The Water Authority should consider dropping this species from coverage or provide more rationale for why impacts are expected to occur. The species is highly dispersive, so the Plan area may be on too small a scale for conservation at that level to be effective. Its conservation biology in California is too poorly known for appropriate means of conservation to be proposed. Therefore, the justification for covering the long-eared owl under this Plan is marginal.

Loggerhead shrike (*Lanius ludovicianus*)

The species occurs in the Plan area, in low density and discontinuously. The loggerhead shrike was once far more numerous in the Plan area and is now recognized as a species of special concern by CDFG so it could be listed at state level, although listing at the federal level is very unlikely. The scale of the Plan area and mitigation sites is adequate for realistic conservation efforts for this species. The Rancho Cañada and San Miguel mitigation sites, possibly the Crestridge site, are relevant to the loggerhead shrike. Therefore coverage under this Plan is justified as long as the conservation strategy contributes to the recovery of the species (per NCCP standards).

California horned lark (*Eremophila alpestris actia*)

The subspecies occurs discontinuously in the Plan area. It was once far more common, being called the commonest bird in Escondido in 1906. It has declined greatly, and was listed by the CDFG as a species of special concern in 1992. However, it is not on CDFG's latest in-press list

(and is not up to date in the Plan). The scale of the Plan area and mitigation sites is adequate for conservation efforts. Rancho Cañada and San Miguel are likely suitable mitigation sites. Also, onsite conservation along rights-of-way is appropriate for this species. Listing of California horned lark during the permit term is unlikely, but coverage under this Plan is justified. Note that the subspecies name should be corrected.

Yellow warbler (*Dendroica petechia*)

The yellow warbler occurs as a breeding species within the Plan area where mature riparian woodland crosses it. It has declined as a result of habitat loss combined with cowbird parasitism and is recognized as a species of special concern by CDFG. San Diego County is one of the primary centers for the yellow warbler in California. The scale of the Plan area and mitigation sites is adequate for conservation efforts. Listing of yellow warbler is possible only at the state level but will depend on whether the cowbird trapping programs directed at the least Bell's vireo can be maintained (yellow warbler has benefited greatly from these trapping programs). For now, coverage under this Plan is justified.

Grasshopper sparrow (*Ammodramus savannarum*)

The grasshopper sparrow occurs discontinuously within the Plan area. Much of its former range in Southern California has been urbanized, and the grasshopper sparrow is recognized as a species of special concern by CDFG. Listing of grasshopper sparrow is only possible at the state level during the permit term. The scale of the Plan area and mitigation sites is adequate for conservation efforts. Therefore, coverage under this Plan is justified.

Existing Data on Covered Species

White-tailed kite

Data from the *San Diego County Bird Atlas* (Unitt 2004 [“the Atlas”]), is sufficient to address the general status and provide a rough population estimate in the area. The species' site fidelity is low so specifying exact nest sites over a short period of time provides only a limited view of the species' breeding distribution. Its occurrence in Riverside County is likely but is not known in detail. Knowledge of distribution in San Diego County is rather sparse, but its distribution should not be restricted to known nest sites. Other relevant sources of data include Wildlife Research Institute reports. CNDDDB records, if any, of this species are undoubtedly very incomplete, as they are expected to be for any species not formally listed as threatened or endangered.

Sharp-shinned hawk

Data from the Atlas and annual Christmas bird counts are only sufficient to evaluate the general status of this species in the area, but not its numbers.

Prairie falcon

Based on the Atlas, the species does not currently breed in the study area. The closest sightings during breeding season are Pala–Temecula Road (Highway S16) and El Cajon Mountain. Nesting sites recorded in the Atlas are probably thorough but not exhaustive. Nesting in Riverside County within the study area is unlikely (no cliffs). The Wildlife Research Institute may have better data.

Burrowing owl

Based on the Atlas, the species is extirpated from the San Diego County portion of the study area, but the Plan mentions a colony in the Riverside County Portion of the Plan area. This is an important observation: more details of what was actually observed, numbers, exact location, and exact dates should be provided. Reported occurrence at the San Miguel mitigation site is vague: is the implication that a single bird was observed on only one occasion correct?

Long-eared owl

The listing of sites in San Diego County in the Plan is not exhaustive (worded so the question of exhaustiveness is unclear). Even after discovery of additional sites during field work for the Atlas, it is likely that the list of known sites is still far from exhaustive. The species' site fidelity in this region is also unclear; it may be low. The efficacy of efforts to conserve and restore this species is unknown.

Loggerhead shrike

The species' distribution within the Plan area is known in moderate detail, as a result of the Atlas. Its occurrence in the Riverside County portion of the Plan area is likely but not known in any detail. The Plan states that there are no CNDDDB records of the Loggerhead Shrike in the Plan area but does not say whether that database actually compiles data on the species on the California mainland.

Horned lark

The species' distribution within the Plan area is known in moderate detail, as a result of the Atlas. The Atlas results show the species near the rights-of-way in San Pasqual Valley, Miramar, and possibly elsewhere; a more detailed overlay is appropriate. Occurrence in the Riverside County portion of the Plan area is likely but not known in detail.

Yellow warbler

The species' distribution within the Plan area is known in good but not exhaustive detail as a result of the Atlas. The Plan mentions that the Yellow Warbler is known from the Rancho Cañada mitigation site without saying whether it is as a breeding bird or as a migrant; this distinction is critical for the yellow warbler, which occurs in the Plan area commonly as a migrant

as well as locally as a breeding species. Besides the sites listed in the Plan, breeding yellow warblers also occur along the San Dieguito and San Diego rivers near where these cross the rights-of-way.

Grasshopper sparrow

The species' distribution within the Plan area is known in good but not exhaustive detail as a result of the Atlas. It is not clear from the Plan whether the sites of the "core areas" for the species in Riverside County are part of the Plan area. The Plan states that "there are CNDDDB records of grasshopper sparrows near the rights-of-way or other facilities," but if so they are not plotted on the maps provided.

Ecological Profiles on Covered Species

White-tailed kite

The summary of this species' range in the Plan has many errors. See edits to the ecological profiles of birds in a separate file provided to the Water Authority, their consultants, and the wildlife agencies.

Sharp-shinned hawk

The sharp-shinned hawk has no preference for native versus landscaped habitats during the winter.

Prairie falcon

The Plan should say "This species is a rare breeding resident in *inland* [not coastal, as it says now] San Diego and Riverside counties."

Burrowing owl

The summary should refer to http://www.albionenvironmental.com/inside_proceedings.pdf for possibly relevant additional information. The burrowing owl is suffering decline range-wide, and the problem needs to be addressed in a range-wide context. Actions taken on the scale of this Plan alone may be on too narrow a scale to be effective. There may be factors beyond those listed in the Plan contributing to bad population dynamics.

Long-eared owl

It's not clear why the Plan says for the long-eared owl that "county population would not be considered significant to the genetic makeup of this North American subspecies." Some other organisms on the list of covered species also have a wide distribution outside the Plan area. Oak groves as well as riparian woodland should be listed as the species' habitat (they are currently more frequently used in the Plan area than riparian woodland).

Loggerhead shrike

The loggerhead shrike's distribution may shift with fire, the birds moving to exploit intermediate successional stages. Partly recovered scrub or chaparral (with considerable open ground remaining but some shrubs grown large enough for nest sites) is favorable to the shrike. Because a patchwork of disturbed open ground is favorable, disturbed rights-of-way along aqueducts may offer suitable habitat.

Horned lark

In the statement of the subspecies' range, the Plan failed to mention that *Eremophila alpestris actia* ranges as a breeding bird well south in northwestern Baja California. The statement that numbers of horned larks in Southern California are significantly augmented in winter by migrants of other subspecies is probably no longer true, if it ever was (see Patten et al. 2003). The account for this species should emphasize that it is susceptible to range reduction and habitat loss through habitat fragmentation (like many ground-nesting birds) but that it also readily colonizes disturbed habitat and burned areas. Conservation focused solely on conserving natural habitats is incomplete with respect to the horned lark.

Yellow warbler

The recovery of the yellow warbler in San Diego County appears to be linked to the maintenance of riparian woodland and widespread cowbird trapping. Prolonged drought, groundwater pumping, and preventing water from reaching natural stream courses could all eliminate riparian woodland and reverse the yellow warbler's recovery. With respect to the Rancho Cañada mitigation site, the Plan misleadingly says that it includes "associated upland habitats that could be used by this species"; in the Plan area breeding yellow warblers are exclusively riparian, frequenting the canopies of mature trees and not using upland habitats to any significant extent.

Grasshopper sparrow

The grasshopper sparrow is notoriously irregular in abundance and local distribution from year to year. At least some of this irregularity appears linked to cycles of rain and drought, the birds being more numerous or at least more conspicuous after wet years and few or inconspicuous following prolonged drought.

Mammals

Justification for Seeking Coverage

Los Angeles little pocket mouse (*Perognathus longimembris brevinasus*)

Little information about the pocket mouse is available regionally, or within the actual Planning area. However, suitable habitat within the Plan area likely exists. Many biologists believe that this subspecies is in serious decline within western Riverside County, which suggests that coverage is warranted.

Dulzura pocket mouse (*Chaetodipus californicus femoralis*)

The distribution of the Dulzura pocket mouse is relatively wide, and the species does occur within the Plan area. Experts consider this species to be at risk, but it is difficult to quantify the potential for this species to become seriously threatened in the future; however, continued habitat loss, degradation, and fragmentation will continue imperiling this species. Coverage for this species is well justified.

