Volume III

MHCP Biological Monitoring and Management Plan

Prepared for:

Multiple Habitat Conservation Program

Administered by:

SANDAG

for the Cities of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista

March 2003

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Prepared by:

California Department of Fish and Game
U.S. Fish and Wildlife Service
Conservation Biology Institute

March 2003

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

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1.0 INTRODUCTION

The Multiple Habitat Conservation Program (MHCP) is a comprehensive plan for the conservation and management of natural habitat in the seven cities of northern San Diego County. The MHCP is one of the subregions within the South Coast Natural Community Conservation Planning (NCCP) ecoregion, which includes portions of five counties in Southern California (Los Angeles, San Bernardino, Riverside, Orange, and San Diego) that support coastal sage scrub habitats. The MHCP subregion is further divided into subareas, defined principally by the jurisdictional boundaries of the seven participating cities (Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista).

The overall objective of the MHCP is to conserve and manage viable populations of native plant and animal species and their habitats in perpetuity, while accommodating continued economic development and quality of life for residents of the north San Diego County cities. In exchange for these conservation actions, the participating cities will receive take authorizations under the federal Endangered Species Act and the state NCCP Act. Biological monitoring and management are mandatory elements of all Habitat Conservation Plans and NCCP plans and are required as a condition of the take authorizations. In addition to documenting compliance with the conditions of MHCP, monitoring will serve to measure the effectiveness of the MHCP in meeting its program objectives, inform adaptive management decisions, assist in defining and modifying biological goals and models of the system (Kendall 2001), test assumptions about ecosystem function, and provide the wildlife agencies with information to conduct rangewide assessments of baseline conditions and covered species status (5-Point Policy, USFWS 2000). Species proposed for take authorizations (i.e., covered species) are listed in Table 1. The distribution, abundance, and threats to these species within the MHCP planning area, along with conditions for coverage, are described in the MHCP Plan, Volume II.

The level of effort required by this plan is consistent with that required for other NCCP monitoring and management plans. The tasks outlined in this plan are the minimum necessary to receive and comply with an incidental take authorization. However, after an approximately 5-year period to establish the baseline range of values, data collection efforts may be reduced for some resources. This plan is a starting point that illustrates the depth and breadth of work required to manage the preserve system towards the goals of the MHCP and to assess the efficacy of the management program. This plan provides guidance for the implementation, staffing, and funding of such a program. The MHCP monitoring and management program is intended to change with the acquisition of new data, refined technologies, and with our increasing understanding of the ecology of the preserve system. Some of the protocols presented herein are currently being tested in the field. The wildlife agencies and cities will refine and modify hypotheses and the methods to test protocols as necessary.

Table 1
MHCP COVERED SPECIES

Common Name	Scientific Name
Plants	
San Diego thorn-mint*	*Acanthomintha ilicifolia*
San Diego ambrosia*	*Ambrosia pumila*
Del Mar manzanita*	*Arctostaphylos glandulosa* ssp. *crassifolia*
Encinitas baccharis*	*Baccharis vanessae*
Thread-leaved brodiaea*	*Brodiaea filifolia*
Wart-stemmed ceanothus	*Ceanothus verrucosus*
Orcutt's spineflower*	*Chorizanthe orcuttiana*
Summer holly	*Comarostaphylis diversifolia* ssp. *diversifolia*
Blochman's dudleya	*Dudleya blochmaniae* ssp. *blochmaniae*
Short-leaved dudleya*	*Dudleya blochmaniae* ssp. *brevifolia*
Sticky dudleya	*Dudleya viscida*
San Diego button-celery*	*Eryngium aristulatum* var. *parishii*
Cliff spurge	*Euphorbia misera*
San Diego barrel cactus	*Ferocactus viridescens*
Orcutt's hazardia*	*Hazardia orcuttii*
San Diego marsh-elder	*Iva hayesiana*
Del Mar Mesa sand aster*	*Lessingia filaginifolia* var. *linifolia*
Nuttall's lotus*	*Lotus nuttallianus*
Little mousetail*	*Myosurus minimus* spp. *apus*
Spreading navarretia*	*Navarretia fossalis*
California Orcutt grass*	*Orcuttia californica*
Torrey pine	*Pinus torreyana* ssp. *torreyana*
Nuttall's scrub oak	*Quercus dumosa*
Engelmann oak	*Quercus engelmannii*
Parry's tetracoccus	*Tetracoccus dioicus*
Animals	
San Diego fairy shrimp*	*Branchinecta sandiegoensis*
Riverside fairy shrimp*	*Streptocephalus woottoni*
Harbison's dun skipper butterfly*	*Euphyes vestris harbisoni*
Salt marsh skipper	*Panoquina errans*
Arroyo toad	*Bufo californicus*
Western spadefoot toad	*Scaphiopus hammondii*
Southwestern pond turtle	*Clemmys marmorata pallida*
Orange-throated whiptail	*Cnemidophorus hyperythrus beldingi*
California brown pelican	*Pelecanus occidentalis californicus*
White-faced ibis	*Plegadis chihi*
Osprey	*Pandion haliaetus*
Golden eagle	*Aquila chrysaetos*

Table 1 (cont.)
MHCP COVERED SPECIES

Common Name	Scientific Name
Cooper's hawk	*Accipiter cooperii*
American peregrine falcon	*Falco peregrinus anatum*
Light-footed clapper rail	*Rallus longirostris levipes*
Western snowy plover	*Charadrius alexandrinus nivosus*
Elegant tern	*Sterna elegans*
California least tern	*Sterna antillarum browni*
Southwestern willow flycatcher	*Empidonax traillii extimus*
Least Bell's vireo	*Vireo bellii pusillus*
Yellow-breasted chat	*Icteria virens*
Coastal cactus wren*	*Campylorhynchus brunneicapillus cousei*
California gnatcatcher	*Polioptila californica californica*
Western bluebird	*Sialia mexicana*
California rufous-crowned sparrow	*Aimophila ruficeps canescens*
Bell's sage sparrow	*Amphispiza belli belli*
Belding's Savannah sparrow	*Passerculus sandwichensis beldingi*
Large-billed Savannah sparrow	*Passerculus sandwichensis rostratus*
Northwestern San Diego pocket mouse	*Chaetodipus fallax fallax*
Pacific pocket mouse*	*Perognathus longimembris pacificus*
Stephens' kangaroo rat	*Dipodomys stephensi*
San Diego black-tailed jackrabbit	*Lepus californicus bennettii*
Mountain lion	*Felis concolor*
Southern mule deer	*Odocoileus hemionus fuliginata*

* Narrow endemic species

1.1 MHCP FRAMEWORK MONITORING AND MANAGEMENT PLAN

A framework monitoring and management plan was distributed as part of the Public Review Draft of the MHCP Plan (December 2001). The framework plan, referred to as Volume 1 of the monitoring and management plan, provided the general framework for the monitoring and management program. It addressed general program needs, regulatory expectations of the wildlife agencies (U.S. Fish and Wildlife Service [USFWS] and California Department of Fish and Game [CDFG]), general monitoring objectives, and general monitoring functions required to implement the program. At the time the framework plan was distributed for public review, it was assumed that a second volume would be prepared to provide further detail on the monitoring activities. However, instead of producing two separate volumes, the framework plan has been revised and expanded to include the detail originally slated for Volume 2. Therefore, this document constitutes both the framework plan (Volume 1) and the proposed Volume 2. This document will also be circulated for public review as part of the final MHCP Plan.

1.2 SUBAREA MONITORING AND MANAGEMENT PLANS

In addition to this MHCP monitoring and management plan, each participating city has prepared a framework management plan as part of its subarea plan. Those plans reference this MHCP monitoring and management plan and identify the resources most important for monitoring and management in the subarea. As described in Section 6 of the MHCP Plan, each city must prepare an area-specific monitoring and management plan for all areas that are currently conserved. In addition, as individual areas are dedicated to the preserve, each city must prepare an area-specific monitoring and management plan or directives for the newly conserved areas within its subarea. There is no minimum acreage for which area-specific monitoring and management directives must be prepared; all areas of the preserve must have area-specific directives.

Depending on the size and resources of the preserve unit, an area-specific monitoring and management plan may be a separate document or a brief attachment to the city's subarea plan that includes a map of resources on the preserve property, describes site-specific threats to resources, and identifies site-specific management and monitoring actions to address these threats (see example attachment in Appendix B.8). Area-specific monitoring and management plans or directives must be developed and approved by the wildlife agencies for preserve lands no later than 2 years after lands are dedicated to the preserve and implemented immediately upon approval of the management plan.

1.3 TYPES OF BIOLOGICAL MONITORING

Biological monitoring for the MHCP must be multifaceted to comply with state and federal regulations and to answer many complex questions. Monitoring activities can generally be classified by scale (preserve level versus subregional level) and by type (compliance monitoring versus effectiveness monitoring). These classifications are not mutually exclusive, but overlap as discussed below.

1.3.1 Preserve-level and Subregional-level Monitoring

The preserve must be monitored and managed consistent with the vegetation communities and covered species known or assumed to occur there. Preserve-level monitoring, conducted at all preserves within the MHCP, will assess and report on key resources within the preserve to inform site-specific management actions by the preserve managers. Individual cities will report annually on preserve-level monitoring within their subarea plans (Figure 1). Some data collected at the preserve level will be aggregated and analyzed to detect patterns and trends that may not be discerned at individual preserve areas (e.g., subregion-wide population declines). The wildlife agencies or their designated entity will specify which data sets are to be aggregated and analyzed at the subregional scale.

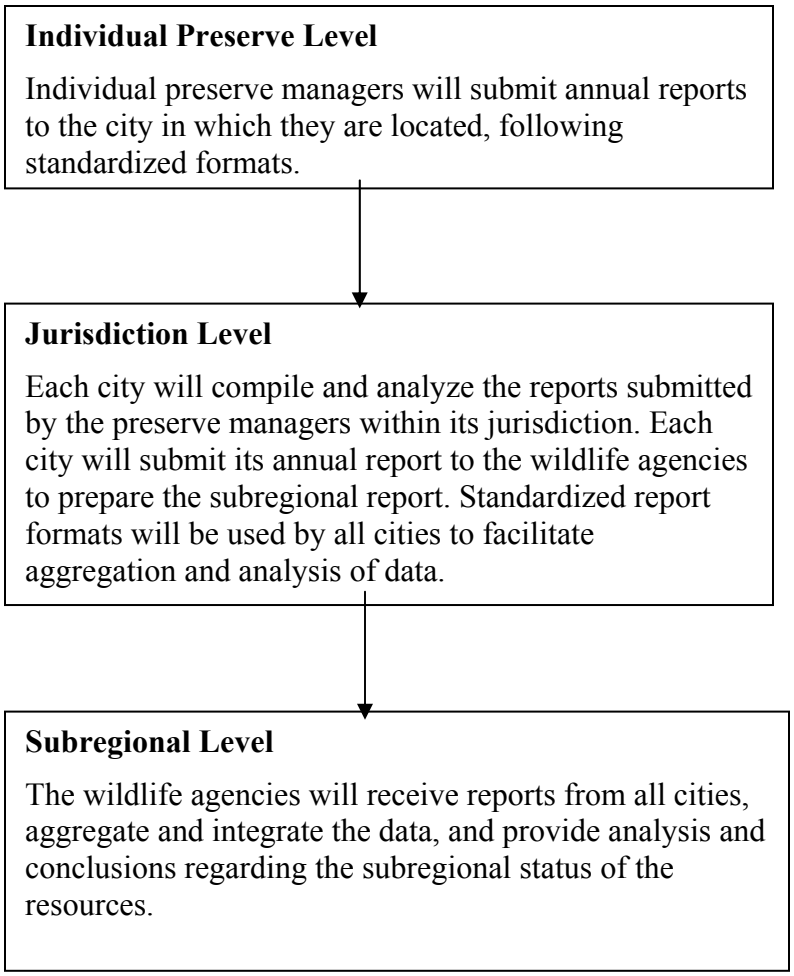

Figure 1
Levels of Monitoring in the MHCP

In addition to aggregating and analyzing the preserve-level data, subregional monitoring will sample selected locations across the MHCP preserve system to assess changes in the distribution and abundance of covered species, as well as other relevant metrics, and to capture spatial and temporal variation in the data (Yoccoz et al. 2001). For example, subregional monitoring will include sampling of riparian and coastal sage scrub bird communities and wildlife corridor use at selected locations throughout the MHCP preserve system. This information may also be used in regional analyses that include data from other subregions throughout south coastal California. These NCCP regional analyses are not an obligation of the MHCP cities.

1.3.2 Compliance Monitoring

MHCP monitoring must include both a compliance monitoring component and an effectiveness monitoring component. Compliance monitoring, also known as implementation monitoring, is required to ensure that the cities are performing the conservation actions listed in the implementing agreements. Compliance monitoring tracks whether the cities are doing what they said they would do, such as conserving particular species locations and acres of habitat, monitoring the condition of the habitat, and performing required management actions.

1.3.3 Effectiveness Monitoring

Effectiveness monitoring (5-Point Policy, USFWS 2000) will evaluate how well the MHCP conservation and management actions are achieving the MHCP biological goals for each subarea and across the MHCP preserve as a whole. Overall, the preserve-level monitoring program will be used to evaluate the effectiveness of management actions at specific preserve areas. Preserve managers will tailor monitoring at each preserve area, based on the role of that preserve in meeting the goals of the MHCP. The cities and wildlife agencies will work together to initiate focused research programs to examine correlations or cause-effect relationships behind changes in resource status.