Southern grasshopper mouse (*Onychomys torridus ramona*)

The southern grasshopper mouse has been a very difficult species to assess and monitor; it is not typically captured using standard small-mammal trapping protocols, and non-lethal methods and monitoring are technically challenging and expensive. However, this species has been documented within the Plan area. Before coverage can be granted, appropriate assessment protocols should be developed. Given the difficulty in assessing this species, its listing may be unlikely during the permit term. Due to the lack of data on occurrences and conservation needs, the Science Panel recommends that this species not be covered in the Plan.

San Diego woodrat (*Neotoma lepida intermedia*)

This species is wide ranging, and is known from the Plan area and the proposed mitigation lands. As with all of the small mammals proposed for coverage, the San Diego woodrat is similarly susceptible to habitat loss, degradation, and fragmentation. However, given its habitat requirements and natural history, this species is also very susceptible to the impacts from fire. As a species of special concern in California, there is a potential for future listing, suggesting that coverage is warranted.

Existing Data on Covered Species

The Science Panel recommends that additional sources of data be consulted, particularly the *San Diego Mammal Atlas* (in press; Mammal Atlas). While not yet in publication, a considerable amount of information has been collected for many of the covered species, and wildlife-habitat associations have also been generated.

Ecological Profiles on Covered Species

The profiles generated for these species closely follow many of the profiles provided in other regional conservation Plan efforts. However, as regional information increases, it would be useful to consult the biologists working on the San Diego Mammal Atlas for more regionally specific information.

Other Species

Justification for Seeking Coverage

All five species of invertebrates have extensive justification for inclusion in this report. The three fairy shrimp species are all federally listed as threatened or endangered, and have been designated with critical habitats. The vernal pools that they are associated with are also protected. Of the two butterfly species, the Quino checkerspot is federally listed with designated critical habitat. Hermes copper is not currently listed, but a proposal for listing was reviewed by the USFWS last year and denied. Following the 2007 fire season, the known populations have been greatly impacted and the proposal to list the species will undoubtedly be resubmitted. The County of San Diego has been interested in this species for a number of years. Its inclusion in the Plan is justified. Additionally, the dunn skipper should be included in this document. There are no other species of invertebrates that have any formal listing that would be impacted by projects related to the Water Authority at this time.

The other species reviewed was the arroyo chub (fish) that occurs in many of the fresh water streams in San Diego and Riverside Counties. The species is often an indicator of changes in water quality in fresh water streams and is listed by the CDFG as a species of special concern. Inclusion in the Plan is justified because of the pipeline routes that do impact possible habitat.

For these species, the justification for coverage is more than adequate, with the exception of Hermes copper butterfly (according to the USFWS). However, there are adequate data within the impact area of this project for this species.

Existing Data on Covered Species

For all species addressed (including the dunn skipper), there is adequate data available on distribution, biology, and impacts that affect populations. A number of these species, such as the Quino checkerspot, are monitored yearly by the USFWS. A recent Master's thesis on Hermes copper by Dan Marcelack contains a list of all known occurrences of this species. The baseline inventory prepared for the MSHCP in Riverside County may provide additional occurrences in Riverside County for all of the covered species. The USFWS Riverside office is the lead agency for this inventory.

Ecological Profiles on Covered Species

The habitat requirements for each of these species are documented. A weakness is that the various preserves available as possible mitigation areas have not been assessed for suitability for all of the species, except Quino and perhaps Hermes. The impact of recent fires has been significant in some of these locations and will need to be reassessed, especially in northern San Diego County.

2.1.1.2 Options for Levels of Coverage

In seeking coverage for a species there are several options available, some of which fall short of a take permit under the federal ESA and state NCCP Act. The Water Authority may wish to consider reduced levels of coverage for species that do not meet all of the criteria outlined above. including:

- **ESA and state coverage** under Section 2081 of the Fish and Game Code. This is available now for state-listed species only. However, species could be addressed to enable a 2081 permit application in the future in the event that a species is state listed during the permit term.
- **ESA coverage only.** This would apply to species not currently state listed, and would provide federal coverage using a mitigation standard and remove the need to contribute to species recovery.
- **“CEQA species.”** No take permit would be issued because the species is not listed and is unlikely to become listed in the permit term, but the conservation measures could address CEQA requirements to reduce impacts to a level below significance. This could streamline CEQA compliance for future Water Authority projects.
- **Conditional coverage.** Coverage provided later in the permit term once thresholds for data standards or other thresholds are met, allowing an easy or automatic coverage without going through a time-consuming formal permit amendment process (e.g., this approach was used for some species in the Clark County, Nevada MSHCP). Conditional coverage only works if the thresholds are defined very clearly.

2.2 Natural Communities and Ecosystems

2.2.1 NCCP Definitions and Data

The NCCP Act uses several important ecological terms that relate to the findings that CDFG must make at the end of the planning process in order to issue permits. These terms are undefined in the NCCP Act. To ensure that they are addressed in the Water Authority NCCP, we recommend that they be defined for the Plan. Suggested definitions for these terms are:

- **Ecosystem function**—The sum total of processes operating at the ecosystem level, such as the cycling of matter, energy, and nutrients (Mooney et al. 1995). Ecosystem functions include such biological and physical processes as dispersal, predation, pollination, decomposition, nutrient cycling, and energy fluctuations.
- **Biological Diversity (or Biodiversity)**—The variety of organisms considered at all levels, from genetic variants of a single species through arrays of species to arrays of genera, families, and higher taxonomic levels; includes the variety of natural communities and ecosystems (Lincoln et al. 1998).
- **Ecological integrity**—Ecosystems have *ecological integrity* when their native components are intact, including abiotic components, biodiversity, and ecosystem processes.
- **Environmental gradient**—A shift in physical and ecological parameters across a landscape, such as changes in topography, climate, land cover types, or natural communities.
- **Natural community**—A collection of species that co-occur in the same habitat or area and interact through trophic and spatial relationships. Communities are typically characterized by reference to one or more dominant species (Lincoln et al. 1998).

In order to demonstrate that these ecological features are adequately addressed, we recommend that the Plan describe how these features will be conserved within the proposed conservation sites.

2.3 Stressors and Threats

Stressors and threats come from two sources: 1) impacts from covered activities (e.g., direct disturbance, effects on hydrology and geomorphology, use of chemicals); and 2) larger-scale stressors such as fire, introduction of exotic species, or other human activities. Because there is so much edge within the rights-of-way, stressors such as invasive species will be of particular concern for managing the species on site.

It is critically important to identify and prioritize the stressors and threats in the study area for each of the covered species, and the proposed monitoring must include the stressors and threats. When major stressors are identified, clear connections are provided to the benefits of the proposed management commitments and minimization or mitigation, with clear links back to goals and objectives.

The Science Panel recommends that conceptual models be developed to help identify and prioritize these stressors and threats. It is also important to clearly define areas of uncertainty in the magnitude of the impacts and the potential species' response. Ideally, conceptual models would be developed up front, but these could also be set forth later in the process as an early step in implementation. Conceptual models could be simple and tie the stressors and threats to the biological goals and objectives, and could be limited to the factors over which the permittee has control.

Stressors should be quantified and trends identified when data are available, characterizing impacts on ecosystem, habitat, and species. At minimum, it is important to provide a qualitative assessment of stressors that can be integrated into a long-term monitoring program; stressors can then be understood as they relate to particular covered species. A matrix linking the stressors with the covered species would be very helpful and would allow illustration of the number of stressors affecting a species and the particular stressors that affect the most number of species. As an example, a matrix ranking stressors as 0 = no effect, 1 = low effect, 3 = moderate effect, 5 = high effect could be used for both the covered species and the natural communities within the Planning area.

3.0 Conservation Strategy

3.1 Guiding Conservation Principles for Plan Development

The conservation plan, as outlined in Chapter 6 of the Plan, works to avoid, minimize, and mitigate the potential impacts that permitted activities may have on the covered species and/or natural communities. The Plan describes the conservation strategy and the process by which implementation occurs. This process includes onsite avoidance and minimization, along with on- and off-site mitigation and restoration.

The need to protect the listed species and to mitigate for incidental “take” of protected species or impact on critical habitat is addressed for all the proposed species. This topic will need to be addressed again in relationship to newly acquired reserves such as Manchester, San Luis Rey River Site, and Rancho Cañada. Habitat assessment for each potentially impacted species for mitigation on these properties would have to be done at the time the impacts occur and not just at some earlier date because of the possibility for the site to change over time as a result of fires, nearby construction, or other factors. Monitoring of these mitigation sites must be ongoing for each anticipated impact.

3.2 Biological Goals and Objectives

The first step in any conservation program involves the development of goals and objectives. Goals should express a clear statement of the information and value provided by the program. Goals should be simple and clearly defined—not open to interpretation. Goals and objectives should have realistic temporal and spatial scales—readily measured or assessed through monitoring.

Many HCPs have developed hierarchical goals, ensuring that high-priority goals are clearly linked to more specific objectives. Where possible, the proposed goals should be designed in rigorous, quantitative terms that help suggest potential indicators to measure in order to assess long-term success. Overall, goals should provide a clear description for what the conservation or management program is supposed to do, with the monitoring data clearly informing whether or not goals are being met.