At the subregional level, effectiveness monitoring involves assessing status and trends (e.g., changes in distribution and abundance) in populations of covered species and testing hypotheses across the MHCP subregion. It also assesses how well the conservation strategy is working to maintain natural ecological processes (e.g., gnatcatcher dispersal). Subregional effectiveness monitoring will involve data collection at selected sample locations to (1) answer specific ecological questions (e.g., what is the effectiveness of coastal sage scrub habitat patches functioning as stepping stones for dispersing birds? Do species make seasonal movements across vegetation communities in different subareas?); (2) track community level responses to predicted causal mechanisms (e.g., how does composition of sage scrub bird communities and herpetofauna communities change over time? How do they change with patchiness created by fires?); and (3) answer questions about populations sizes of the covered species.

1.4 RESPONSIBILITIES FOR MONITORING

Monitoring is the responsibility of the participating cities, which may choose to delegate this responsibility to a nonprofit conservancy or other centralized entity (see MHCP Plan, Section 5.7), and the wildlife agencies, depending on land ownership. Coordination of monitoring and management across the MHCP planning area will allow sharing of resources (staff, materials, and equipment) and economize on costs. A conservancy or other centralized entity could hire or contract with technical specialists (preserve managers) to perform management and monitoring responsibilities.

In the absence of an MHCP conservancy, or in the interim period before a conservancy is formed, individual cities may choose to contract out management and monitoring responsibilities for specific lands to multiple groups or use in-house staff to fulfill certain roles. If a conservancy is formed, the conservancy would serve as the coordinating entity for all preserve management and monitoring for the cities.

The wildlife agencies and the cities or conservancy will conduct the same level of monitoring on lands they administer. On existing, privately owned open space lands, cities will coordinate with the owners to ensure that management and monitoring are consistent with the MHCP. The term "preserve manager" is used in this document to refer to the entity with authority delegated by the property owner (city, wildlife agency, developer, or other) to manage and monitor a given preserve area.

Data management and analysis at the subregional level are the responsibility of the wildlife agencies. The agencies may choose to delegate some of their subregional and regional monitoring responsibility—for example, to an MHCP conservancy or the proposed Regional Environmental Information Center (REIC) (see Section 5.4.2).

The distinction between compliance and effectiveness monitoring is important for understanding legal responsibilities under the MHCP. If compliance monitoring indicates that the cities are adequately performing their required actions per the implementing agreement, but effectiveness monitoring reveals that biological objectives are not being met due to unforeseen circumstances, then the federal “No Surprises” rule (USFWS 1998a) takes effect; hence, rectifying the problem becomes the financial responsibility of the wildlife agencies. For example, if the cities are performing all required conservation and adaptive management actions for a covered species, but the species is declining regardless, any specific research, management, or conservation actions that are required above and beyond those conducted pursuant to MHCP obligations become the responsibility of the state and federal governments. Any declines related to changed circumstances, as defined in the implementing agreement, are the responsibility of the take authorization holder (see MHCP Plan, Section 5.2).

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2.0 IMPLEMENTATION (COMPLIANCE) TRACKING

As part of compliance monitoring, the conservation and loss of vegetation communities and covered species, relative to baseline, must be tracked over time as the preserve system is assembled and vegetation communities outside of the preserve are developed.

2.1 VEGETATION COMMUNITY ACCOUNTING

The conservation and loss of vegetation communities or "habitats" in the MHCP area will be tracked on an annual basis. The following accounting process will be required for (1) all vegetation communities within the MHCP and lands purchased as mitigation in the unincorporated area (gnatcatcher core area), and (2) restoration areas within the MHCP (see MHCP Plan, Volume I).

Each city will be responsible for the annual accounting of the acreage, type, and location of vegetation communities conserved and destroyed by permitted land uses and other activities. The cities also will be responsible for tracking conservation of vernal pools and for accounting of vegetation communities in the unincorporated gnatcatcher core area. Records will be maintained in both ledger and digital map (GIS) format. A committee of City of San Diego, County of San Diego, San Diego Association of Governments (SANDAG), and wildlife agency staff has developed a GIS-based tool for this purpose (HabiTrak) that will be used for vegetation community accounting by the MHCP cities. This accounting process will help to ensure that conservation proceeds in rough proportion with losses of vegetation communities. Each city (take authorization holder) will submit this accounting information to the wildlife agencies as part of an annual public report to demonstrate compliance with the terms and conditions of its subarea plan, implementing agreement, and take authorizations.

The loss of habitat will be recorded in HabiTrak when the land is graded. For conserved lands, the conservation of habitat will be recorded in HabiTrak when habitat is permanently conserved (e.g., date of recordation of title transfer, recordation of a conservation easement, or execution or recordation of any other instrument that confers third-party beneficiary status to the project or property). The accounting information for conserved acres also will identify the protection mechanism (e.g., easement or fee title), owner and entity responsible for management, and other related information.

2.2 COVERED SPECIES ACCOUNTING

One of the specific objectives of the MHCP Plan is to conserve and manage covered species. Major and critical populations of these species are documented in the species coverage analyses and conditions (MHCP Plan, Volume II, Section 4) and are mapped on the MHCP vegetation quadrangle maps (1" = 2000'). The MHCP Plan specifies the proposed conservation and take of these species and populations resulting from implementing the plan. Take authorization holders (cities) must comply with the conservation levels, locations, and conditions specified in the MHCP Plan and subarea plans.

Preserve managers will track conservation and loss of covered species in the preserves by monitoring long-term habitat condition and species' population status throughout the life of the take authorization. The frequency with which a species' status is monitored will depend on the ecology of the species. In addition to this field monitoring (described further in Sections 3 and 4), the cities will report information about the covered species using GIS, as follows:

1. For selected species, map specific locations targeted for conservation, based on existing major and critical population locations and future baseline surveys.
2. Document the conservation of these populations in the MHCP preserve (GIS map showing species location relative to preserve boundary).
3. Demonstrate the continued conservation and maintenance of these populations in the preserve through long-term preserve-level field monitoring.
4. Record the loss of critical or core populations outside the preserve, using GIS.

The selected species recommended for recording in GIS are narrow endemic species, vernal pool species, and other plant and animal species for which take authorizations require site-specific preserve design, special management measures, or site-specific monitoring (see Appendix A.1). Some covered species are not currently documented within the MHCP planning area (e.g., Parry's tetracoccus, arroyo toad, and Pacific pocket mouse). Baseline surveys of preserve areas should determine if there is potential habitat for these species. Where potential habitat for a given species is documented, specific surveys for these species will be required in at least two different years when rainfall is at or above average. If future populations of these species are discovered within MHCP preserve areas, they would be monitored consistent with their status and coverage conditions (see MHCP Plan, Volume II).

Spatial data required for the species in Appendix A.1 will include polygons showing the species distribution, mapped as part of initial baseline surveys (Appendix B). These polygons will be periodically updated to show changes in population size or extent, compared to baseline. Nonspatial data will include the percentage of the population conserved and lost and population size through time. Historic (i.e., baseline and all subsequent revisions) population sizes and boundaries will be maintained in the GIS to illustrate trends and mark potential changes in habitat quality or seed bank sizes and locations.

Population boundaries of species that are not narrow endemics and for which the coverage analysis was based on conservation of vegetation communities (Appendix A.2), rather than site-specific preserve design and special management and monitoring measures, are not recommended for tracking with GIS. Rather, conservation and loss of these species' habitats will be reported using the GIS-based vegetation community accounting process (HabiTrak, described in Section 2.1 above).

3.0 CONCEPTUAL MODELS, MONITORING QUESTIONS, AND MONITORING PROTOCOLS

This section provides management-oriented conceptual models of the biological systems to be monitored, monitoring objectives, and some potential management options. Conceptual models are used to identify the monitoring questions or hypotheses to be tested in the monitoring program and the critical assumptions and uncertainties that need to be resolved. The monitoring program should be "hypothesis-driven," i.e. monitoring should be driven by clearly articulated monitoring objectives or questions that the data will be used to evaluate. Such questions should be articulated before data collection occurs, and predictions should be as specific as is reasonably possible.

Conceptual models are presented herein for groups of vegetation communities in the MHCP planning area. Additional sets of competing hypotheses or models about species, vegetation communities, and ecological processes may be developed and tested using the model selection approach (Franklin et al. 2001). Models should be developed empirically, where possible, but also may include expert opinion (Franklin et al. 2001, Kendall 2001). The monitoring program will help to increase our knowledge about the ecosystem (Franklin et al. 2001) and may also help determine what management actions are most effective or compatible with the biological goals.

The intensity (i.e., frequency and level of effort) of monitoring varies for each species depending on a variety of factors, including the importance of the MHCP planning area to the survival of the species as a whole. Generally, the level of monitoring is greater for species with site-specific permit conditions (Appendix A.1) than for species with habitat-based permit conditions (Appendix A.2). Monitoring is also more intensive for narrow endemic species than for other species and more intensive for listed species than for unlisted species. Monitoring protocols for plants vary depending on whether the species is an annual herbaceous species or a perennial shrub species. Monitoring strategies for covered species are summarized in Appendix A.3. The distribution, abundance, and threats to these species, along with assumptions regarding their biology and conditions for coverage, are described in the MHCP Plan, Volume II.

Sampling protocols are currently being field-tested, or, in some instances, have yet to be finalized and are therefore subject to change. Initially, preserve-level monitoring must be conducted annually at all MHCP preserve areas by the cities and the wildlife agencies. In the future, after the range of natural conditions is established, the frequency of monitoring may be reduced.

3.1 COASTAL SAGE SCRUB, CHAPARRAL, AND GRASSLAND

3.1.1 Conceptual Vegetation Community Model

Vegetation Community Descriptions

Coastal Sage Scrub. In the MHCP planning area, the coastal sage scrub ecological community includes southern coastal bluff scrub, maritime succulent scrub, Diegan coastal sage scrub, and coastal sage-chaparral mix. These communities occur on a variety of soils and aspects. Maritime succulent scrub is distributed narrowly along the coast, and coastal bluff scrub is restricted to a small area on the coast in Solana Beach. The other communities are well distributed through the MHCP planning area. Coastal sage scrub is often characterized by the presence of California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), and laurel sumac (*Malosma laurina*), but its composition is variable. Coastal sage scrub often occurs in a mosaic with chaparral and grassland communities.

Chaparral. In the MHCP planning area, the chaparral ecological community includes southern mixed chaparral and southern maritime chaparral. Southern maritime chaparral is more narrowly distributed along coastal areas than the more widely distributed southern mixed chaparral. Chaparral is often characterized by the presence of mission manzanita (*Xylococcus bicolor*), chamise (*Adenostoma fasciculatum*), scrub oak (*Quercus berberidifolia*), redberry (*Rhamnus crocea*), and toyon (*Heteromeles arbutifolia*). Chaparral is typically found on more mesic sites than coastal sage scrub and often dominates moderate to steep north-facing slopes. This community is taller in stature and generally denser than coastal sage scrub and is typically characterized by evergreen species.

Grassland. In the MHCP planning area, grasslands include both native and annual grasslands. Annual grasslands are characterized by nonnative annual grasses such as bromes (*Bromus* spp.) and oats (*Avena* spp.). Native grasslands are rare in the MHCP planning area and are characterized by native perennial grasses such as purple needlegrass (*Nassella pulchra*) and forbs such as blue-eyed grass (*Sisyrinchium bellum*) and blue dicks (*Dichlostemma pulchellum*). Grasslands that occur on heavy clay soils may support sensitive grassland plant species such as San Diego thorn-mint, Orcutt's brodiaea (*Brodiaea orcuttii*), and San Diego golden star (*Muilla clevelandii*). Vernal pools in the MHCP planning area are also found in grassland communities on clay soils (see Section 3.5).

Physical and Biological Processes that Support Vegetation Communities and Species

The distribution and structure of these upland vegetation communities is largely governed by climate, fire regimes, soils, and species colonization and regeneration patterns associated with primary and secondary succession (Hanes 1977, Mooney 1977, Westman 1981). Coastal sage scrub, chaparral, and grasslands in Southern California have evolved in and are adapted to a Mediterranean climate, with hot, dry summers and cool, wet

winters. The Mediterranean climate is considered a major environmental factor in the ecology of the plant communities (Hanes 1977, Mooney 1977). In this climate, summer wildfires historically occurred at intervals of 20 to 70 years (Keeley 1986, Minnich 1995), and coastal sage scrub, chaparral, and native grasslands rely on this fire cycle to maintain their distribution and structure. Modifications of natural fire cycles can alter the composition of the community (Zedler et al. 1983).

Many coastal sage scrub species are considered to be "pioneer species," which are present in early successional stages following disturbances (Mooney 1977, Zedler et al. 1983). However, the coastal sage scrub community can either be "preclimax" to chaparral or be a stable climax community, depending on soil parent material, aspect, and disturbance history. Coastal sage scrub tends to be a stable climax community on drier sites (Mooney 1977), and the spatial patterning of chaparral versus coastal sage scrub can often be related to soil moisture (Hanes 1977). As the moisture-holding capacity of soil types can vary, soil type can have a significant effect on the distribution of plant species (Westman 1981). Nitrogen has been shown to be a limiting nutrient for chaparral plants, and soils vary with respect to the availability of nutrients (Westman 1981).

MHCP Covered Species in Coastal Sage Scrub, Chaparral, and Grassland

Animals	**Plants**
Orange-throated whiptail	San Diego thorn-mint*
Golden eagle	San Diego ambrosia*
Coastal cactus wren*	Del Mar manzanita*
Coastal California gnatcatcher	Encinitas baccharis*
S. California rufous-crowned sparrow	Orcutt's spineflower*
Bell's sage sparrow	Wart-stemmed ceanothus
Stephens' kangaroo rat	Summer holly
Northwestern San Diego pocket mouse	Del Mar sand aster*
*Pacific little pocket mouse**	Blochman's dudleya
San Diego black-tailed jackrabbit	*Short-leaved dudleya**
Mountain lion	Sticky dudleya
Mule deer	Cliff spurge
	San Diego barrel cactus
	Orcutt's hazardia*
	Torrey pine
	Nuttall's scrub oak
	Parry's tetracoccus

Species in italics are not currently known to occur in the MHCP planning area.
* Narrow endemic species.

Threats to Vegetation Communities, Covered Species, and Processes

There are a variety of threats to coastal sage scrub, chaparral, and grassland within the MHCP planning area (see MHCP Plan, Volume II). Many of these threats are related to habitat fragmentation by development and infrastructure. As development fragments habitat areas into smaller patches, the amount of habitat edge increases. Habitat edges are the interfaces between natural habitats and adjacent human land uses, and this interface is where many adverse indirect impacts to remaining natural open space originate (Lovejoy et al. 1986, Yahner 1988, Sauvajot and Buechner 1993). Indirect impacts include increases in lights and noise, invasions by exotic plant and animal species, increased mortality from road kill, changes in fire cycles, and disturbance of vegetation by foot and vehicle traffic. The long-term adverse effects of the majority of these indirect impacts are not fully understood, but it is clear that they can severely degrade the quality of habitats that are not directly impacted by development.

Developments and associated roadways result in elevated light and noise levels compared to undeveloped areas. Elevated light levels are receiving more attention as a causal factor of biological change. Nocturnal animals, such as owls and many snakes, may have their foraging activities disrupted by excessive light levels. Recent research by the USGS (Fisher unpublished data) indicates that some nocturnal snake species are not found in proximity to developments; Fisher speculates that excessive lighting is responsible. Elevated noise has long been recognized as having the potential to adversely affect species that communicate by vocalizing (RECON 1989). Songbirds that establish breeding territories and attract mates with vocalizations can have their reproductive success reduced by excessive ambient noise levels.

Development and other human land uses generally facilitate the invasion of nonnative plant and animal species into adjacent natural habitats, especially in small habitat fragments (McConnaughay and Bazzaz 1987, Tyser and Worley 1992, Brothers and Spingarn 1992, Matlack 1993). Exotic species in landscaping adjacent to natural open space often escape, become established, and spread further into the interior of open space areas. Many of the species can spread rapidly and are difficult to control (e.g., pampas grass, eucalyptus, iceplant). In addition, many human activities, such as road and other infrastructure construction (e.g., pipelines and transmission lines) and recreational activities within open space areas, result in disturbance of existing vegetation, compaction of soils, and changes in runoff patterns. These alterations facilitate the invasion of nonnative plants, particularly annual grasses and forbs, by providing points of establishment within the interior of open space areas where the nonnative species can successfully outcompete native species in the altered physical environment. Urban runoff into the preserve can promote invasion by Argentine ants, which compete with native species of ants and may be a threat for nesting birds. In addition, free-ranging pets (cats and dogs) can cause substantial mortality to some wildlife species, particularly birds, reptiles, and small mammals (Spencer and Goldsmith 1994).

Development and the construction of roads alter movement patterns of many wildlife species, particularly mobile species such as larger mammals (e.g., mule deer, coyotes,

bobcats, and mountain lions). Development can force these mobile species to move more frequently across roadways to reach fragmented habitat patches. Road crossings by wildlife often result in increased mortality from road kill on busy roadways (Beier 1993, 1995). This is particularly true on newly constructed roads that cross existing movement corridors. This increased source of mortality, coupled with reduced habitat quantity and quality from direct and indirect impacts, may be enough to produce local extinction of some species.

Most upland vegetation communities in Southern California have evolved with fire, which is thought to have burned at intervals of 20-70 years (Keeley 1986, Minnich 1995). Overly frequent fires can type-convert shrub habitats to grassland habitats. The establishment of annual grasses provides a fuel load that decreases the return interval between fires, creating a positive feedback loop that continues to favor annual nonnative grasses over native species (Minnich and Dezzani 1998). On the other hand, human fire suppression can lead to overly mature habitats and increased fuel loads, which result in larger, hotter fires when a burn does occur. Development and fragmentation of habitats does not allow natural fire regimes to continue without placing adjacent homes and businesses at risk, thereby increasing pressure on fire protection agencies to suppress wildfires. In addition, in natural open space areas, fire frequency has actually increased due to human sources of ignition (e.g., off-road vehicles, cigarettes, campfires at homeless encampments).

Increased nitrogen input into soils from automobile exhaust greatly favors weedy annual species over native perennial species (Allen et al. 1996). When this effect is combined with invasion of exotic grasses and unnaturally frequent fires, coastal sage scrub and other communities are rapidly converted to nonnative grasslands or weedy fields (Minnich and Dezzani 1998). This process is likely to accelerate under global climate change (Field et al. 1999).

Residential developments in close proximity to natural open space areas generally result in increased disturbances from foot, bicycle, and motorized vehicular traffic as well as an increase in trash. Establishment of unauthorized trails is a large management issue in most open space areas in San Diego County, resulting in the loss of vegetation and compaction and erosion of underlying soils. These trails are also routes for the invasion of nonnative species. In some instances, these disturbances can produce severe, virtually permanent habitat degradation. Buildup of trash or litter in and adjacent to the preserve can attract house rats and promote the abundance of mesopredators such as raccoons and skunks. An overabundance of mesopredators can affect nesting success of native birds.

Further discussion of exotic species' threats and threats to wildlife movement is included in Section 4.

Special Issues and Critical Assumptions

Connectivity between habitat fragments is assumed to facilitate dispersal and movements of plant and animal species among patches of habitat in the MHCP preserve network. The

MHCP planning area is assumed to be a crucial bird dispersal corridor, connecting large patches of coastal sage scrub at Marine Corps Base (MCB) Camp Pendleton to the north and in the Multiple Species Conservation Program (MSCP) preserve system to the south. In particular, it is assumed that the "stepping stones" of coastal sage scrub habitats in the MHCP planning area maintain genetic and demographic connectivity between large core populations of the coastal California gnatcatcher on MCB Camp Pendleton and those in the MSCP planning area.

It is assumed that the level of survey effort for narrow endemic plant species in the planning area has been relatively high, particularly in coastal locations. The MHCP preserve design assumes that adequate suitable habitat for pollinators and seed dispersal agents is available in smaller habitat patches supporting covered plant species. However, for many covered plant species, the specific pollinators are not known. Annual fluctuations in population size and levels of recruitment are not known for most of the covered plant species. For shrub species, life expectancy is not known, and seed set is expected to be low.

This monitoring plan assumes that exotic plant species pose the largest threat to covered plant species and that human disturbance allows or facilitates invasion by exotic plants. The current necessary levels of weed management to eradicate or control these exotic species have not been predicted for these areas, and the impacts of weed management on native species have not been evaluated.

This monitoring plan also assumes that vegetation communities exhibiting little human disturbance in the form of trails, soil erosion, trampling, trash, exotic species, etc. are ecologically healthier than areas that exhibit this type of disturbance. For species whose permit conditions are habitat-based (Appendix A.2), it is assumed that managing toward a habitat with little evidence of disturbance, as described above, will be sufficient to sustain these species.

Another major unknown for upland vegetation communities is the appropriate fire interval and whether mechanical disturbance can be an effective replacement for fire. Fire response mechanisms are not known for many species (e.g., Encinitas baccharis). We assume that most communities in the MHCP planning area have burned too frequently during the period of human habitation, and, thus, prescriptive burning should not be necessary in the near future. However, when developing preserve management plans, individual preserve managers should review this assumption relative to fire history data for the property.

We anticipate that the large number of small habitat fragments in the preserve will be subject to substantial edge effects and will require intensive management to control adverse effects and maintain habitat value. The form of this management against edge effects is not clearly understood, but it could include fencing, trapping of cowbirds and domestic pets, landscaping restrictions, and controlling nonnative ant species.

Based on the scientific literature, it is assumed that invasive nonnative ant species (i.e., Argentine ant and fire ant) could significantly reduce or eliminate the prey base for orange-throated whiptails and other reptiles in smaller, edge-affected habitat patches (see Section 4.2.1). Preventing surface runoff and subsurface seepage of water into the preserve may help in controlling nonnative ants. Pesticides may be effective in very localized situations. However, pesticides that kill ants can cause a replacement of native ants by nonnative ant species because the nonnative ants can re-invade and re-establish faster than the native species (Swartz pers. comm.). Other methods of control are not known.

Because of fragmentation and the small size of habitat patches in the coastal portions of the MHCP planning area, it is assumed that mountain lions and deer use only the easternmost portions of the MHCP preserve.

3.1.2 Available Management Actions

Some of the management actions available to address the threats identified above and to minimize potentially negative impacts are mentioned below. Implementation of specific management actions should maintain or enhance ecological "functions" of individual areas of the preserve and the preserve as a whole. Responses to management actions will be predicted *a priori* (i.e., before the action is initiated), and the results will be monitored where any degree of uncertainty in either implementation or effectiveness exists. Future management actions will be modified depending on the response. The preserve managers are responsible for prioritizing management actions and reallocating or reprioritizing funds, as necessary, to accommodate changes in management actions on lands they manage. Preserve managers may need to initiate focused research programs to test critical assumptions and cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Control public access points.
- Establish fencing and signs, and close or redirect trails to protect habitat or species populations from trampling or other adverse, direct impacts.
- Remove invasive exotic plant species to protect native habitats, plant populations, and wildlife values.
- Remove or control nonnative animal species (e.g., cowbirds, feral cats) to protect native species.
- Educate homeowners about keeping pets indoors at night and keeping pet food indoors or in a secured location that does not attract animals from the preserve.
- Implement landscaping restrictions adjacent to the preserve, to prevent invasive exotic species from invading the preserve.
- Enhance habitat to provide pollinator habitat or breeding areas for wildlife.
- Restore habitat to reverse the effects of habitat disturbance and improve habitat quality for covered species where natural regeneration processes are expected to be unacceptably slow or delayed.

- Develop and implement a fire management plan that identifies appropriate fire suppression practices for the preserve and prioritizes areas for fire suppression and, where appropriate, for prescribed burns.
- Evaluate the need for prescribed burns (or alternative, mechanized methods) to revitalize senescent stands of habitat or promote germination of fire-adapted covered plant species (note: prescribed burns likely will be limited except for larger areas of the preserve).
- Consider enhancement of cactus wren habitat and narrow endemic plant populations where conserved population numbers become so low due to human- or environmentally-induced factors as to threaten the continued viability of the population, and where suitable habitat and other factors necessary for survival still exist.
- Consider plant population reintroductions in areas where species populations have been inadvertently extirpated, or into historical but unoccupied habitat where overall number of populations is less than five;
- Control water sources and urban runoff within the preserve through an educational program that informs residents of the detrimental effects of certain types of landscaping plants and watering regimes on adjacent biological resources and offers literature on alternatives such as xerophytic plantings and drip irrigation. Additional recommendations may be appropriate for new developments, such as requiring the use of French drains to minimize seepage on slopes, diverting runoff away from the preserve, and restricting irrigation and certain types of plantings adjacent to the preserve.
- Redirect urban runoff away from the preserve to minimize moist soils that provide habitat for Argentine ants.
- Restrict equestrian and mountain bike activity to existing maintained roads. Close roads to equestrians and mountain bikes for 3 days following rainfall events greater than 1 inch.
- Identify erosion problems that have the potential to impact covered plant populations, and install reinforcements to slow erosion.
- Install water bars across dirt roads to control erosion.
- Prohibit unauthorized motor vehicles.
- Prohibit feeding of wildlife.
- Arrange for regular trash pickup.
- Patrol for illegal uses in the preserve.
- Direct all lighting sources away from the preserve, and restrict night-time activities in the preserve.
- Restrict construction noise and other noises >60 dB during the bird breeding season.
- Also see management actions in Section 4 relative to wildlife movement and exotic species.

3.1.3 Monitoring at All Preserve Areas

Baseline Surveys and Vegetation Mapping

Baseline surveys and vegetation mapping will be conducted at all preserve areas where these habitats occur, as outlined in Appendix B. Baseline surveys will include surveys of potential habitat for all covered species, including species not currently known to occur in the MHCP planning area or known from only one or two locations. Predictions about habitat associations will be developed and tested during baseline surveys for all covered species.