Objectives must be defined and directly linked to the goals. In essence, monitoring objectives are supposed to support the goals, providing information for decision-makers. Objectives should describe desired outcomes, focusing on what actually needs to be measured.

It is recommended that all goals from the Plan be synthesized into a single section or table at the beginning of the Conservation Strategy chapter. There are several goals already stated in

the Plan, such as the preservation of wildlife connectivity within the Water Authority right-of-way. Objectives could be developed beneath this goal, and others. For example:

- Goal 1: Preserve and maintain connectivity across the landscape to enable covered and other native species to move freely through Water Authority right-of-way. (Another goal regarding connectivity could be developed for the mitigation sites. The Plan could better demonstrate how these mitigation areas maintain and enhance connectivity in the landscape using additional figures.)
 - Objective 1.1. Restore native habitat on Water Authority right-of-way to, when feasible, enhance wildlife movement.
 - Objective 1.2. Minimize the spread of exotic species to maintain native habitat that will provide connectivity.

The Science Panel further recommends that goals and objectives be developed for groups of species with similar habitat requirements (e.g., riparian species, vernal pool species). Also, the Science Panel recommends that the Plan work toward developing species goals and objectives that are tied to the feasibility of contributing to recovery and the ability to measure a quantitative response. For example, for very rare or threatened species the objective for the species should be to enhance the population in such a way as to be able to clearly demonstrate a contribution toward recovery and for which the Water Authority can affect and measure a population increase (e.g., Munz's onion, prostrate navarretia, vernal pool shrimp, Hermes copper). For more wide-ranging species for which Water Authority conservation actions will not greatly affect the population, the goal should be to maintain or enhance suitable habitat (e.g., Quino checkerspot, grasshopper sparrow, San Diego woodrat).

A no-net-loss standard is implied in the Plan as a biological goal or objective for many (or all?) of the covered species. It is unclear whether this standard applies to species habitat, populations, or individuals. This should be clarified for the biological goals. The units should vary by species depending on what makes the most sense biologically and whether data are available to inform the biological goals.

A no-net-loss standard does not meet the NCCP requirement of contribution to recovery, which means that a net benefit is provided for the species. The Water Authority may be able to demonstrate contribution to recovery for the species that occur on the mitigation sites if those populations are larger and more viable than the populations on the pipeline easements. However, for those species that rely on restoration for their conservation, a no-net-loss standard requires successful restoration or creation of habitat or species populations. Biological goals that rely on restoration should be limited to the species and habitats where there is a high degree of confidence of success.

The Science Panel is uncertain whether it is compatible with Water Authority operations to enhance populations of the covered species within their right-of-way. Increasing populations of covered species will create potentially more mitigation requirements and more constraints on covered activities. Some enhancement activities may need to occur off-site to avoid this conflict. There may also be issues with species expanding outside the right-of-way onto adjacent private

land. The Science Panel recommends that additional detail be provided to demonstrate the compatibility of onsite population enhancement and covered activities.

3.3 Feasibility of Restoration

The conservation strategy relies on the success of onsite habitat restoration as the primary conservation action for many covered species. The Plan should demonstrate through citations or examples of successful projects whether restoration of habitat is likely to work. To address the risk that restoration may not work, and the temporal loss of habitat, the Water Authority should consider mitigating off-site in addition to onsite restoration.

The Plan addresses species-specific needs of each covered species but needs to include this in relationship to each of the potential mitigation sites. Restoration may not be possible for some areas simply because it is the wrong plant community. Mitigation might be best if two independent sites were obtained and monitored rather than depending on a single location. Augmentation of a habitat might often be a better approach than restoration in order to support populations of the impacted species.

The Advisors recommend that onsite restoration should be the first priority when the right-of-way has relatively high biological value, but not when it has low value. Sites with high biological value are likely to be within a larger matrix of high priorities for conservation in the regional HCPs and NCCPs:

- MSCP and MHCP = Core Habitat and Linkages (Note that the legend should be corrected in Figure 4-3 of the Plan)
- Western Riverside County MSHCP = Criteria Cells
- 15 linkages identified by the South Coast Wildlands project in the South Coast Ecoregion (planning for all 15 linkages was recently completed; data are available on line)

3.4 Conservation Evaluation of the Covered Species

A primary focus in the Plan is for the conservation of vegetation types as habitat for the covered species. This approach is warranted for a multi-species HCP and NCCP. To implement this approach, the Plan relies on the application of mitigation ratios that vary by vegetation type (Tables 6-5 and 6-6).

A mitigation ratio is not identified for several vegetation types, but the rationale for this is unclear. The Science Panel recommends a ratio of at least 1:1 mitigation for impacts to southern mixed chaparral and nonnative grassland for all impact categories because these communities support several covered species. If the Plan is taking a habitat-based approach to mitigation, it needs to offset impacts on these habitats to adequately mitigate for species impacts.

To demonstrate contribution to recovery for the suite of species in coastal sage scrub, we also recommend mitigating at 2:1 for permanent impacts outside preserves (the same as inside preserves). Coastal sage scrub that occurs outside designated preserves may contain high-quality habitat for many of the covered species.

We caution that saltpan mitigation at 2:1 may not be feasible given the extreme rarity of this vegetation type. It is unclear from Table 5-2 whether there are any impacts to this vegetation type, so perhaps this is not an issue.

It is unclear why mitigation ratios are identified for vegetation types for which there are no impacts. Are these mitigation ratios established in the event of impacts from emergency activities or pipeline ruptures? If so, this should be clarified. Mitigation ratios are not needed for vegetation types with no impacts.

It is appropriate to mitigate impacts to multiple species based on habitat or vegetation types. However, the document needs to make a clearer connection between the vegetation types and the covered species to ensure that the habitat-based approach will adequately conserve the covered species. A simple matrix linking the species and the vegetation types would be a helpful addition. Some species will require more description if they require specific habitat elements such as host plants or soil types within a particular vegetation type.

Proposals in the Plan for the conservation of the covered species that warranted coverage (see discussion above) are, for the most part, adequate. However, the Science Panel offers the comments in the subsections below on the adequacy of conservation for specific species. Species recommended to be dropped from coverage in the Plan are not discussed.

Plants

The overall conservation strategy for covered plant species relies on “avoidance of all major plant populations, narrow endemic species, and critical locations in Water Authority ROW” and/or “conservation within habitat conservation banks.” The management actions for plants included in Appendix B of the Plan are generally applicable “best management practices” that are reasonable to apply to all covered species; however, there are not many species-specific management actions provided (see p. 6-42, which states “Species specific management actions will be implemented as necessary to enhance or protect habitat quality and increase population size”).

Appendix B does not seem to include species-specific information about “enhancing declining populations, restoring damaged habitat, and establishing seed banks.” Is there a plan to collect seed or propagate plants from covered species to use in restoration? How would seed banks be established (what is the seed source)? Pre-activity surveys are a good idea, but with some plant species (i.e., annuals) it is not going to help if the surveys are done at the wrong time of year and populations or seed banks are physically disturbed because they are not readily apparent. Some of the covered species (such as *Githopsis diffusa*) are cryptic species that are difficult to

find, and the Environmental Surveyor would need to be sufficiently skilled in locating such species. Collections at the SDNHM are available for examination by appointment, and would help with identification.

On p. 6-34 under the heading “Erosion Control at Construction Sites” the Plan states that nonnative cover crop species such as *Plantago insularis* may be used in areas or slopes prone to high levels of erosion. The Science Panel does not recommend using nonnatives for erosion control (and *P. insularis* is not documented as occurring in San Diego County).

Rainbow Manzanita

Appendix B of the Plan does not mention fire as a threat or consideration. It is not known what the effect would be of fire (particularly frequent fire) on this species. Because of its limited distribution, it could be in danger of being wiped out by repeated fire events. Also, it will not occur in the habitat conservation banks, so care must be taken to avoid loss of this species.

Smooth Tarplant

The management actions mention conserving “80% of populations within project footprint,” yet this appears to be the only plant species for which a target percentage is specified. Why is that?

Chaparral bear-grass

Appendix B does not mention fire as a threat or consideration.

Munz’s sage

Appendix B does not mention fire as a threat or consideration. While Appendix B states that the species is relatively common in northern Baja California, it must be remembered that there has been substantial human disturbance in recent years along the border region, so it is not prudent to count on a reservoir of such border species in Baja California.

Herpetofauna

For the six amphibians and reptiles evaluated, the Plan relies heavily on the offset of mitigation lands as the key conservation measure. While it is probable that these species occur in the mitigation properties, it is difficult to evaluate this claim because the boundaries of the three properties (Rancho Cañada, San Miguel, and Crestridge) were not detailed in this report (Appendix I not included). Most of the claims for the presence of species are made from anecdotal accounts. There is no discussion of the threat of habitat conversion due to the spread of invasive plants, nor the direct problem of predation by exotic species such as the bullfrog. This is likely a severe problem with the two-striped gartersnake, as well as, the Southern Pacific pond turtle, arroyo toad, and western spadefoot (especially juveniles or tadpoles of these

species). Water quality is a concern for the two-striped gartersnake, pond turtle, and arroyo toad (especially their tadpoles). Chytrid fungus is an additional concern for the two frog species.

Birds

White-tailed kite

Threats include urbanization of grassland needed for foraging, drying of the climate, reducing the population of voles (the species' primary prey), and killing off trees where the birds nest (and possibly the proliferation of crows and ravens, kleptoparasites of the kite).