The cities should prepare a list of preserve areas that are conserved at the time of signing the implementing agreement, and jointly identify with the wildlife agencies which areas need new baseline surveys and which areas have already had recent baseline surveys. Recent surveys conducted as part of environmental analyses (i.e., CEQA or NEPA) may be used as baseline surveys, as long as they are supplemented by data collected on management needs (which typically are not collected as part of technical reports for environmental documentation). The cities may wish to implement a policy requiring that CEQA/NEPA biological analysis be expanded to include the baseline information required for preparing a MHCP management and monitoring plan for the property.

San Diego Thorn-mint, San Diego Ambrosia, Orcutt's Spineflower, Del Mar Mesa Sand Aster, Orcutt's Hazardia, and Short-leaved Dudleya

The objective of monitoring these plant species is to annually track their distribution and density in all preserve areas where they occur. These plants are narrow endemic species with site-specific permit conditions. The San Diego thorn-mint and Orcutt's spineflower are federally and state listed, while San Diego ambrosia is federally listed as endangered. Their persistence in the MHCP planning area is critical to the survival of the species. Management actions to reverse a downward trend in densities of these species may include exotic species removal, erosion control, fencing, seed collection, or additional research to determine causal factors. Orcutt's spineflower is currently known to occur in only one location in the planning area. Short-leaved dudleya is not currently known to occur in the MHCP planning area.

Monitoring Questions. The cities, an MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. What are the distribution and current status (e.g., density, areal extent) of these species' populations?
2. What factors (e.g., site conditions, nonnative plants, recreation, etc.) may be significantly affecting their persistence or distribution?
3. What is the density of nonnative plant species in and adjacent to these populations, and how does density change over time?

4. How do management actions affect nonnative plant impacts on covered plant species? What are the effects of other management actions on covered plant species?

Monitoring Protocols. The areal extent of these species' populations will be mapped as part of baseline inventory efforts and monitored annually. Additional suitable habitat where the species have not been documented will also be surveyed during at least 2 years with average to above-average rainfall. If the species is not found, no further surveys are required. Each year's distribution will be maintained in the database to allow tracking of the population's spatial dynamics. Within all of the mapped population areas, population density or relative abundance will be estimated using appropriate sample techniques.

One way to evaluate the response of annual herbaceous species to factors hypothesized to affect their status is to assess changes in density of the individuals in the population. Density provides a useful metric for management purposes, in that it can be directly related to changes in nonnative plant cover. Total population size can be projected from density estimates, if the area occupied by the population is known. In addition, sampling effort can be allocated to obtain statistical comparisons with adequate power.

This protocol is a variation of the methods described in the MSCP Biological Monitoring Plan (Ogden 1996). This protocol uses the relevé quadrat survey method (Braun-Blanquet 1932) and has been used in monitoring conducted by Scott McMillan for the City of San Diego (McMillan and CBI 2002). Monitoring will be conducted annually at each preserve where these species occur (see the example data form in Appendix C.1).

Determine the number of quadrats by the population size and distribution of the population. Distribute quadrat plots across the observed range of rare plant densities at each locality (i.e., stratified sampling based on visual estimates of density). Place quadrats in areas with low, medium, and high densities of the target rare plant species and at varied distances from the center of the population. Note: For small populations, the entire population should be counted. In this instance, quadrats would be used primarily to estimate densities of nonnative species.

Quadrats should not be permanently marked but rather should be redistributed throughout the population each monitoring period. Reallocating sampling units each monitoring period will provide an assessment of the change in the average condition of the area from one sampling period to the next, instead of the change in condition within the fixed quadrat locations. In addition, permanent quadrats can result in more foot traffic disturbance from repeated visits in the monitored areas, thus contributing to an increase in nonnative plant cover. It is likely that the results of monitoring permanent quadrat locations would be influenced by the repeated presence of the field investigator, rather than changes associated with natural variability or other stresses.

Recommended quadrat size for these species is 1 m^2 but quadrat size should be reevaluated after initial field monitoring is conducted. In each quadrat, count the number of individuals of each covered plant species, and estimate the percent cover of native and

nonnative species. In very small populations, all individuals should be counted and the quadrats can be used to estimate native and nonnative species cover. This approach allows the density of the target plant species and the average cover of native and nonnative species to be estimated for the monitored population.

In addition to counting numbers of individuals of a rare plant species, estimate percent of individuals in vegetation, flower, and fruit for each quadrat. Also record the slope and slope aspect (slope direction) for each quadrat, and the percent native cover, nonnative cover, and bare ground. Describe the habitat surrounding the population, noting specific management problems and disturbances. Monitor management actions for their effectiveness in controlling or reducing exotic species and habitat disturbance.

Flag the monitored populations in the field, and map the perimeter of each population using a GPS (Global Positioning System) unit for better geographic accuracy and improved relocation of each population. Knowing the exact boundary of each population will make it easier to detect changes in the size and shape of the population. This will also allow calculation of the total area for each population which, in combination with knowing the plant densities, will allow for a more accurate estimate of the total population size.

Density of covered plant species often varies widely with annual precipitation. Correlations between annual precipitation and plant density will be important in establishing a baseline range of variation for these species.

Del Mar Manzanita and Encinitas Baccharis

The objective of monitoring these narrow endemic plant species is to track their distribution and condition in all preserve areas where they occur. These plants are perennial shrub species covered by the MHCP with site-specific permit conditions. Del Mar manzanita is federally endangered, while Encinitas baccharis is federally threatened and state endangered. Their persistence in the MHCP planning area is critical to the continued existence of the species. Management actions to reverse a downward trend in densities of these species may include exotic species removal, erosion control, fencing, seed collection, or additional research to determine causal factors.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. What is the distribution of Del Mar manzanita and Encinitas baccharis?
2. What are the site conditions that may influence spatial patterns in the population dynamics of these species?
3. Are the populations being avoided by recreational users?
4. Have management actions been effective in maintaining or enhancing the populations?
5. What is the condition of the population, for example, the level of disturbance, degree of recruitment, abundance of exotics, etc.?

Monitoring Protocol. The areal extent of these perennial shrub species' populations will be mapped as part of baseline inventory efforts and every 5 years as part of the vegetation community mapping updates (see Appendix B). The distribution in each survey period will be maintained in the database to allow tracking of the population's spatial dynamics, i.e., calculating changes in areal extent of the population based on delineation of the population boundary. Condition and degree of disturbance to the habitat will be recorded and monitored. Management actions to control or reduce habitat disturbance will be monitored for effectiveness.

Wart-stemmed Ceanothus, Summer Holly, Blochman's Dudleya, Sticky Dudleya, Cliff Spurge, San Diego Barrel Cactus, Nuttall's Scrub Oak, Torrey Pine, and Parry's Tetracoccus

Permit conditions for wart-stemmed ceanothus, summer holly, Blochman's dudleya, sticky dudleya, cliff spurge, San Diego barrel cactus, Nuttall's scrub oak, Torrey pine, and Parry's tetracoccus are habitat-based, i.e., the permit assumes that managing the habitat will be sufficient to maintain the species. These species are also known to occur outside the MHCP planning area. Parry's tetracoccus is not currently known to occur in the MHCP planning area. The objective of monitoring these species is to annually track their presence in all preserve areas where they occur, using systematic surveys for each species. The wildlife agencies will provide guidance on the level of effort required for these surveys.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. What are the distribution and current status of these species? Are these species present in the preserve unit?
2. What is the general condition of the habitat supporting these species? For example, what is the level of disturbance, degree of recruitment, abundance of exotics, etc.?
3. What factors (e.g., site conditions, nonnative plants, recreation, etc.) may significantly affect their persistence and distribution?

Monitoring Protocol. The presence of these species' populations will be noted as part of systematic surveys during baseline inventory efforts. Thereafter, annual presence-absence surveys will be conducted, and general condition of the habitat and degree of disturbance will be observed and recorded. Suitable habitat for Parry's tetracoccus will be surveyed during at least 2 years with average to above-average rainfall. If the species is not found, no further surveys are required. Presence should be periodically reconfirmed in appropriate rainfall years. Management actions to control or reduce habitat disturbance will be monitored for effectiveness.

California Gnatcatcher and Coastal Cactus Wren

The California gnatcatcher is a federally threatened species. The gnatcatcher population within the MHCP planning area has been estimated to be 400 to 600 pairs (MHCP Plan, Volume II); however, not all areas of the MHCP planning area have been thoroughly surveyed. Monitoring of conserved habitats will allow a more accurate estimate of the population and will allow tracking of population size across time. Habitat for the coastal cactus wren, a narrow endemic species, in San Diego County is declining. The area of suitable nesting habitat for coastal cactus wrens is limited in the MHCP planning area, and this area is considered critical to the total cactus wren population around Lake Hodges and in San Pasqual Valley. Monitoring in suitable habitat will allow tracking of this population. Translocation scenarios can be tested through the adaptive management program. MHCP permit conditions are site-specific for both the gnatcatcher and the cactus wren (see MHCP Plan, Volume II).

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. What are the estimated population size and distribution of these bird species in the planning area, and how do the population size and distribution change within individual preserves and across the MHCP planning area?
2. How do changes in population size and distribution relate to changes in environmental factors and human-induced stressors? Is the population being avoided by recreational users?
3. Are management actions effective in maintaining or enhancing the population?

Monitoring Protocols. For cactus wren surveys, surveyors will visit suitable cactus patches (Bernardo Mountain and San Pasqual Valley sites in Escondido) three times from January through mid-March each year, with at least a 7-day interval between site visits. Taped vocalizations will be used, as needed. The number of cactus wren pairs will be recorded, and notes will be taken on the condition of the cactus patch and habitat surrounding the cactus patch (e.g., level of vehicular disturbance, trampling of habitat, relative abundance of exotic species, trash, erosion, drainage conditions, etc.). See an example field data form in Appendix C.2.

For gnatcatcher surveys, surveyors will establish systematic survey routes through patches of suitable habitat, such that the suitable habitat is completely covered. Survey routes should be varied relative to time of day between visits. The surveyors will visit these patches three times during January through mid-March each year, with at least a 7-day interval between site visits. Taped vocalizations will be used, as needed. The number of gnatcatcher pairs will be recorded, and notes will be taken on the condition of the habitat (e.g., level of vehicular disturbance, trampling of habitat, relative abundance of exotic species, trash, erosion, drainage conditions, etc.). See an example field data form

in Appendix C.2. Management actions to control or reduce habitat disturbance will be monitored for effectiveness.

The observer should be skilled in identification, including knowledge of the songs and calls of birds. Surveys should begin within 1 hour after sunrise and end by noon. Surveys should not be conducted under extreme conditions, i.e., during heavy rain or when the temperature is >95°F or <40°F or with winds >10 mph.

Orange-throated Whiptail, Golden Eagle, Rufous-crowned Sparrow, Bell's Sage Sparrow, Northwestern San Diego Pocket Mouse, Stephens' Kangaroo Rat, San Diego Black-tailed Jackrabbit, Mountain Lion, and Southern Mule Deer

Permit conditions for orange-throated whiptail, golden eagle, rufous-crowned sparrow, Bell's sage sparrow, northwestern San Diego pocket mouse, Stephens' kangaroo rat, San Diego black-tailed jackrabbit, mountain lion, and southern mule deer are habitat-based, i.e., the permit assumes that managing the habitat will be sufficient to maintain the species. The Pacific little pocket mouse is a narrow endemic species with specific microhabitat requirements. Stephens' kangaroo rat and Pacific pocket mouse are not known to currently occur in the MHCP planning area.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. What preserve areas are occupied by these species?
2. How accurate are the models of the relationship between habitat and predictions of species occurrence?
3. What are the factors that may influence spatial patterns in the population dynamics of these species?

Monitoring Protocol. The general locations of these species' populations will be mapped, based on observation of individuals or their sign during systematic surveys of the preserve, as part of annual presence-absence survey efforts. Condition and degree of disturbance to the habitat will be recorded. Management actions to control or reduce habitat disturbance will be monitored for effectiveness. In addition, suitable habitat will be surveyed for sign of Stephens' kangaroo rat and Pacific little pocket mouse during at least 2 separate years of average or above-average rainfall. If the species is not found, no further surveys are required. The wildlife agencies will provide guidelines on the expected level of effort for presence-absence surveys and surveys of suitable habitat. The amount of search effort before a species is declared "absent" should also be standardized so that presence and absence results across the MHCP preserve can be compared.

3.1.4 Additional Monitoring at Selected Preserve Areas (Subregional Monitoring)

The objective of subregional-level monitoring is to provide the wildlife agencies with information to assess: (1) the potential relationships between landscape-scale preserve

configuration, land use patterns, and ecosystem condition across the MHCP planning area, and (2) relative abundance and distribution of key resources across the MHCP planning area.

Avian Coastal Sage Scrub Community

The MHCP conservation strategy has focused to a large degree on conserving coastal sage scrub vegetation and, particularly, habitat for the California gnatcatcher. The objective of monitoring coastal sage scrub bird species is to track the status and trends of the entire coastal sage scrub bird community, not just MHCP covered species.

Monitoring Questions. Coastal sage scrub bird community monitoring will be conducted annually at selected locations across the MHCP. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of coastal sage scrub habitat. Potential questions include:

1. How does the abundance of coastal sage scrub bird species vary across the MHCP preserve, and how does it change over time?
2. What is the species richness of coastal sage scrub bird species in the MHCP preserve, and how does it change over time?

Sampling Strategy. Annually conduct "extensive" point-count surveys along fixed routes, according to the methods described in Ralph et al. (1993). This method allows observations of the yearly changes in bird populations at fixed points, differences in species composition between habitats, and abundance patterns of species.

Monitoring Locations. The locations of sampling points will be determined by the area for which inference is desired and the amount of money and time available. Avian point-count monitoring should be considered at the following critical locations (MHCP Plan, Volume II) for California gnatcatchers, along the assumed stepping-stone coastal sage scrub linkage through the MHCP planning area. *Critical locations* are defined in the MHCP Plan as areas that must be substantially conserved for the species to be considered adequately conserved by the MHCP. Most of these locations also support *major populations* of gnatcatchers, defined in the MHCP Plan as populations considered sufficiently large to at least support enough breeding individuals to contribute reliably to the overall metapopulation stability of the species. The wildlife agencies and cities will work together to determine the number and exact locations of the sampling sites and frequency of monitoring.

- Unincorporated gnatcatcher core area
- La Costa/University Commons area in southeast Carlsbad/southwest San Marcos
- Stepping-stone coastal sage scrub habitat through Carlsbad
- Calavera Lake/Carlsbad Highlands area in northeast Carlsbad
- Oceanside Wildlife Corridor Planning Zone (see Oceanside Subarea Plan)

- North Oceanside adjacent to Camp Pendleton
- Portions of Escondido bordering San Pasqual Valley

Monitoring Protocols. Establish routes along roads or trails, consisting of ten census points situated approximately 255 m (850 ft) apart. Census points should be flagged, recorded on a GPS unit, and mapped. Point counts require the observer to record all the birds seen or heard within 50 m of a fixed point, within a given period of time (8 minutes at each point), and to describe the vegetation at each census point (see example data forms in Appendix C.3). The observer should be skilled in identification, including knowledge of the songs and calls of birds. Surveys should begin within 1 hour after sunrise and end by noon. Surveys should not be conducted under extreme conditions, i.e., during heavy rain or when the temperature is >95°F or <40°F or with winds >10 mph.

California Gnatcatcher Dispersal

A major goal of the MHCP conservation strategy is maintaining genetic connectivity for California gnatcatchers across the MHCP preserve with core gnatcatcher areas to the north and south (MHCP Plan, Volume II). The objective of gnatcatcher dispersal monitoring is to assess dispersal of gnatcatchers throughout the MHCP preserve system.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of habitat for gnatcatcher dispersal. Potential questions include:

1. Are gnatcatchers dispersing through the MHCP planning area to core populations to the north and south of the MHCP?
2. What is the effectiveness of habitat patches of coastal sage scrub functioning as stepping stones for dispersing birds, and do these patches act more as population sources or sinks?
3. Are gnatcatchers breeding in coastal sage scrub patches that form the dispersal corridor?

Sampling Strategy. Initial baseline studies will be conducted where California gnatcatchers will be individually marked and followed to monitor dispersal through the MHCP preserve. The wildlife agencies and cities will coordinate with Camp Pendleton and biological monitors for the MSCP preserve to record locations, dispersal distances, and likely dispersal routes from source patch to observation patch. After the initial baseline studies, the wildlife agencies and cities will develop a strategy and timeline for periodic banding and reassessment of dispersal.

Monitoring Locations. The wildlife agencies and cities will work together to determine the number and exact locations of the sampling sites and a specific design for this monitoring program. Potential locations include:

- Unincorporated gnatcatcher core area
- La Costa/University Commons area in southeast Carlsbad/southwest San Marcos
- Stepping-stone coastal sage scrub habitat through Carlsbad
- Calavera Lake/Carlsbad Highlands area in northeast Carlsbad
- Oceanside Wildlife Corridor Planning Zone (see Oceanside Subarea Plan)
- North Oceanside adjacent to Camp Pendleton
- Portions of Escondido bordering San Pasqual Valley

Monitoring Protocols. The USFWS is testing monitoring protocols and will provide details once the testing period is completed.

Herpetofauna

The objective of herpetofauna monitoring is to annually track distribution, species richness, and relative abundance by sampling a variety of habitat types (i.e., coastal sage scrub, chaparral, grassland, oak woodland) and landscape configurations (e.g., large and small patches, closed vs. open vegetation canopy, elevation or aspect variations) throughout the preserve.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate preserve management. Potential questions include:

1. What are the distribution, species richness, and relative abundance of the herpetofauna species throughout the preserve, and how do they change over time?
2. How do distribution, species richness, and relative abundance of herpetofauna relate to patch size, canopy cover, elevation, and distribution of vegetation communities? What are specific predictions?

Sampling Strategy. Reptile species diversity will be monitored at a selected number of fixed sites in coastal sage scrub, chaparral, oak woodland, and grassland habitats of different patch sizes. Arrays will be distributed around the site to capture variations in physical habitat features (e.g., closed vs. open vegetation canopy, elevation or aspect variations).

Monitoring Locations. In coastal sage scrub habitats, sampling for herpetofauna will be in the same general locations for monitoring the coastal sage scrub avian community. The wildlife agencies and cities will work together to determine the number and exact locations of the sampling sites. These may include:

- Unincorporated gnatcatcher core area
- La Costa/University Commons area in southeast Carlsbad/southwest San Marcos
- Stepping-stone coastal sage scrub habitat through Carlsbad
- Calavera Lake/Carlsbad Highlands area in northeast Carlsbad

- Oceanside Wildlife Corridor Planning Zone (see Oceanside Subarea Plan)
- North Oceanside adjacent to Camp Pendleton
- Portions of Escondido bordering San Pasqual Valley

Monitoring Protocols. The U.S. Geological Survey (USGS) is currently evaluating herpetofauna survey results from monitoring efforts throughout the South Coast Ecoregion. It is anticipated that the results of this evaluation will refine the herpetofauna monitoring program for MHCP. The current USGS protocol involves a minimum of ten pit fall trap arrays at each monitoring location, a maximum array density of one array per 20 acres of suitable habitat. Arrays will be constructed and installed per the protocol used by USGS for other locations in the South Coast Ecoregion. Arrays will be opened for a minimum 4-day sample period and checked daily. (This is actually 5 days of work including opening day.) One 4-day sampling period will occur in May/June, and one 4-day sampling period will occur in August/September. All data will be collected on standardized forms (see examples in Appendix C.4). All sites will be monitored every other year (with all sites being monitored in the same year). The number of monitoring locations for the MHCP has not yet been determined.

Data analysis will include a list of all reptile and small mammal species captured or observed within 100 ft of each pit fall trap array, relative abundance of each species, species diversity index, and an assessment of any changes to the physical setting or immediate surroundings of each site.

3.2 RIPARIAN VEGETATION COMMUNITIES

3.2.1 Conceptual Vegetation Community Model

Vegetation Community Description

In the MHCP planning area, the riparian ecological community includes riparian forest, riparian woodland, riparian scrub, and natural floodchannel/streambed vegetation. These vegetation types are associated with rivers, streams, drainages, and other watercourses. Riparian vegetation communities in the MHCP planning area generally are dominated by willows (*Salix* spp.), cottonwoods (*Populus* spp.), mulefat (*Baccharis salicifolia*), and western sycamores (*Platanus racemosa*). Willows and cottonwoods are often dominant along the active stream channel when permanent water is present, whereas sycamores tend to be a minor component of riparian habitats associated with permanent water but increase in abundance on higher flood terraces or along intermittent and ephemeral drainages.

Physical and Biological Processes that Support Riparian Vegetation Communities and Species

Riparian plant species recruitment and survival are strongly associated with riverine hydrology and fluvial processes (Scott et al. 1996, 1997; Shafroth et al. 1998; Stromberg 1993, 1998). Woody riparian plant species establish in positions along streams where there are suitable conditions for seed germination and sufficient water for seedling

survival, and where they can tolerate physical disturbance from floods (Stromberg and Patten 1992, Hupp and Osterkamp 1996, Scott et al. 1996, Mahoney and Rood 1998). Thus, the structure of riparian vegetation communities is often a mosaic, at varying spatial scales, of species and age classes produced by spatial and temporal variations in stream discharge patterns (Auble and Scott 1998, Stromberg et al. 1997, Shafroth et al. 1998).

Many willow species are recognized as "pioneer species" that are among the first to colonize newly exposed substrates along streams. In the Mediterranean climate zones of coastal California, riparian tree species tend to follow a dominance gradient with willows occurring on lower, wetter sites, cottonwoods on slightly higher first terraces, and sycamores on higher, dryer stream terraces (Walters et al. 1980). In Southern California, sycamores and coast live oaks dominate intermittent and ephemeral streams, whereas willows and cottonwoods dominate the banks of perennial streams (Faber et al. 1989).

Aquatic habitat quality is largely determined by substrate composition and water quality. Macroinvertebrate diversity is generally highest in streams with coarse substrates (coarse sands, gravels, and cobbles), moderate nutrient and high dissolved oxygen concentrations, and adequate tree canopy cover to moderate water temperatures. Many species associated with aquatic habitats require undisturbed adjacent upland areas to complete portions of their life cycle. Vegetation in adjacent upland areas also provides carbon and nutrients to aquatic habitats in the form of leaf litter, woody debris, and terrestrial insects and serves to moderate sediment input.

MHCP Covered Species in Riparian Vegetation Communities

Animals	Least Bell's vireo
Harbison's dun skipper butterfly*	Yellow-breasted chat
Arroyo toad	Mountain lion
Western spadefoot toad	Mule deer
Southwestern pond turtle	
White-faced ibis	**Plants**
Cooper's hawk	San Diego marsh-elder
Southwestern willow flycatcher	

Species in italics are not currently known to occur in the MHCP planning area.
* Narrow endemic species.

Threats to Riparian Vegetation Communities, Covered Species, and Processes

Storm water runoff from developed areas can carry significant loads of urban pollutants (Paul and Meyer 2001). Runoff from impermeable surfaces such as buildings, streets, and landscaped areas transports a number of water quality constituents, such as silt, metals, fertilizers, herbicides, and pesticides, to downstream waterbodies. These constituents have been shown to cause toxicity to aquatic organisms and cause

eutrophication of receiving waters. Eutrophication generally depresses dissolved oxygen concentrations, particularly in pools and slow-moving waters. Sewage effluent can contain contaminants. The effect of high levels of estrogens in sewage effluent on biological communities is unclear.

Less studied, but potentially as significant, is the influence of altered stream hydrology on riparian biological communities. Alteration of hydrology and sediment supply affect riparian habitats by altering the amount and timing of flows. Many species have evolved under specific hydrologic regimes and can be sensitive to changes in the magnitude, frequency, and duration of flows. There is increasing evidence that modifications of riverine hydrologic characteristics by urban development and irrigated agriculture can greatly affect the composition of the riparian and aquatic communities. Research at Los Peñasquitos Creek (White and Greer in prep.) shows that increasing watershed development has greatly altered stream hydrology (increasing peak flood flows, total runoff, and summer base flow) and appears to have produced a shift in riparian vegetation community composition. In many instances, altered hydrologic characteristics favor nonnative species at the expense of native species. For example, recent research by the USGS (Fisher unpubl. data) shows that historically intermittent drainages that now have permanent base flow from irrigated landscaping or agriculture no longer support arroyo toads. This pattern has been attributed to the successful establishment of nonnative aquatic species (e.g., bullfrogs, bass, and sunfish) that prey on or compete with larval toads. Permanent summer flow can also encourage the establishment of nonnative plant species, such as giant reed.

A number of factors can reduce breeding success of riparian bird species. Excessive noise and lights can adversely affect mating behaviors of songbirds. Nest parasitism by brown-headed cowbirds (*Molothrus ater*) has the potential to significantly reduce reproductive success, and cowbirds can be particularly abundant in agricultural areas with livestock. Nonnative predators, such as house cats, can also prey on riparian birds.

As discussed for the upland communities (Section 3.1), development and human uses facilitate the invasion of nonnative plant species into adjacent natural habitats. Pampas grass and giant reed are especially invasive and abundant species in the riparian habitats of the MHCP planning area. Residential developments in close proximity to natural open space areas generally result in increased disturbances from foot, bicycle, and motorized vehicular traffic as well as an increase in trash. Illegal migrant worker encampments also contribute to trash and disturbance in riparian areas. Establishment of unauthorized trails is a large management issue in most open space areas in San Diego County, resulting in the loss of vegetation and compaction and erosion of underlying soils. These trails are also routes for the invasion of nonnative species. In some instances, these disturbances can produce severe, virtually permanent habitat degradation. Buildup of trash or litter in and adjacent to the preserve can attract house rats and promote the abundance of mesopredators such as raccoons and skunks. An unnaturally high abundance of mesopredators can affect nesting success of native birds.

Further discussion of exotic species' threats and threats to wildlife movement is included in Section 4.

Special Issues and Critical Assumptions

The linear configuration of riparian habitats often provides the only remaining movement corridor through urban and agricultural areas for many species. As such, riparian habitats provide the primary connection between coastal lagoon and inland upland habitats in the MHCP planning area. The MHCP Plan assumes that, by allowing top predators to control mesopredators in small coastal habitat patches, nest predation on ground-nesting birds will be reduced. Therefore, maintaining connections between coastal and inland habitats, primarily for coyote movement, was a specific element of the MHCP preserve design. It is assumed that mountain lions and deer use only the eastern portions of the MHCP preserve.