Prairie falcon

Restoration or augmentation would be dependent on reintroductions (as done with the Peregrine falcon), not on manipulation of habitat, provided that adequate nest sites and foraging habitat are available. Threats include human disturbance near nest sites, urbanization of grassland, and prolonged drought that can suppress the abundance of prey below the level needed to support the species.

Burrowing owl

Because this species has suffered population collapse over such a wide area, deliberate restoration as well as conservation of adequate habitat is likely needed for long-term survival. Techniques for restoration are still experimental. Threats include habitat fragmentation (probably mediated through road kill) and increase of predators facilitated by the planting of trees and erecting of artificial structures in the owl's habitat. A major question remaining is the extent of conserved habitat in which restoration has a chance of being effective. Conservation of the remaining colony near Temecula may entail conservation of habitat beyond that controlled by the Water Authority. What kinds of maintenance and/or development does the water authority plan for this site?

Long-eared owl

Precise factors responsible for this species' decline are not well known. Human disturbance, light pollution, and the proliferation of crows and ravens may all be contributing factors, and experimentation is likely necessary before effective conservation and restoration measures can be proposed. Threats include habitat loss, human disturbance, light pollution, and the proliferation of ravens and crows. Other factors yet unknown may also be important. The Tijuana River valley mitigation site may be appropriate on the basis of habitat but not on the basis of human disturbance and light pollution. Because the species is now so rare in Southern California, its population density is low and the birds are lacking from most apparently suitable habitat. Because the species is highly dispersive, conservation probably needs to be addressed at a scale broader than the water authority's Plan. Is there any biological basis for specifying a radius of 300 feet for avoidance of disturbance around nests? Citations? Nests of the long-

eared owl are very inconspicuous; they could easily be overlooked without considerable effort at a search.

Loggerhead shrike

The relative contribution of habitat loss, habitat fragmentation, or other factors leading to the decline of the loggerhead shrike is not well understood. Like the burrowing owl, the shrike appears to be suffering adverse population dynamics on a broad scale, perhaps too broad for a relatively narrow plan like that for the Water Authority to address in isolation. Threats include habitat loss and fragmentation, possibly pesticide poisoning, and likely other broad-scale factors still not identified. Because the shrike readily uses disturbed open ground, onsite mitigation is appropriate for this species, if Water Authority rights-of-way are embedded in other semi-open habitat. Rights-of-way that are regularly disturbed could offer habitat usable for the shrike, provided that scattered shrubs or small trees suitable for nesting are nearby. Planting of a few dense-foliaged, preferably spiny shrubs would be a habitat enhancement possibly beneficial to the shrike. Controlled burning is a management technique that could probably be used for the shrike's benefit (and evaluated with follow-up monitoring)

Horned lark

Because, like other ground-nesting birds, the horned lark clearly suffers from habitat fragmentation, the size of fragments still useful to the species over the long term needs to be identified. Threats include habitat loss and fragmentation through urbanization. The horned lark responds positively to disturbance, using bare ground with only scattered weedy vegetation. Therefore maintenance of rights-of-way could benefit this species incidentally, much as the firebreaks on ridge tops on Miramar are horned lark habitat. Also, the horned lark responds positively to fire, using burned areas before the recovering vegetation becomes too dense. The horned lark avoids steep slopes, using flat to gently sloping terrain. The suitability of the mitigation sites needs to be considered in this context; the Plan does not describe the topography of any of these sites. The Plan states that "a 50-foot to 100-foot buffer around active nests should be maintained if work must be done during the nesting season in habitat occupied by this species. An Environmental Surveyor will monitor if work will be done near an active nest." Also, "Destruction of active nests is not allowed." However, horned lark nests, though placed on the ground, are very difficult to find. The birds typically slip away from them when an intruder is more than 50 to 100 feet away, depending on the topography.

Yellow warbler

The yellow warbler has benefited from the trapping of brown-headed cowbirds intended for the benefit of the least Bell's vireo. Reduction of this trapping has been proposed in an effort to wean the victim species off this intensive method of management. If trapping is reduced, the effect of the reduction on species other than least Bell's vireo, such as the yellow warbler, needs to be assessed. Furthermore, the effect of trapping on the cowbirds themselves is not well known: what level of trapping and what density of traps is needed to maintain an acceptably low

level of parasitism over how large an area? Threats include habitat loss through urbanization, over pumping of ground water, prevention of water from reaching natural stream courses, and prolonged drought (also, replacing native riparian woodland with invasive plants (especially *Arundo donax*) and cowbird parasitism). Maintenance of stream flows through at least the early part of the summer is critical to the survival of the yellow warbler (and other riparian birds). The Water Authority's activities should allow for this. By locking all water up in reservoirs and pumping the water table down, the water authority could affect the yellow warbler (and other riparian birds) negatively even if no riparian habitat is deliberately removed.

Grasshopper sparrow

The grasshopper sparrow's habitat plasticity under various rainfall regimes is still unclear. The species uses grassland, but the sparrow's definition of grassland is more flexible than that of vegetation ecologists defining vegetation communities. How great a density of shrubs does the sparrow tolerate, and how does this density vary from wet years to dry years? Similarly, to what extent, in Southern California, does the grasshopper sparrow use grassland lacking any native component, and how does this use vary from wet years to dry years? The grasshopper sparrow's fire ecology in Southern California is not well known. Fire may enhance native grasses or exotic ones according to various factors. Controlled burning could be a useful management strategy, but this needs basic investigation. Threats include urbanization of grassland, invasion of exotic weeds, and prolonged drought. The grasshopper sparrow was excluded from the metropolitan San Diego MSCP because of the lack of adequate conservation of grassland. Therefore, the Water Authority's Plan cannot rely on this previous plan to claim coverage of the grasshopper sparrow. The Plan states that "a 50-foot to 100-foot buffer around active nests should be maintained if work must be done during the nesting season in habitat occupied by this species" and "destruction of active nests is not allowed." However, nests of the grasshopper sparrow are among the most difficult of all bird nests to find. It will be very easy for someone to claim "there's no nest" when there really is one. Have techniques for restoration of native grassland on disturbed soil been developed? If so, citations for the techniques to be followed are needed.

Mammals

For mammal species, the proposed generalized minimization, avoidance, and mitigation measures are appropriate.

Los Angeles little pocket mouse

The distribution of this species is largely within the Los Angeles Basin, but populations are known from western Riverside County. The Plan states that O&M operations may impact up to 10 acres per year of potentially suitable habitat, and incidental take may occur. The proposed minimization and mitigation for onsite impacts are appropriate and reasonable. However, off-site mitigation in San Diego County is likely not a suitable option because the proposed mitigation

banks will likely not contain the species or suitable habitat. Off-site mitigation in Riverside County should be included in the conservation strategy.

Dulzura pocket mouse

Direct and indirect impacts on the species may occur due to habitat loss, degradation, and fragmentation.

Southern grasshopper mouse

The main threats to this species include habitat loss and fragmentation, particularly in grassland and sparsely vegetated sage scrub habitats.

If this species is covered, more species-specific minimization and mitigation measures are necessary, particularly given the unique nature of this small mammal. However, these actions may be difficult to develop given the limited information and understanding that exists for this species.

San Diego woodrat

The proposed on- and off-site mitigation and minimization measures are appropriate for this species.

Other Species

Proposals in the Plan are, for the most part, adequate for the covered invertebrates and fish. However, continual habitat monitoring needs to be implemented for these taxa. In some cases, habitat may need to be prepared in advance of possible impacts. Each covered species needs to be defined by at least the minimum environmental requirements to support a population. Using Quino checkerspot as an example, the property would need to contain mesas or south facing slopes, opening in the chaparral, soil crusts, at least two primary larval host plants, harvester ant colonies, adult nectar sources, and available hilltops. Additional enhancement would also be beneficial but would not necessarily be required. This approach should be taken for each species in relationship to its known and historic range.

3.5 Protection of Ecosystem Processes and Critical Linkages/Connectivity

The Plan acknowledges the importance of protecting critical landscape linkages and maintaining habitat connectivity. The reality is, however, that the creation or protection of linkages to maintain contact with other species' populations may have passed. It may also be that the best connectivity between populations may be along the aqueduct or pipeline route, and not near some of the mitigation banks. For insects, there is often adult dispersal during years of high population densities that help to establish satellite colonies. This is especially true of Quino checkerspot. Dispersal distance may be five miles or farther. Disjunct populations can therefore maintain some gene flow in widely separated locations.

However, with Hermes copper, they would rarely be expected to disperse more than 50–100 yards in a single season. The butterfly also tends to follow the habitat containing its larval host plant. Populations behaving this way can fragment easily and recolonization may take years. If there are additional barriers to dispersal, the insect is unlikely to establish even if the habitat is again suitable.

For each species of plant or animal in an ecosystem, gene flow is necessary to maintain the integrity of the species. For animals that can fly, movement is easier compared to those that can only walk or crawl. Highways, fenced and concrete-lined drainages, construction projects, or the transformation of natural habitat into artificial parklands can restrict the free flow of animals. Seed distribution in plants, other than wind aided, can be reduced by physical barriers. Wildlife corridors for dispersal can be looked at as movement from east to west and from north to south. However, it can also include ridge lines, food sources, water, light exposure, cover, and other factors.

Most of the mitigation sites are already isolated to some extent. The existing aqueduct routes are adjacent to major highway, flood control channels, housing developments, agriculture, and airports. Successful mitigation may require not only suitable habitat but the relocation of species impacted by future projects. Monitoring of introduced colonies or individuals is needed to assess results. This is an issue that still needs to be addressed for each covered species as it relates to the mitigation ratios.