The San Diego marsh-elder is assumed to be wind-pollinated, and seeds are self-dispersed. This species has been successfully propagated in restoration projects. The level of survey effort for this species is considered relatively high in the planning area.

The MHCP Plan assumes that adequate upland habitat will be maintained around aquatic breeding habitats for spadefoot toads and southwestern pond turtles. It is assumed that mosquito control measures will harm toads and turtles and should be avoided in or near the preserve. The MHCP Plan also assumes that a diversity of vegetation age structures, including mature trees, will help to maintain vireo and willow flycatcher habitat, which will also benefit other riparian breeding birds, including yellow-breasted chat.

The U.S. Army Corps of Engineers proposes to maintain a portion of the San Luis Rey River as part of a flood control project that includes the 7.2-mile length from the river mouth to College Boulevard. The project includes periodic clearing or cutting of habitat. It is not known how these impacts will affect covered species.

3.2.2 Available Management Actions

There are several management actions available to address the threats identified above that could be tested for their ability to minimize potentially negative impacts. Responses to management actions will be predicted *a priori*, and results will be monitored in any circumstances where there is some measure of uncertainty in either the success of implementation or effectiveness of the action. Management actions will be modified depending on the response. The preserve managers are responsible for reallocating or reprioritizing funds to accommodate changes in management actions on lands they manage. Preserve managers may need to initiate focused research programs to search for correlations or cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Implement bank stabilization and erosion control measures only to protect key habitats or populations of covered species.

- Remove bank stabilization measures and erosion control measures to promote a natural dynamic succession of riparian habitats.
- Plant *Carex spissa* in suitable areas as habitat for Harbison's dun skipper larvae.
- Manipulate stands of riparian vegetation to provide structural diversity for covered bird species or breeding areas for covered wildlife species.
- Control public access points.
- Establish fencing and signs, and close or redirect trails to protect habitat or species populations from trampling or other adverse, direct impacts.
- Remove invasive exotic plant species to protect native habitats, plant populations, and wildlife values.
- Remove or control nonnative animal species (e.g., cowbirds, bullfrogs, bass, sunfish) to protect breeding birds and native aquatic species).
- Educate homeowners about keeping pets indoors at night and keeping pet food indoors or in a secured location that does not attract animals from the preserve.
- Control water sources and urban runoff within the preserve through an educational program that informs residents of the detrimental effects of certain types of landscaping plants and watering regimes on adjacent biological resources and offers literature on alternatives such as xerophytic plantings and drip irrigation. Additional recommendations may be appropriate for new developments, such as requiring the use of French drains to minimize seepage on slopes, diverting runoff away from the reserve, and restricting irrigation and certain types of plantings adjacent to the preserve. Refer to the Regional Water Quality Control Board standards for urban runoff.
- Work with upstream water management to maintain a flow regime amount and timing that is as close as possible to the natural flow regime.
- Restrict equestrian and mountain bike activity to existing maintained roads. Close roads to equestrians and mountain bikes for 3 days following rainfall events greater than 1 inch.
- Install water bars across dirt roads to control erosion.
- Prohibit unauthorized motor vehicles.
- Prohibit feeding of wildlife.
- Arrange for regular trash pickup.
- Patrol for illegal uses in the preserve.
- Direct all lighting sources away from the preserve, and restrict night-time activities in the preserve.
- Restrict construction noise and other noises >60 dB from the outer edge of the riparian habitat during the riparian bird breeding season.
- Work with pet stores to increase pet owner education, and develop a “take-back” program for unwanted non-native turtle pets.
- Maintain appropriate upland buffer zones.
- Also see management actions in Section 4 relative to wildlife movement and exotic species.

3.2.3 Monitoring at All Preserve Areas

Baseline Surveys and Vegetation Mapping

Baseline surveys, including systematic surveys of suitable habitat for all covered species, and vegetation mapping will be conducted as outlined in Appendix B.

Southwestern Willow Flycatcher, Least Bell's Vireo, Yellow-breasted Chat, and Cooper's Hawk

Monitoring in riparian communities will focus on breeding habitat for covered riparian bird species, i.e., southwestern willow flycatcher and least Bell's vireo (both are federally and state listed species), yellow-breasted chat, and Cooper's hawk.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions about these species include:

1. How many pairs of these bird species are estimated to be present in individual preserve areas, and what factors influence their occupancy over time?
2. What factors are positively or negatively affecting these species (e.g., are recreational users negatively impacting nesting success)?
3. Have management actions been effective in maintaining or enhancing the population?

Monitoring Protocols. Surveyors will establish systematic survey routes through patches of suitable habitat, such that the suitable habitat is completely covered. Survey routes should be varied relative to time of day between visits. The surveyors will visit these patches three times during April through June, with at least a 7-day interval between site visits. Taped vocalizations will be used, as needed. The number of pairs of each covered species will be recorded, and notes will be taken on the condition of the habitat (e.g., level of vehicular disturbance, trampling of habitat, relative abundance of exotic species, trash, erosion, drainage conditions, etc.). See example field data form in Appendix C.2.

The observer should be skilled in identification, including knowledge of the songs and calls of birds. Surveys should begin within 1 hour after sunrise and end by noon. Surveys should not be conducted under extreme conditions, i.e., during heavy rain or when the temperature is >95°F or <40°F or with winds >10 mph.
Condition and degree of disturbance to the habitat will be recorded, and management actions to control or reduce habitat disturbance will be monitored for effectiveness.

Arroyo Toad

The federally endangered arroyo toad is not currently known to occur in the MHCP planning area. However, thorough surveys have not been conducted throughout the

planning area for this federally endangered species. Conservation and monitoring of riparian habitats will allow a comprehensive evaluation of potential habitat for the arroyo toad.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate preserve management for this species. Potential questions include:

1. Is there potential breeding habitat for the arroyo toad in the preserve? What is the level of confidence with which we can predict its occurrence?
2. If there is potential breeding habitat in the preserve, are arroyo toads using this habitat?
3. What is the distribution of this habitat across the MHCP preserve system?
4. What factors may be improving or degrading potential habitat (e.g., recreation)?
5. Have management actions been effective in maintaining or enhancing the habitat?

Monitoring Protocols. First, survey for potential arroyo toad habitat. If potential habitat occurs in the preserve area, conduct night-time surveys for toads, tadpoles, and/or egg masses. Camp Pendleton is testing a new monitoring protocol over the next 3-5 years that could be transferable to the MHCP. The protocol described below is from the Biological Monitoring Plan for the MSCP (Ogden 1996).

In areas of potential breeding habitat, conduct surveys once every 3 years. Conduct at least three site visits between late March and late May. The survey should be conducted by a permitted biologist familiar with the male arroyo toad's breeding call and identification of toad eggs, tadpoles, and adults. Conduct surveys between 1 hour after dusk and midnight on nights lacking a full moon and nights when air temperatures are >55ºF. Avoid surveying during rain, high winds, or flood flows. Surveyors must be silent during surveys so as not to disturb calling toads. Use strong flashlights to visually identify adult toads; otherwise, lighting should be kept to a minimum. Surveyors must not enter the water near mating pairs and should not handle any toads.

Survey along the bank of the watercourse 10 ft back from the water's edge. If possible, survey up one bank and back along the other, concentrating on open habitats adjacent to suitable breeding habitats. Stop, listen for calls, then proceed to the next listening point until all suitable habitat has been covered. Shine a bright light ahead to detect eye-shine, and also survey for toads at close range. When crossing the stream, cross at the downstream end of potential breeding areas or on stable substrate to avoid trampling eggs or larvae and to avoid clouding the water with silt, which can smother eggs and young.

Each sighting of a toad, egg mass, or group of tadpoles will be entered as a separate line on a standard field form (see example in Appendix C.5), and a GPS reading will be recorded for the location. Condition and degree of disturbance to the habitat will be

recorded, and management actions to control or reduce habitat disturbance will be monitored for effectiveness.

San Diego Marsh Elder, Harbison's Dun Skipper, Western Spadefoot Toad, Southwestern Pond Turtle, White-faced Ibis, Mountain Lion, and Southern Mule Deer

Permit conditions for San Diego marsh elder, Harbison's dun skipper, western spadefoot toad, southwestern pond turtle, white-faced ibis, mountain lion, and southern mule deer are habitat-based, i.e., the permit assumes that managing the habitat will be sufficient to maintain the species.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of these species. Potential questions include:

1. What preserve areas are occupied by these species? How well does current knowledge of species-habitat relationships predict the occurrence of the species?
2. What are the variables that influence spatial patterns in the population dynamics of these species?
3. What is the relationship between the amount, timing, and type of disturbance and the presence or absence of these covered species?

Monitoring Protocol. The locations of these species' populations will be mapped as part of annual presence-absence survey efforts, which will include systematic surveys of all potential habitat. Condition and degree of disturbance to the habitat will be recorded, and management actions to control or reduce habitat disturbance will be monitored for effectiveness. The wildlife agencies will provide guidelines regarding the level of effort for presence-absence surveys.

3.2.4 Additional Monitoring at Selected Preserve Areas (Subregional Monitoring)

The objective of this monitoring is to provide the wildlife agencies with information to assess the potential relationships between landscape-scale preserve configuration, land use patterns, and ecosystem condition across the MHCP preserve and habitat quality and covered species persistence in the MHCP preserve.

Avian Community

The objectives of riparian monitoring are to (1) increase our knowledge of habitat use by breeding riparian birds, in general, (2) identify variables that influence the dynamics of populations of least Bell's vireos, southwestern willow flycatchers, yellow-breasted chats, and other obligate riparian bird species, and (3) assess the effectiveness of management actions. MHCP goals for vireos, flycatchers, and chats require conservation, management, and restoration, where needed, of high quality habitat. MHCP covered

riparian bird species are particularly sensitive to habitat degradation, nest parasitism, nest predation, and other adverse edge effects.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the management of breeding riparian bird species. Potential questions include:

1. What are the distribution and abundance of covered riparian bird species populations and other obligate riparian bird species in the MHCP preserve?
2. What is the incidence of cowbird parasitism or nest predation in critical populations of covered riparian birds in the MHCP preserve?
3. What management techniques reduce nest parasitism and predation?

Sampling Strategy. Subregional riparian monitoring will use reaches of the San Luis Rey River system as sampling units. This quantitative monitoring program is designed to build off of work conducted by Dr. Barbara Kus of the U.S. Geological Survey on the San Luis Rey River system. Quantitative monitoring will be conducted to assess the numbers of individuals establishing territories and nesting, evidence of nest parasitism, and evidence of fledging. The status and trends of covered riparian species in selected areas of the preserve will be assessed by quantifying the numbers of individual covered species establishing territories, nesting, and the fate of the nests. These data also will allow the incidence of nest parasitism and predation to be determined.

Monitoring Locations. Monitoring is proposed to be conducted on "critical populations" as defined in the MHCP Plan Volumes I and II (specific locations of species populations that must be substantially conserved to meet the MHCP biological goals and state and federal take authorization standards). Subregional monitoring for covered riparian species and their habitats will be conducted within conserved areas of the San Luis Rey River system (primarily the lower San Luis Rey River and Pilgrim Creek) due to the importance of this system to the MHCP covered species and riparian species in general. Dr. Kus has been monitoring avifauna use of the riparian habitat along Pilgrim Creek, adjacent to Douglas Drive in Oceanside, since 1997. She also has been monitoring the status of least Bell's vireos on the San Luis Rey River between College Avenue and Interstate-15 since 1997. Therefore, there are baseline data available at these locations.

Quantitative monitoring is recommended in the following reaches of the San Luis Rey River system. The wildlife agencies and cities will work together to determine the number and exact locations of the sampling sites and the frequency of sampling.

- San Luis Rey River – Interstate-5 to Oceanside Airport
- San Luis Rey River – Foussat Road to Douglas Drive
- San Luis Rey River – Douglas Drive to College Avenue
- San Luis Rey River –College Avenue To Mission Boulevard
- Pilgrim Creek – Golf course to Camp Pendleton
- North tributary to San Luis Rey River – between Vandergrift Boulevard and Sleeping Indian Road.

Monitoring Protocols. Within each reach listed above, a single permanent monitoring plot, 25-acres in size or less (depending on the amount of habitat in the reach) will be defined. Quantitative monitoring will be conducted within the monitoring plot, which is considered to characterize the entire reach. While monitoring of riparian vegetation and monitoring of covered riparian bird species are discussed separately, the monitoring strategy involves pairing the monitoring for both. These plots will be used to characterize particular river reaches that may provide gradients of riparian vegetation community structure/condition and covered species abundance and recruitment rates.

Within each monitoring plot, the territories (singing males) of the riparian covered bird species will be quantified, nest locations will be identified and mapped, and nest fate will be determined. The determination of nest fate will include determining number of eggs laid, nest parasitism rates, eggs or nests lost to nest predators, and number of chicks fledged.

Vegetation Community Structure

MHCP conservation goals and adaptive management strategies (MHCP Plan, Volume II) require measures to enhance riparian habitats and reduce cowbird nest parasitism. To accomplish this requirement, it is necessary to first describe quantitatively the physical and biological attributes of riparian vegetation communities that are indicative of high quality habitats for covered riparian bird species. Measuring the trends of physical and biological attributes of important riparian habitats and comparing these attributes with wildlife use will allow an assessment of general habitat quality for various wildlife species, groups, or guilds in the preserve, in addition to the MHCP covered species. The responses of birds to different habitat variables will be tested to identify some of the features that constitute "high quality" habitat.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the following questions:

1. What are relationships of changes in vegetation communities to changes in the populations of covered riparian bird species?
2. What is the response of the birds to manipulations in variables predicted to influence habitat quality, e.g., exotic plant removal, removal of erosion control measures, etc.?