3.6 Evaluation of the Seven Tenets of Reserve Design

As part of the typical scientific review process, advisors are asked to review the tenets of reserve design and how they have been applied in the particular HCP/NCCP. In this unique case, the project area is linear, and the proposed mitigation areas are, for the most part, already established. Therefore, there is no clear opportunity to review whether the Plan adequately addresses the tenets of reserve design.

The Science Panel recommends that the Plan provide more details on the conservation values of the three established conservation areas (Rancho Cañada, San Miguel, and Crestridge) and the in-process banks (San Luis Rey River, Manchester, and Tijuana River Valley), as well as how they are expected to support the covered species and meet the tenets of reserve design. Factors that should be evaluated include the contribution of these sites to the regional conservation strategies of the MSCP and MHCP and their connectivity to other protected areas.

3.7 Evaluation of Mitigation Areas

For the proposed covered species, it is not clear, or demonstrated, that the proposed avoidance, minimization, or mitigation measures contribute to recovery for these species. An analysis follows of the ability of the proposed conservation areas to adequately conserve the evaluated covered species.

Plants

Two of the covered plant species under this review are *Allium munzii* and *Arctostaphylos rainbowensis*. These plant species are only known from very specific geographic areas and therefore cannot be expected to occur in conservation areas located elsewhere. *Allium munzii* has not been documented in San Diego County (it is known from western Riverside County) and has low probability of occurring in any of the proposed banks. Similarly, *Arctostaphylos rainbowensis*—which is represented by 11 specimen occurrences in the Plant Atlas/Herbarium database (all located in northwest San Diego County along the border with Riverside County)—is unlikely to occur in any of the banks. There is a similar concern for *Centromadia parryi* ssp. *australis*.

Rainbow Manzanita

It is not known what the effect would be of fire (particularly frequent fire) on this species. Because of its limited distribution, it could be in danger of being wiped out by repeated fire events. Also, it will not occur in the habitat conservation banks, so care must be taken to avoid loss of this species.

Smooth Tarplant

The management actions mention conserving “80% of populations within project footprint,” yet this appears to be the only plant species for which a target percentage is specified. Why is that?

Herpetofauna

Management activities include pre-activity surveys and minimization plans to limit degradation of habitat, and in the case of the two-striped gartersnake, exclusion fencing. General surveys should be expanded to include the mitigation properties (Rancho Cañada, San Miguel, and

Crestridge) to ensure the presence of these species, in addition to their continued persistence on these lands. In addition, exotic species eradication should be included in the management strategy. This is especially important because the Plan's area includes major reservoirs that often serve as the source populations to the spread of exotic species, such as the bullfrog (eradication of exotic turtle species would also serve the Southern Pacific pond turtle). Maintaining and improving water quality of reservoirs and streams is recommended. Sampling for the presence or absence of chytrid fungus should be included for the two frog species.

Red diamond rattlesnakes are important members of the natural landscape and serve as both predator and prey. As mid-level species in the natural community, this large-bodied snake can serve as an indicator species for the overall health of the Plan area. Surveys should be undertaken to evaluate the health of this species in the mitigation areas, as its presence would indicate healthy predator-prey populations.

Birds

Burrowing owl

The Plan recommends considering "translocation of individuals to currently unoccupied, suitable habitats through the creation of artificial burrows." Is there unoccupied suitable habitat on Water Authority land? Proven successful techniques for translocation need to be cited, or how experiments will be conducted and their efficacy will be tested need to be specified. Are sites of translocation ones that can be sustained indefinitely, entailing maintenance of ground squirrel colonies? Otherwise sites may become overgrown and no longer suitable. Any translocation will require indefinite monitoring.

Long-eared owl

The Plan mentions mitigation sites (San Miguel and Crestridge) lacking habitat appropriate to the long-eared owl; these should be deleted. Figures for total acreage of natural habitats are not very relevant to the long-eared owl; figures for woodlands alone are needed.

Loggerhead shrike

The Plan states that "the total suitable habitat on these [mitigation] banks is approximately 866 acres" without saying how suitable habitat is defined. It also states "Impacts to potential native habitat from CIP projects is estimated at approximately 133 acres and O&M operation may impact up to 22 acres per year of native habitats." Because disturbance of the Water Authority's rights-of-way, etc., may actually be favorable to the shrike by keeping the habitat open, these figures are an oversimplification.

San Luis Rey River site

This site is impossible to evaluate without more details of the habitats included and whether they are contiguous to other conserved habitats. The site is probably relevant to the yellow warbler (under the assumption that it contains mature riparian woodland), possibly relevant to the white-tailed kite and long-eared owl, probably not relevant to the horned lark, and almost surely irrelevant to the prairie falcon, burrowing owl, loggerhead shrike, and grasshopper sparrow.

Manchester site

The small size of this site makes it of slight value to relatively large, mobile animals like birds. It may be relevant in a minor way to the horned lark and white-tailed kite, the latter for foraging only, not nesting. It is not relevant to the prairie falcon, burrowing owl, long-eared owl, loggerhead shrike, yellow warbler, or grasshopper sparrow.

Rancho Cañada site

This site is almost certainly relevant to the white-tailed kite and grasshopper sparrow. It is probably relevant to the loggerhead shrike and horned lark, though the numbers of those species on the site, if they occur there, are likely to be very low. It is possibly relevant to the burrowing owl (if there were an effort at restoration), long-eared owl, and yellow warbler. It is not relevant to the prairie falcon, which would likely use the site only as occasional foraging habitat.

Crestridge site

This site may be relevant to the loggerhead shrike, though if that species occurs there the numbers are very low. It is likely relevant to the horned lark only for a few years following fires and only if the topography is not too steep. It would be relevant to the burrowing owl only as a restoration site and only if the habitat remained relatively open. Lacking trees, it is not relevant to the white-tailed kite, long-eared owl, and yellow warbler; and, lacking grassland, it is not relevant to the grasshopper sparrow. It is too small to offer significant foraging habitat to the prairie falcon.

San Miguel site

This area of extensive sage scrub and grassland is relevant to the grasshopper sparrow and probably relevant to the loggerhead shrike. It is possibly relevant to the horned lark (especially following the Harris Fire) and burrowing owl (lying near the restoration site at Sweetwater Reservoir). Lacking trees, it is not relevant to the long-eared owl or yellow warbler. It is relevant to the white-tailed kite and prairie falcon as foraging but not as nesting habitat.

Tijuana River Valley site

This site is definitely relevant to the white-tailed kite and yellow warbler and possibly to the horned lark, loggerhead shrike, and burrowing owl, depending on how the site is managed for riparian woodland versus open habitat. It is not relevant to the prairie falcon or grasshopper sparrow. It could be relevant to the long-eared owl if human disturbance can be minimized (not likely in the Tijuana River Valley).

Mammals

Los Angeles little pocket mouse

The proposed minimization and mitigation for onsite impacts is appropriate and reasonable. However, off-site mitigation is likely not a suitable option, since the proposed mitigation banks will likely not contain the species or suitable habitat.

Dulzura pocket mouse

Considerable amounts of suitable habitat occur within the Plan area. Fortunately, suitable off-site habitat exists at the proposed mitigation areas. The proposed on- and off-site minimization and mitigation actions for this species are appropriate.

Southern grasshopper mouse

It is not clear from the Plan whether the proposed mitigation sites will provide adequate habitat for this species.

San Diego woodrat

The proposed on- and off-site mitigation and minimization measures are appropriate for this species.

Other Species

It is not clear whether the mitigation sites will be suitable for these species. For example, it would be of no benefit to Quino checkerspot to conserve suitable habitat in the Tijuana River Valley, Manchester, or San Luis Rey River since these areas likely do not support these species. However, Rancho Cañada might be appropriate since it is within the known historic range of the insect.

4.0 Adaptive Management

4.1 Fundamental Principles

Adaptive management is considered a key component in conservation planning and monitoring. Adaptive management allows us to employ an iterative learning process, where the principles of experimental design guide our decisions. Unfortunately, the definition and application of adaptive management vary from rigorous and specific to poorly defined and vague. The most concise definition states that it "consists of managing according to a plan by which decisions are made and modified as a function of what is known and learned about the system, including information about the effect of previous management actions" (Parma 1998). Beyond these generalizations, the requirements and implementation of adaptive management are necessarily vague, mainly because the implementation and design must be flexible enough to adapt to any situation. Adaptive management is largely intended to deal with the uncertainty inherent in natural systems, allowing for flexibility in conservation planning and implementation. Adaptive management requires a long-term commitment to monitoring and the ability to modify plans based on results. Considerable resources have to be devoted to the design and implementation of adaptive management and monitoring programs to ensure the long-term success of any HCP/NCCP.

To ensure the conservation of the covered species within rights-of-way, active adaptive management may be necessary in some cases. For example, vernal pool plants will require active management to prevent encroachment by exotic species and sedimentation of the pools. In order to receive credit for onsite mitigation, active management would need to be required on Water Authority rights-of-way. The Water Authority needs to ensure that active management is compatible with the easement terms on all private lands where active management may be necessary to maintain the covered species.

The conservation lands should, at a minimum, follow the umbrella management and monitoring program for the regional NCCPs to ensure consistency and minimum standards.

4.2 Collaboration with USFWS and CDFG

At the Science Advisor meeting, the Advisors were informed that Rancho Cañada and Crestridge mitigation sites are owned and managed by either CDFG or the USFWS. The Water Authority needs to ensure that USFWS and CDFG are able to manage and monitor the mitigation sites according to the terms of the Plan. They should adapt existing or future management plans to incorporate the management needs of the Plan. The Water Authority suggested at the meeting that some portions of the sites would be managed and monitored to different standards than the PLAN. This may be very challenging when it comes to analyzing data and developing standard protocols for management. Coordinated management and monitoring is essential to detecting long-term status and trends. To aid implementation and

consistency an overarching management plan that is in line with the requirements of the terms included in the Plan should be formulated.

4.3 Monitoring

Two distinct types of monitoring occur in HCPs and NCCPs. *Compliance monitoring* is basically an accounting system, tracking how and when management actions, environmental requirements, and permitted activities are implemented. The purpose of this type of monitoring is to ensure compliance with permit requirements. The second type is *effectiveness monitoring*, which determines the effects of development and management activities on the covered species and ecosystems. The Science Panel recommends that the Plan clearly describe compliance monitoring versus effectiveness monitoring.

Many contributions to the literature recommend several essential steps in the monitoring process (e.g., USFWS 1996, Gibbs et al. 1999, Mulder et al. 1999, Noon 2003). The creation of a monitoring plan often follows a step-down approach. While this is theoretically appealing, collective experience with monitoring design indicates the process includes feedback loops with simultaneous and complementary activities at multiple steps. Figure 1 below (adapted from Rahn 2005) summarizes the major components and structure of effectiveness monitoring programs, incorporating the guidance provided by the Services, ecological literature, and the examples of HCPs. Ultimately, the development of most monitoring plans will require individualized application of these steps based on a plan's questions, needs, and resources. The Science Panel recommends that clearly articulated sections of the monitoring program be developed to ensure long-term viability and accountability.

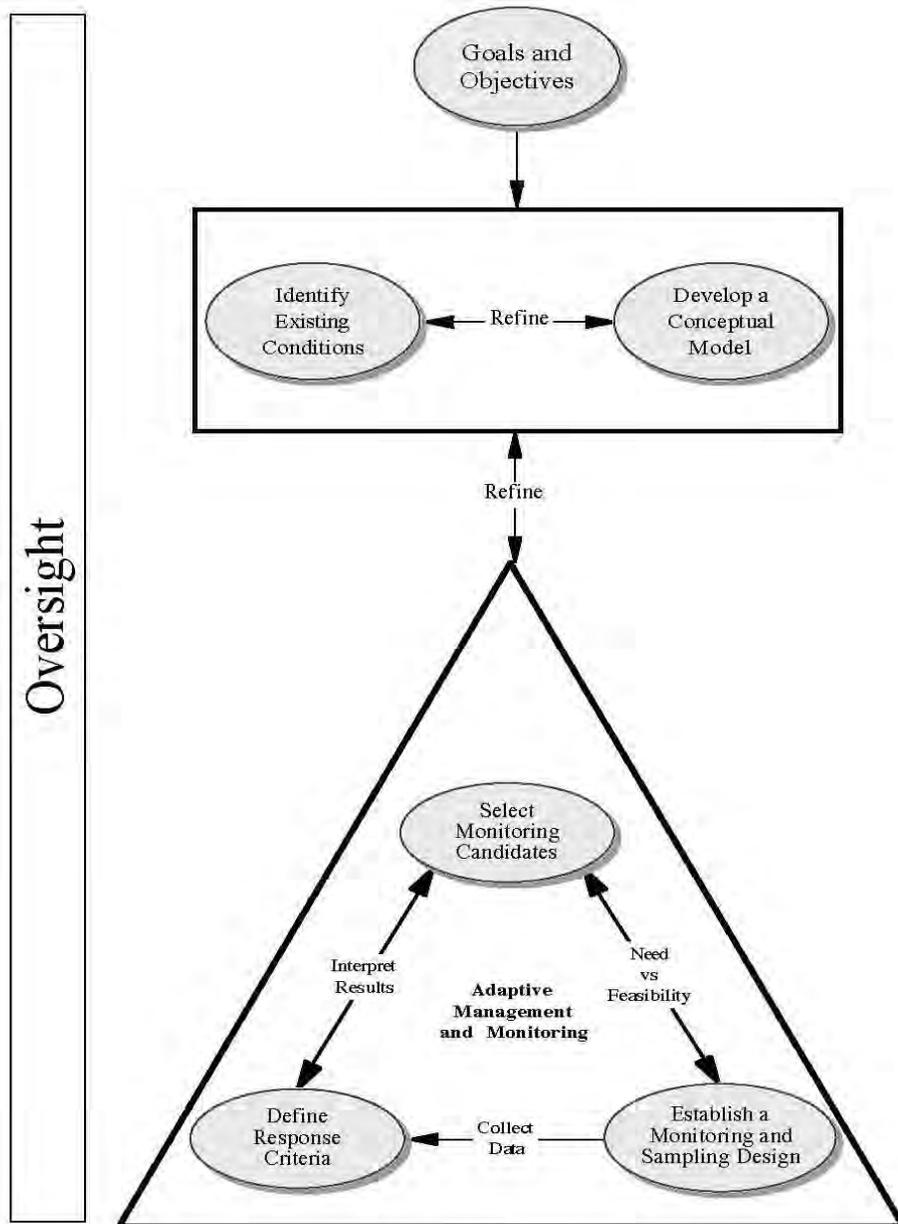


Figure 1. A step-down model is provided, describing the basic components of a monitoring plan for a habitat conservation plan. The first step is to establish the goals and objectives. This is followed by establishing existing conditions which informs the development of a conceptual model. These two can be conducted in concert to help refine one another and improve understanding. Following this, an adaptive management/monitoring framework guides the rest of the process. Monitoring candidates are selected, which in turn helps establish the monitoring design. A feedback loop exists between the two, where cost and feasibility are weighed against the prioritized list of monitoring candidates and needs. Once the protocols are selected, data collection begins, and response criteria are established (based on the goals and objectives). As the monitoring program proceeds, data are analyzed, and the results are used to inform the adaptive management process. The data collected can be used to refine and improve the understanding of the system and conceptual models. Finally, oversight plays a significant role throughout the development of a monitoring program and during its implementation.

4.4 Responses to Changed/Unforeseen Circumstances

Catastrophic declines in populations occur, whether caused by natural phenomena or anthropogenic calamities, yet upfront planning for these situations is rare in natural resource management. Two paradigms for maintaining biodiversity exist in conservation biology. One focuses on creating large reserves using principles derived from island biogeography, metapopulation theory, and species-area relationships. This paradigm is useful when creating reserves (especially in the context of MSHCPs), but has little bearing on management once the reserve is in place. The other paradigm focuses on single species and the roll of random stochastic events and catastrophes on population dynamics and extinction rates. This paradigm often focuses on developing detailed management strategies for specific species, including population viability analyses. While not entirely mutually exclusive, long-term biodiversity conservation requires the integration of these two paradigms. This integration becomes particularly important for both minimizing the probability and the severity of large-scale catastrophes. It also helps in the development of effective post-catastrophe responses for individual species of interest. We cannot overstate the importance of upfront planning and emergency response in conservation programs.

The linear nature of the planning area complicates conservation planning. It is therefore important to address how the permittee and agencies will respond to changes in the future. These large-scale impacts may include fire, climate change, etc. Several of these issues are briefly discussed below. However, broader investigation of other large-scale impacts may be important to ensure adequate conservation planning to occur.

4.4.1 Catastrophic Fire

Catastrophic fires may lead to potential cumulative impacts due to larger mosquito populations and West Nile virus (e.g., indirect impacts to covered bird species). The frequency, intensity, and often anthropogenic nature of fires may be worth addressing.

4.4.2 Climate Change

It may be worth considering (or modeling) how covered species will respond to the predicted effects of climate change, such as vegetation shifts in coastal sage scrub. It may be important to document whether the reserves are linked to other conservation areas in an altitudinal and latitudinal gradient to allow for shifting species distributions or vegetation shift, and how they would fit into a larger regional network of open space in response to climate change. It may be necessary to consider directing some of the monitoring effort to detection of long-term trends that might be related to climate change.

4.4.3 Pipeline Ruptures

The construction method chosen should be the one with the least impacts to the covered species and native vegetation types. The Science Panel recommends developing a post-disaster response plan to ensure that these responses are coordinated with other agencies and are appropriate for the habitat and species in the conservation areas. Lessons could be incorporated from the recent pipeline rupture through Mission Trails Regional Preserve.

4.4.4 Disease/Viruses

Impacts from diseases and viruses are varied and complicated. Catastrophic declines may occur and could likely be addressed by the conservation plan.

Of concern would be spraying or chemical control in rights-of-way or preserve lands for any perceived pest problems. Localized pest control inside of buildings or other structures will have minimum impact on the overall environment. There should be a record of each chemical application. This applies to both insect and weed control (nonnative). Application techniques and control approaches should be established before the need arises. In many instances, physical removal of pests, interception traps, biological control agents, or barriers can be used before chemical spraying is considered. Impacts on nontarget organisms, and indirect effects caused by run-off, need to be addressed.