Sampling Strategy. Subregional riparian monitoring will use reaches of the San Luis Rey River system as sampling units. This quantitative monitoring program is designed to build off of work conducted by Dr. Barbara Kus of the U.S. Geological Survey on the San Luis Rey River system. Quantitative monitoring will be conducted to assess the riparian vegetation composition and vertical and horizontal structure. Monitoring will be conducted within fixed plots in each of the reaches described below. These sampling data will be used to estimate biological conditions and change in these conditions across the subregion to address the monitoring questions. The distribution of riparian community

structure attributes across the sampled portion of the preserve can be correlated with covered species status and trends information to identify those attributes that relate to increased abundance or recruitment of covered species.

Monitoring Locations. Monitoring is proposed to be conducted on "critical populations" as defined in the MHCP Plan Volumes I and II (specific locations of species populations that must be substantially conserved to meet the MHCP biological goals and state and federal take authorization standards). Subregional monitoring for covered riparian species and their habitats will be conducted within conserved areas of the San Luis Rey River system (primarily the lower San Luis Rey River and Pilgrim Creek) due to the importance of this system to the MHCP covered species and riparian species in general. Dr. Kus has been monitoring vegetation community structure of the riparian habitat along Pilgrim Creek, adjacent to Douglas Drive in Oceanside, since 1997. Therefore, there are baseline data available at this location.

Quantitative monitoring is recommended in the following reaches of the San Luis Rey River system. The wildlife agencies and cities will work together to determine the number and exact locations of the sampling sites and the frequency of sampling.

- San Luis Rey River – Interstate-5 to Oceanside Airport
- San Luis Rey River – Foussat Road to Douglas Drive
- San Luis Rey River – Douglas Drive to College Avenue
- San Luis Rey River –College Avenue To Mission Boulevard
- Pilgrim Creek – Golf course to Camp Pendleton
- North tributary to San Luis Rey River – between Vandergrift Boulevard and Sleeping Indian Road.

Monitoring Protocols. Within each reach, a single permanent monitoring plot, 25-acres in size or less (depending on the amount of habitat in the reach) will be defined. Quantitative monitoring will be conducted within the monitoring plot, which is considered to characterize the entire reach. While monitoring of riparian vegetation and covered riparian bird species is discussed separately, the monitoring strategy involves pairing the monitoring for both. These plots will be used to characterize particular river reaches that may provide gradients of riparian vegetation community structure/condition and covered species abundance and recruitment rates.

Within each monitoring plot, permanent vegetation transects will be established perpendicular to the river channel. Along each transect, foliage volume at 1-meter (m) height intervals within 2 x 2-m plots will be measured and species contributing to the foliage volume will be identified. Monitors will also look for evidence of recruitment of woody riparian tree and shrub species and collect samples of heights and girths from the dominant riparian tree and shrub species along each transect.

Hydrology and Water Quality

The composition of riparian and stream communities can be strongly influenced by hydrologic patterns. Understanding these patterns is important to understanding the status of aquatic and riparian resources and their potential for restoration and management. Stream hydrology may also play an important role in the dynamics of riparian systems. When determined necessary by the wildlife agencies, stream gage data and water quality information will be collected and analyzed by the wildlife agencies to be used to evaluate the relationship between vegetation structure and covered species (including non-avian species) to flow patterns and water quality characteristics.

The wildlife agencies also will track permitted streambed alteration actions and conduct surveillance for non-permitted streambed alteration actions.

3.3 LAGOONS

3.3.1 Conceptual Lagoon Model

Vegetation Community Description

In the MHCP planning area, the lagoon and marsh ecological community includes the southern coastal salt marsh, alkali marsh, freshwater marsh, open water, estuarine, and saltpan/mudflats vegetation communities. The species composition in these communities is variable and dependent on elevations relative to tidal fluctuations and soil and pore water salinities. Characteristic species in areas of higher salinity may include cordgrass (*Spartina foliosa*), pickleweed (*Salicornia* spp.), alkali-heath (*Frankenia salina*), shoregrass (*Monanthochloe littoralis*), and saltgrass (*Distichilis spicata* var. *spicata*). In areas with reduced salinities, cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), and rushes (*Juncus* spp.) typically dominate.

Physical and Biological Processes that Support Lagoons and Species

The composition and structure of lagoon and marsh communities are tied largely to the hydrodynamics of each lagoon. The frequency of inundation by tides, volume of the tidal prism, volume of freshwater entering the lagoon, and elevations of marsh areas all interact to determine patterns of habitat distribution, which in turn determine physical structure and habitat suitability for wildlife species. Water quality in the lagoons is determined largely by the degree of tidal flushing and quality (nutrient and sediment concentrations) of inflow.

MHCP Covered Species in Lagoons

Animals	Western snowy plover
Saltmarsh skipper	Elegant tern
California brown pelican	California least tern
White-faced ibis	Belding's Savannah sparrow
Osprey	Large-billed Savannah sparrow
Peregrine falcon	**Plants**
Light-footed clapper rail	Nuttall's lotus

Threats to Lagoons, Covered Species, and Processes

Increasing volumes of freshwater runoff from urban development can alter the salinity regime of coastal lagoons and facilitate invasions by freshwater species Greer (2001). Poor quality urban runoff can cause eutrophication of lagoon systems, which produce algal blooms that reduce dissolved oxygen concentrations, thereby threatening aquatic life. Algal blooms can also reduce water clarity, which may reduce foraging success of fish-eating birds. These problems can be exacerbated when tidal flushing is reduced by frequent closures of lagoon mouths, decreased tidal prisms from elevated sedimentation rates and placement of fill, and constrictions of tidal channels by roadways.

The isolation of lagoons from populations of top predators can result in increased population sizes of mesopredators via "mesopredator release" (Soulé et al. 1988, Crooks 2000). These mesopredators (e.g., raccoons, skunks, opossums, foxes) can increase predation rates on ground-nesting birds. Human activity during the nesting season can disturb nesting by least terns and snowy plovers.

Developments and associated roadways result in elevated light and noise levels compared to undeveloped areas. Elevated light levels are receiving more attention as a causal factor of biological change. Excessive light levels may disrupt foraging activities of nocturnal animals, such as owls and many snakes. Elevated noise has long been recognized as having the potential to adversely affect species that communicate by vocalizing. Excessive ambient noise levels can result in reduced reproductive success in bird species that establish territories and attract mates with vocalizations.

As discussed for the upland communities (Section 3.1), residential developments in close proximity to natural open space areas generally result in increased disturbances from foot, bicycle, and motorized vehicular traffic as well as an increase in trash. In some instances, these disturbances can produce severe, virtually permanent habitat degradation. Buildup of trash or litter in and adjacent to the preserve can attract house rats and promote the abundance of mesopredators.
Further discussion of exotic species' threats and threats to wildlife movement is included in Section 4.

Special Issues and Critical Assumptions

The MHCP Plan assumes that, by allowing top predators to control mesopredators in small coastal lagoon systems, nest predation on ground-nesting birds will be reduced. Therefore, maintaining connections between coastal lagoons and inland habitats, primarily for coyote movement, is a specific element of the MHCP preserve design.

The level of previous survey effort for Nuttall's lotus in the planning area is considered to be relatively high; however, annual plants germinate in response to specific climatic conditions, so this species could be missed during a poor survey year. The seed dispersal strategy for Nuttall's lotus is unknown; it is possibly self-dispersed.

This plan assumes that adequate buffer areas will be maintained around salt marsh and mudflat habitats to minimize disturbances and edge effects and to help maintain water quality. It also assumes that conservation and management of wetland habitats upstream from coastal wetlands will help maintain water quality.

The MHCP Plan assumes that newly created dredge spoil islands for the western snowy plover and least tern can be managed to provide cover materials, suppress weed growth, and control predation and human activity. It is also assumed that minimizing human disturbance will increase the likelihood of elegant tern recolonization and breeding.

3.3.2 Available Management Actions

There are several management actions available to address the threats identified above and to minimize potentially negative impacts. Responses to management actions will be predicted *a priori*, and results will be monitored in any circumstances where there is some measure of uncertainty in either the success of implementation or effectiveness of the action. Management actions will be modified depending on the response. The preserve managers are responsible for reallocating or reprioritizing funds to accommodate changes in management actions on lands they manage. Preserve managers may need to initiate focused research programs to search for correlations or cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Control public access points.
- Establish boardwalks to protect habitat from trampling.
- Establish fencing and signs, and close or redirect trails to protect habitat or species populations from trampling or other adverse, direct impacts.
- Enforce seasonal restrictions on human activity during the breeding season for specific species.
- Remove invasive exotic plant species to protect native habitats, plant populations, and wildlife values.
- Remove or control nonnative animal species (e.g., feral cats) to protect breeding birds.

- Educate homeowners about keeping pets indoors at night and keeping pet food indoors or in a secured location that does not attract animals from the preserve.
- Create or enhance protected beach areas, tidal creeks, or islands to provide breeding areas for covered bird species.
- Restore saltmarsh habitat and adjacent uplands.
- Provide shoreline stabilization to control erosion.
- Remove trash, including water-borne debris in breeding areas, during the non-breeding season.
- Dredge the mouth of the lagoon to keep it open.
- Control water sources and urban runoff within the reserve through an educational program that informs residents of the detrimental effects of certain types of landscaping plants and watering regimes on adjacent biological resources and offers literature on alternatives such as xerophytic plantings and drip irrigation. Implement all available Best Management Practices (BMP) for existing and new developments in watershed areas to minimize alterations to stream flow and water quality. Additional recommendations may be appropriate for new developments, such as requiring the use of French drains to minimize seepage on slopes, diverting runoff away from the reserve, and restricting irrigation and certain types of plantings adjacent to the reserve.
- Restrict equestrian and mountain bike activity to existing maintained roads. Close roads to equestrians and mountain bikes for 3 days following rainfall events greater than 1 inch.
- Prohibit feeding of wildlife.
- Arrange for regular trash pickup.
- Patrol for illegal uses in the preserve.
- Direct all lighting sources away from the preserve, and restrict night-time activities in the preserve.
- Restrict construction noise and other noises >60 dB during the breeding season.
- Also see management actions in Section 4 relative to wildlife movement and exotic species.

3.3.3 Monitoring at All Lagoons

The distribution and abundance of covered species and the relative activity levels of carnivore species will be estimated in each lagoon. An example monitoring data form is included in Appendix C.6. The nest and productivity monitoring that is conducted by the wildlife agencies independently of the MHCP will augment the required MHCP monitoring.

Baseline Surveys and Vegetation Mapping

Baseline surveys and vegetation mapping will be conducted as outlined in Appendix B. In addition, each lagoon, including the immediately conserved uplands, will be divided

into zones based on geographic, topographic, hydrologic, or habitat features hypothesized to be highly correlated with the variables of interest (e.g., covered species) for management purposes. Each lagoon manager will establish the zones in a manner most useful for management purposes at a given lagoon. The size and number of zones will vary for each lagoon. Zones will be delineated on a recent aerial photograph to be used as a reference by biologists in the field. Vegetation communities will be mapped within each zone. This mapping of zones and vegetation communities will be reviewed every 5 years.

California Least Tern and Western Snowy Plover

The California least tern is federally and state listed as endangered. The western snowy plover is federally listed as threatened. Both of these species have site-specific permit conditions.

Monitoring Questions. The wildlife agencies will use monitoring data to evaluate the following questions:

1. What areas are these species using within lagoon and estuarine habitats, and does use change over time?
2. What are the status and trends in the number of breeding pairs?
3. How does the number of breeding pairs relate to habitat availability and distribution and to the activity of mammalian and avian predators?

Monitoring Protocol. Survey all potential California least tern and western snowy plover breeding habitat annually in April. Map locations supporting one or both of these species, and record the number of breeding pairs. Record condition and degree of disturbance to the habitat, and monitor management actions for effectiveness in controlling or reducing habitat disturbance. If funding is available, nest productivity will also be monitored, using existing CDFG and USFWS protocols.

Belding's Savannah Sparrow

The Belding's Savannah sparrow is state listed as endangered. As a MHCP covered species, its permit conditions are site-specific (MHCP Plan, Volume II).

Monitoring Questions. The wildlife agencies will use monitoring data to evaluate the following questions:

1. What area is this species using within lagoon and estuarine habitats, and does use change over time or in response to hypothesized causal mechanisms? What are the characteristics of areas this species uses?
2. How does the number of breeding pairs relate to habitat availability and distribution and to the activity of mammalian and avian predators?
3. How well do the birds respond to efforts at reducing predation or disturbance compared to predictions?

Monitoring Protocol. Annually count the total number of breeding Belding's Savannah sparrow pairs in March. The surveys will consist of circuitously walking through salt marsh habitat bordering the lagoon and mapping locations of territorial birds, using existing CDFG and USGWS protocols. Note and record condition and degree of disturbance to the habitat, and monitor management actions for effectiveness in reducing habitat disturbance. An alternative protocol, which may be used by CDFG, requires conducting annual censuses only in areas of potential human disturbance or where a restoration project is proposed. Under this protocol, a lagoon-wide census of all potentially occupied habitat, as described above, should be conducted every 3 years.