4.4.5 Invasive Species

It is estimated that up to 46% of the nation's endangered species have been listed under the ESA due exclusively or in part to impacts from invasive species. Despite this, the treatment of nonnative species in HCPs is typically a secondary consideration in many conservation and management programs. This may be partially due to the inherent difficulty in proving that nonnative species have caused species extinctions or listings under the ESA. In light of the pervasive impacts of invasive species, it is safe to assume that many conservation programs will experience some level of invasion during the permit duration, causing direct or indirect impacts on the covered species and their habitats.

It is possible to anticipate that many of the activities permitted under an HCP/NCCP can either directly or indirectly lead to increased invasion and impacts on covered species. For some species there is an obvious link; for others there is insufficient data or understanding to support this claim. Ultimately, permittees do not need to be forced to include an invasive species management plan in an HCP, unless there is a possibility that invasives are or will be an issue. Ideally, the Services and permittees would invoke the precautionary principle, especially for large-scale, multi-species plans. Clearly articulated requirements and frameworks for invasive species management and control are the next necessary step in improving the planning process.

5.0 Literature Cited

PLEASE REFERENCE THIS DOCUMENT AS FOLLOWS:

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Attachment A:
Biographies of Advisors

Matt Rahn, Ph.D.

Dr. Matt Rahn is currently employed as the Executive Director for the SDSU Field Stations Program. Dr. Rahn has a broad background in field biology and the conservation of wildlife throughout various ecosystems. He has experience in the design of wildlife, habitat, and ecosystem monitoring programs, with an emphasis on the identification of invasive species, the impacts on threatened or endangered species, and the development of appropriate management and mitigation programs.

He has participated in various habitat and vegetation restoration programs, sensitive species relocation, wetland restoration, and habitat enhancement projects. He developed restoration monitoring programs to assess cover and diversity, plant survival, herbivory, and studies of wildlife use using a variety of GIS and statistical analysis methods.

In addition to his expertise in conservation biology, Dr. Rahn conducted research in collaboration with environmental lawyers and ecologists on the design, implementation, and evaluation of multi-species habitat conservation plans. He supports various conservation biology groups through his knowledge of various state and federal environmental laws, having spent two years studying and working in collaboration with faculty at the UC Davis School of Law, evaluating the Endangered Species Act and various aspects of conservation planning including the selection of covered species, the implications of invasive species, monitoring, and disaster planning.

David K. Faulkner, MS

David Faulkner was the Head of the Entomology Department at the San Diego Natural History Museum for 25 years and currently serves there as a research associate. His research interests include the biogeography of butterflies in Southern California and Baja California, Mexico, and the systematics of the insect order Neuroptera. He has extensive collecting experience in Southern California and northwestern Mexico and is currently self-employed; working on invertebrate conservation issues and forensic entomology for numerous agencies in California and the western United States.

Mary Ann Hawke, Ph.D.

Dr. Mary Ann Hawke is Director of the San Diego County Plant Atlas project at the San Diego Natural History Museum (SDNHM) which is training volunteer parobotanists to scientifically document the county's floristic diversity by collecting field data and voucher plant specimens across the county. She earned a Ph.D. in 1994 from the University of Western Ontario in Canada and is certified as a Senior Ecologist by the Ecological Society of America.

A decade of work in environmental consulting and as a scientific project director at the University of Washington (and most recently at the SDNHM) has provided experience with project management, rare plant and vegetation field surveys, biological monitoring, natural resource management plans, wetland delineation, database development and management, stakeholder participation, and environmental laws and permitting. Dr. Hawke is co-Principal Investigator of grants from the Institute of Museum and Library Services, and from the Systematic Biology Program of the National Science Foundation.

Trained as a plant ecologist and environmental educator, Dr. Hawke's research focuses on assessing ecological health in arid lands. Her interests include lichens and biological soil crusts, soil/microbe/plant interactions, and the fire ecology of Southern California.

Bradford Hollingsworth, Ph.D.

Dr. Hollingsworth oversees amphibian and reptile research at the San Diego Natural History Museum and curates the collection of over 73,000 individually catalogued specimens, which date back to 1891. Dr. Hollingsworth specializes in the morphological and molecular systematics of amphibians and reptiles from Southern California and Baja California. He studies the evolutionary history of isolated populations, which include species restricted to oases, mountaintops, and islands in both the Pacific Ocean and Gulf of California. He received his doctorate in 1999 from Loma Linda University and earned Bachelor's and Master's degrees from San Diego State University. Dr. Hollingsworth is on the Board of Governors for the largest and oldest herpetological professional group, the American Society for Ichthyologists and Herpetologists. He has had a lifelong interest in natural history and teaches the course "The World of Animals" at San Diego State University. His favorite pastime is the photography of amphibians and reptiles in the wild.

Philip Unitt

Philip Unitt has served as collection manager for the Department of Birds and Mammals at the San Diego Natural History Museum since 1988 and curator since 2005. His expertise includes the distribution, status, identification, subspecies, and conservation of the birds of California and Baja California. He has written over 30 scientific papers and reports, including the seminal paper on the Southwestern Willow Flycatcher, (*Empidonax traillii extimus*), and taxonomic

analyses of the Marsh Wren and Brown Creeper, with descriptions of one new subspecies of each. From 1997 to 2002 he organized the *San Diego County Bird Atlas*, a project that involved directing the work of over 300 volunteers and analyzing a database of nearly 400,000 records; the result was published in 2004. Current studies include the effects on birds of San Diego County's large-scale firestorms. Since 1986 Phil has served as the editor of *Western Birds*, the regional journal of ornithology for western North America. Since 1979 he has served as a consultant for various public agencies and private firms. Projects include surveying for a variety of endangered species, population monitoring, and serving on the technical advisory committee to the California Department of Fish and Game for revision of its list of bird species of special concern. That revision, including six species accounts written by Unitt, is being published in early 2008.

Attachment B:

Initial Questions Addressed by the Science Advisors



Jones & Stokes

Memorandum

Date: November 16, 2007

To: San Diego County Water Authority NCCP/HCP Science Advisors:
Dave Faulkner, Forensic Entomology Services
Mary Ann Hawke, San Diego Natural History Museum
Matt Rahn, San Diego State University
Phil Unitt, San Diego Natural History Museum

cc: San Diego County Water Authority, California Department of Fish and Game,
U.S. Fish and Wildlife Service, RECON

From: David Zippin, Science Advisor Facilitator

Subject: **Science Advisor Charge and Questions**

First, I want to thank the Science Advisors for participating in this important effort to provide the San Diego County Water Authority (Water Authority) with expertise to improve their habitat conservation plan (HCP) and natural community conservation plan (NCCP). This memo will provide you with an overview of the panel's charge and a list of initial questions that the panel will be addressing in the review process.

Regulatory Background

The NCCP Act requires that all NCCPs include a process for the inclusion of independent scientific input (California Fish and Game Code Section 2810(b)(5)). The purpose of this input is to assist the plan participants in incorporating the best available science into the plan. The input also helps the California Department of Fish and Game (CDFG) make sound findings that the plan adequately conserves the covered species and natural communities, among others. The NCCP Act specifically requires that the independent scientific input:

- Recommend scientifically sound conservation strategies for species and natural communities proposed to be covered by the plan.
- Recommend a set of reserve design principles that addresses the needs of species, landscape, ecosystems, and ecological processes in the planning area proposed to be addressed by the plan.
- Recommend management principles and conservation goals that can be used in developing a framework for the monitoring and adaptive management component of the plan.

- Identify data gaps and uncertainties so that risk factors can be evaluated.

Findings that CDFG must make at the end of the process to approve an NCCP and issue a permit are relevant to the charge of the Science Advisors. Information provided by our panel can help CDFG to make these findings. According to Section 2820(a) of the Fish and Game Code, CDFG must determine that:

- The plan integrates adaptive management strategies that are periodically evaluated and modified based on the information from the monitoring program and other sources, which will assist in providing for the conservation of covered species and ecosystems within the plan area.
- The plan provides for the protection of habitat, natural communities, and species diversity on a landscape or ecosystem level through the creation and long-term management of habitat reserves or other measures that provide equivalent conservation of covered species appropriate for land, aquatic, and marine habitats within the plan area.
- The development of reserve systems and conservation measures in the plan area provides, as needed for the conservation of species, all of the following:
 - Conserving, restoring, and managing representative natural and seminatural landscapes to maintain the ecological integrity of large habitat blocks, ecosystem function, and biological diversity.
 - Establishing one or more reserves or other measures that provide equivalent conservation of covered species within the plan area and linkages between them and adjacent habitat areas outside the plan area.
 - Protecting and maintaining habitat areas that are large enough to support sustainable populations of covered species.
 - Incorporating a range of environmental gradients (such as slope, elevation, aspect, and coastal or inland characteristics) and high habitat diversity to provide for shifting species distributions due to changed circumstances.
 - Sustaining the effective movement and interchange of organisms between habitat areas in a manner that maintains the ecological integrity of the habitat areas within the plan area.

Note that few of the terms listed above are defined in the NCCP Act. Therefore, many plans define the terms operationally for themselves.

Independent scientific input has become a regular part of all NCCPs prepared in California. To date, there have been at least 14 independent scientific reviews of NCCPs¹. You may wish to consult some of these previous reports for examples of the types of information provided by Science Advisors.

Background on the Plan

The Water Authority has been preparing an NCCP/HCP for their water operations and capital projects for the last several years. The Water Authority plans to release a public draft of the plan by April 2008. In order to meet that deadline, the Water Authority must complete a key requirement of the NCCP Act by conducting an independent scientific review of the plan.

The Water Authority NCCP/HCP is a stand-alone Subregional NCCP within the coastal sage scrub region of Southern California. The Water Authority NCCP/HCP is designed to be compatible with other Subregional NCCPs through which it passes, including the San Diego Multiple Species Conservation Program (MSCP) and the San Diego Multiple Habitat Conservation Plan (MHCP). Both of these plans are exempt from the current NCCP Act's new requirements, which includes independent scientific review (Section 2810(b)(5)(A) through (D))². The Water Authority NCCP/HCP is subject to the requirements NCCP Act, with several exceptions. Section 2830(f)(1) exempts the Water Authority NCCP from the preparation of a Planning Agreement. Section 2830(f)(2) narrows the scope of the independent scientific input. This section says that the Water Authority must include independent scientific input consistent with the process described on page 1 this memo and

“...in a manner that focuses on the covered species that are proposed for take authorization and that are not otherwise covered in the San Diego Multiple Species Conservation Program or the San Diego Multiple Habitat Conservation Program. The scientific input required by this paragraph shall be based on the best and most current scientific data generally available, and shall assure that documentation for coverage of all species is equal or greater than the San Diego Multiple Habitat Conservation Program.”

Following this requirement, 33 species out of the 94 species covered species are not covered by either the MSCP or the MHCP (Exhibit A). An additional 8 species have been added to the list for the Science Advisors to consider, bringing the total to 41 species.

It will be important to keep in mind throughout the review the scope of the covered activities proposed by the Water Authority. For example, the Water Authority operates along 286 miles of pipeline and aqueduct corridors that encompass approximately 3,000 acres. Of this land, the Water Authority owns only approximately 10%; the rest are easements that allow the Authority to maintain its facilities on private land. Further, the amount of disturbance estimated from the

¹ See www.dfg.ca.gov/habcon/nccp/science.html for most of these reports.

² The 2002 NCCP Act expanded and completely replaced the original 1991 NCCP Act. Plans exempt from the new Act follow the requirements of the 1991 Act, as amended.

covered activities is estimated to be relatively small: 133 acres of native vegetation from permanent impacts and 27 acres per year from operations and maintenance.

More background and details on the Water Authority NCCP/HCP will be provided to the Advisors on the morning of the workshop by RECON, the NCCP/HCP lead consultant.

Science Advisor Charge

The role of the Science Advisors in an NCCP is to provide review and comment on the science used in the plan including data, analytical methods, biological goals and principles, and conclusions drawn from these data and analyses. The review is not intended to validate or ratify the plan, but rather to provide guidance and recommendations to strengthen the plan's scientific underpinnings.

While the NCCP Act provides specific topics on which Science Advisors should comment (see list on page 1), the scope of the review should not be limited to these topics. The Science Advisors are free to bring up new questions or comments that are relevant to the scientific basis of the plan. Below is a draft list of questions that the Science Advisors will initially address. This list of questions was developed based on consultation with the Water Authority, their lead NCCP/HCP consultant (RECON), CDFG, and the Science Advisors. Jones & Stokes staff also provided input after reviewing the current draft NCCP/HCP and consulting other Science Advisory process reports. The questions are organized into three broad topic areas:

1. The scope of the plan and use of existing data
2. Conservation design and analysis
3. Adaptive management and monitoring

Initial Questions for Science Advisors

Scope of the Plan and Use of Existing Data

1. Does the list of covered species under review by the Science Advisors contain species for which enough information is known to evaluate impacts, develop conservation actions, and conduct monitoring? Are the covered species on the list well justified?
2. Are there any new or pending taxonomic revisions that would affect the list of covered species under review by the Science Advisors?
3. Are there any species not under review by the Science Advisors and not otherwise covered by the Water Authority NCCP that should be considered for coverage?

4. Do the biological data and maps prepared to date adequately compile, interpret, and present existing information to support the conservation strategy? Are there other sources (data, published papers, technical reports) that should be incorporated into the plan and considered in the conservation strategy?
5. Are there significant data gaps or uncertainties for the covered species under review that should guide how reserve design, management, or monitoring is conducted during implementation? What are the greatest sources of risk as a result of these data uncertainties and gaps?
6. Are the terms in the NCCP Act such as ecosystem function, ecological integrity, and biological diversity adequately defined for the purposes of the plan?

Conservation Design and Analysis

7. Does the Plan use the existing data appropriately to develop the reserve design and other components of the conservation strategy? Are the methods used to develop the conservation strategy based on sound principles and analytical tools? Does the analysis adequately consider the data gaps and data uncertainties?
8. Does the conservation strategy address species-specific needs and adequately conserve the covered species under review?
9. Are the threats and stressors for the species and habitats identified and/or prioritized?
10. Does the conservation strategy conserve natural communities, environmental gradients, and ecosystem processes necessary to sustain biological diversity given the limitations of the permit area and the linear nature of the impacts?
11. Does the plan address any issues related to invasive species, and the potential impacts on the covered species?
12. Based on your knowledge of the area, does the plan adequately support protection of specific areas critical to the success of the conservation strategy such as biological “hot spots”, crucial linkages, rare natural communities, species occurrences, or other unique and important landscape features?
13. Is the conservation strategy for the Subregional Plan consistent with the conservation principles of the NCCP/HCP, including the following tenets of reserve design:
 - Conserve target species throughout the planning area
 - Larger reserves are better
 - Keep reserve areas close

- Keep reserves contiguous
 - Link reserve with corridors
 - Reserves should be diverse
 - Protect reserves from encroachment and invasion of non-native species
14. Does the conservation strategy include management actions on Water Authority lands sufficient to maintain sustainable populations of the covered species under review? Is the guidance provided on the conduct of these management actions sufficient to provide reserve managers with enough direction to carry out these actions effectively?

Adaptive Management and Monitoring

15. Is the monitoring and adaptive management approach adequate for Water Authority lands? (This approach is generally described in this plan but described in detail in the interim Crestridge Management Area/Ecological Reserve Management Plan and San Miguel Management Plan.)
16. Does the monitoring and adaptive management plan include a process that will appropriately incorporate scientific information into plan implementation?
17. What are the most important data gaps or data uncertainties that should be addressed in the adaptive management process?
18. Are there examples of monitoring programs or protocols that could be used in implementation to properly design the monitoring protocols for the covered species under review? What additional guidance on monitoring should be included in the plan to ensure that monitoring the covered species under review is effective?
19. Does the plan clearly identify the goals and objectives for the monitoring program?
20. Are the “existing conditions” provided within the plan, or is a framework in place for the development of a baseline inventory of the planning area?
21. Has the plan provided a basis for understanding the system (e.g., conceptual models) for how management and conservation actions relate to the covered species and adaptive management program?
22. Are there specific hypotheses related to conservation actions, management, or the covered species?

November 16, 2007

Page 7

23. Is there a mechanism in place that will establish “trigger-points” to initiate adaptive management responses in the future?
24. Does the adaptive management program address catastrophic events (eg. fire, disease, etc).
25. Is there a clear link between the implementation of the monitoring and adaptive management program and an oversight committee?

These are the questions that, at a minimum, will be addressed at the Science Advisors workshop on November 19. Additional questions may arise in the meantime or be raised at the workshop by the Water Authority, the wildlife agencies, RECON, or the advisors themselves. As the workshop facilitator, I look forward to working with each of you to fulfill the panel’s charge and help to improve the Water Authority NCCP/HCP.

If you have any questions about this task, please contact me at (408) 434-2244 ext. 2209 or Kailash Mozumder at (858) 578-8964.

Attachment C:
Workshop Agenda

Science Advisors Workshop
San Diego County Water Authority NCCP/HCP

November 19, 2007
8:30 am – 5:00 pm

Hilton San Diego Airport/Harbor Island
1960 Harbor Island Drive
San Diego, California 92101

Meeting Objectives: Provide independent scientific input on the scientific basis of the administrative draft San Diego County Water Authority NCCP/HCP and address the questions posed to the Science Advisors.

Meeting Outcomes: Produce the following three lists that can be incorporated into the Meeting Summary and used to help produce the Final Report: 1) Preliminary Recommendations 2) Outstanding questions, 3) Information Needs. Also, establish schedule and assignments for completing the Final Report.

SESSION 1 – Advisors, Consultants, Wildlife Agencies, Water Authority

8:30 – 9:00 Attendees sign-in
Coffee/continental breakfast
9:00-9:10 Welcome and introductions (Jones & Stokes)
9:10-9:15 Opening remarks (Water Authority)
9:15-9:20 Wildlife Agency comments (CDFG, USFWS)
9:20-9:45 Overview of scientific input process (Jones & Stokes)
9:45-10:45 Overview of Plan (RECON)
10:45-11:00 Break
10:45-12:00 Q&A of NCCP/HCP consultant
12:00 END SESSION 1

SESSION 2 – SCIENCE ADVISORS AND FACILITATORS ONLY

12:00-12:30 Lunch and break
12:30-1:00 Brainstorm key issues and prioritize afternoon session
1:00-2:15 Review methods used by consultants (data, analysis)
2:15-2:30 Break
2:30-3:15 Species and activities covered under the Plan - Data analysis and gaps
3:15–4:15 Conservation guidelines analysis, reserve design, adaptive management, practices, and monitoring
4:15–4:45 Final report: Review draft outline of final report; assign writing tasks
4:45–5:00 Review action items, schedule post-workshop conference call
5:00 END SESSION 2