Large-billed Savannah Sparrow

Permit conditions for this species are habitat-based (MHCP Plan, Volume II). It is not known to breed in the MHCP planning area.

Monitoring Questions. The wildlife agencies will use monitoring data to evaluate the following questions:

1. What area is this species using within lagoon and estuarine habitats, and does use change over time? What are the characteristics of areas this species uses?
2. How does the number of individuals relate to habitat availability and distribution and to the activity of mammalian and avian predators?
3. How well do the birds respond to efforts at reducing predation or disturbance compared to predictions?

Monitoring Protocol. Survey potential salt marsh habitat in January for a minimum of 2 years to assess the current status of this species in the MHCP planning area. Where the species is located, continue annual surveys, and count and map the number of individuals. Note and record condition and degree of disturbance to the habitat, and monitor management actions for effectiveness in reducing habitat disturbance.

Light-footed Clapper Rail

The light-footed clapper rail is federally and state endangered and has site-specific permit conditions as a MHCP covered species (MHCP Plan, Volume II).

Monitoring Questions. Monitoring data will be used to evaluate the following questions, as determined to be necessary for effective preserve management by the wildlife agencies:

1. What area is this species using within lagoon and estuarine habitats, and does use change over time? What are the characteristics of areas this species uses?
2. How does the relative abundance of rails relate to habitat availability and distribution and to the activity of mammalian and avian predators?

3. How well do the birds respond to efforts at reducing predation or disturbance compared to predictions?

Monitoring Protocol. Annually conduct spring call counts at each lagoon or appropriate marsh area within the MHCP planning area. Conduct call counts between March and early May, in early morning (until 2 hours after sunrise) or late afternoon (2 hours before sunset). In locations where rails are relatively common, all spontaneous rail calls should be mapped. In marshes with few rails, or in long narrow channels or narrow strips of habitat, use taped "clappering" calls sparingly. No surveys should be conducted under rainy or windy conditions. "Duets" and "clappering" should be treated as a rail territory (Zembal pers. comm.). Note and record condition and degree of disturbance to the habitat, and monitor management actions for effectiveness in reducing habitat disturbance. Collect data to test the effects of factors hypothesized to influence the distribution or habitat use by the birds.

High tide counts may also be appropriate to survey for rails. Observers should be stationed around the perimeter of a flooded marsh to observe all clapper rails (Zembal pers. comm.).

Nuttall's Lotus

Nuttall's lotus is a narrow endemic species with site-specific permit conditions (MHCP Plan, Volume II). The objective of this monitoring is to annually track distribution, density, and/or estimate abundance. The relationship between factors proposed to influence this species and the status of the species (i.e., distribution, density) may be tested. Management actions such as exotic species removal, erosion control, fencing, and seed collection may be used to reverse downward trends. Evaluation of the effectiveness of these actions may result in additional research to determine causal factors for decline in the plant.
The cities, MHCP conservancy, or wildlife agencies will use monitoring data for Nuttall's lotus to evaluate the following questions, as determined to be necessary for effective preserve management:

1. What is the distribution of this species within the MHCP planning area?
2. What is the density of individual populations, and how does density change over time?
3. What is the density of nonnative plant species in and adjacent to these populations, and how does density change with and without management measures?
4. What are the site conditions that may influence spatial patterns in the population dynamics of this species?

The areal extent of Nuttall's lotus will be mapped as part of baseline inventory efforts and monitored annually following dedication of the land to the preserve. Additional suitable habitat will also be surveyed. Each year’s distribution will be maintained in the database to allow tracking of the population’s spatial dynamics. Within the mapped population

areas, population density or abundance will be estimated using appropriate sample techniques.

Monitoring Protocols. A meaningful monitoring objective for Nuttall's lotus is to assess changes in density of the individuals in the population in response to treatments (e.g., removal of nonnative plants). Density provides a useful metric for management purposes, in that it can be directly related to changes in nonnative plant cover. Total population size can be projected from density estimates, if the area occupied by the population is known. In addition, sampling effort can be allocated to obtain statistical comparisons with adequate power.

This protocol is a variation of the methods described in the MSCP Biological Monitoring Plan (Ogden 1996). This protocol uses the relevé quadrat survey method (Braun-Blanquet 1932) and has been used in monitoring conducted by Scott McMillan for the City of San Diego (McMillan and CBI 2002). This monitoring will be conducted annually in each area where Nuttall' lotus occurs. See the example monitoring form in Appendix C.1.

Determine the number of quadrats by the population size and distribution of the population. Distribute quadrat plots across the observed range of rare plant densities at each locality (i.e., stratified sampling based on visual estimates of density). Place quadrats in areas with low, medium, and high densities of the target rare plant species and at varied distances from the center of the population. Note: For small populations, the entire population should be counted. In this instance, quadrats would be used primarily to estimate densities of nonnative species.

Quadrats should not be permanently marked but rather should be redistributed throughout the population each monitoring period. Reallocating sampling units each monitoring period will provide an assessment of the change in the average condition of the area from one sampling period to the next, instead of the change in condition of the fixed quadrat locations. In addition, permanent quadrats can result in more foot traffic disturbance from repeated visits in the monitored areas, thus contributing to an increase in nonnative plant cover. It is likely that the results of monitoring permanent quadrat locations would be influenced by the repeated presence of the field investigator, rather than changes associated with natural variability or other stresses.

Recommended quadrat size for these species is 1 m^2. In each quadrat, count the number of rare plant species, and estimate the percent cover of native and nonnative species. In very small populations, all individuals should be counted and the quadrats can be used to estimate native and nonnative cover. This approach allows the density of the target plant species and the average cover of native and nonnative species to be estimated for the monitored population.

In addition to counting numbers of individuals of a rare plant species, estimate percent of individuals in vegetation, flower, and fruit for each quadrat. Also record the slope and slope aspect (slope direction) for each quadrat, and the percent native cover, nonnative cover, and bare ground. Describe the habitat surrounding the population, noting specific

management problems and disturbances. Monitor management actions for their effectiveness in controlling or reducing exotic species and habitat disturbance.

Flag the monitored populations in the field, and map the perimeter of each population using a GPS (Global Positioning System) unit for better geographic accuracy and improved relocation of each population. Knowing the exact boundary of each population will make it easier to detect changes in the size and shape of the population. This will also allow calculation of the total area for each population which, in combination with knowing the plant densities, will allow for a more accurate estimate of the total population size.

California Brown Pelican, Elegant Tern, White-faced Ibis, Osprey, Peregrine Falcon, and Saltmarsh Skipper

Permit conditions for the California brown pelican, elegant tern, white-faced ibis, osprey, peregrine falcon, and saltmarsh skipper are habitat-based, i.e., the permit assumes that managing the habitat will be sufficient to maintain the species (MHCP Plan, Volume II). The California brown pelican is federally and state endangered, and the peregrine falcon is state endangered; however, there are no major populations for these species in the MHCP planning area.

Monitoring Questions. Examples of possible monitoring questions that may be tested by the wildlife agencies include:

1. Which lagoons and areas of lagoon and estuarine habitat are these species using, and how does use change over time? What are the characteristics of areas these species use?
2. What are the site conditions that may influence spatial patterns in the population dynamics of these species?

Monitoring Protocol. The locations of these species' populations will be mapped as part of annual systematic presence-absence survey efforts. Condition and degree of disturbance to the habitat will be recorded, and management actions to reduce disturbance will be monitored for effectiveness. The wildlife agencies will determine the level of effort for the presence-absence surveys.

Waterfowl and Shorebirds

The lagoons and estuarine habitats of the MHCP provide important habitat for waterfowl and shorebirds, and the number and abundance of these species may serve as indicators of the quality of these habitats.

Monitoring Questions. The wildlife agencies will use monitoring data to evaluate the following questions:

1. Which lagoons and areas of lagoon and estuarine habitats are these species

using, and does use change over time? What are the characteristics of areas these species use?
2. How does relative abundance of waterfowl and shorebirds relate to habitat availability and distribution and to the activity of mammalian and avian predators?
3. What factors are hypothesized to influence the use of the lagoons by these species?

Monitoring Protocol. Systematically survey the entire lagoon for all waterfowl and shorebirds twice per year, once in winter (January) and once in late summer (August). Each survey will consist of a total count of all birds observed on open water, shoreline, and uplands, by designated zone. Survey the entire lagoon between dawn and noon. Conduct the survey once during each sampling period. Calculate the average number of birds, by species per zone. Assess condition and degree of disturbance to the habitat, and monitor management actions for their effectiveness in reducing habitat disturbance. The wildlife agencies will determine the level of effort for the presence-absence surveys.

Mammalian and Avian Predators

Monitoring Questions. The wildlife agencies will use monitoring data to evaluate the following questions:

1. What areas are mammalian and avian predators using within the lagoons, and does use change over time? What are the characteristics of areas these species use?
2. How does relative abundance of covered species relate to the activity of mammalian and avian predators? What is the response of covered species to removal of predators?

Sampling Protocol. During each survey period for waterfowl and shorebirds, estimate predator abundance, using a qualitative measure (high, medium, and low). The primary purpose of this survey is to rank areas around the lagoon for relative predator activity (i.e., sightings, tracks, and scat). What is considered "high" predator activity may vary by lagoon and by the resource management priorities of the preserve manager. For example, a raptor roost site, or track evidence of heavy dog activity, may be considered "high" if it is in the immediate vicinity of a California least tern breeding colony, while "medium" or "low" if far removed from sensitive resources. A "high" predator activity designation may trigger a management response, whereas a "medium" or "low" designation may not. Record this information on the same data forms used for recording waterfowl and shorebirds. The wildlife agencies will determine the level of effort for the presence-absence surveys.

Hydrology and Water Quality

The water quality of lagoons can (1) determine the biological composition of lagoon communities and (2) exhibit responses to upstream stresses (e.g., urban runoff,

channelization, vegetation removal, etc.) and thus may serve as an indicator of lagoon condition, if a relationship can be shown. When determined necessary by the wildlife agencies, the agencies will obtain and analyze lagoon water quality data (e.g., dissolved oxygen, salinity profiles, nutrient concentrations, suspended solids) to evaluate the relationship between preserve habitat quality and covered species status to water quality. Data being collected by other agencies (e.g., Regional Water Quality Control Board) will be used where available.

3.4 OAK WOODLANDS

3.4.1 Conceptual Vegetation Community Model

Vegetation Community Description

Oak woodlands in the MHCP planning area are dominated by coast live oaks (*Quercus agrifolia*) and Engelmann oaks, with an understory of grasses, poison oak (*Toxicodendron diversilobum*), or broad-leaved herbaceous cover in more mesic sites. Oak savannahs with both Engelmann and coast live oaks are found on deep clay soils in foothill areas (Griffen 1977). The majority of Engelmann oaks in the MHCP planning area are largely restricted to foothills in Escondido, including Daley Ranch and the Lake Wohlford area. Coast live oak woodlands dominate on shady north slopes or on upper terrace floodplains (Griffen 1977). Oak woodlands often are interspersed with chaparral communities.

Physical and Biological Processes that Support Oak Woodlands and Species

Recruitment of oaks is governed by soil moisture, acorn dispersal by wildlife, and acorn and seedling predation. Coast live oak acorns require higher soil moisture for germination than do Engelmann oaks and thus are often found on northern exposures, in ravines, or near rock outcrops where soil moisture levels are relatively high. Wildlife species (e.g., scrub jays and ground squirrels) can facilitate oak woodland regeneration by removing acorns from under mature trees and caching them in areas suitable for germination. Especially in areas where cattle grazing has occurred, young oak trees are often found in association with rock outcrops, because cattle avoid these areas and acorns are cached by wildlife around rock outcrops. Many native species (e.g., deer and rodents) also eat acorns or seedlings, and their abundance may affect the recruitment of oaks into the population.

MHCP Covered Species in Oak Woodlands

Animals	Mountain lion
Harbison's dun skipper butterfly	Mule deer
Cooper's hawk	**Plants**
Golden eagle	Engelmann oak
Western bluebird	

Threats to Oak Woodlands, Covered Species, and Processes

Unnatural fire cycles may threaten individual trees in oak woodlands. Extremely hot fires that burn through the protective bark of coast live and Engelmann oaks can kill individual trees. Coast live oak has adapted to fire by crown- or stump-sprouting. Engelmann oak seedlings are relatively tolerant of fire.

Grazing by cattle, browsing by deer, predation by pocket gophers, and competition for soil moisture can prevent recruitment of oaks by destroying acorns or seedlings (Pavlik et al. 1991). Grazing can alter the environment to the extent that the effects of grazing persist for years after cattle are removed. Introduced weed species deplete surface water much earlier in the season than the displaced perennial grasses, which diminishes water supplies to oak seedlings (Pavlik et al. 1991). Other disturbances, such as hiking trails, off-road vehicle disturbance, and certain agricultural practices, can also destroy seedlings. Urban runoff can promote invasion by Argentine ants (see Section 4.2). Oaks are also susceptible to damage by pest species, and "sudden oak death" is a problem in northern California oaks that we can likely expect to be an issue in the MHCP planning area.

As discussed in Section 3.1, residential developments in close proximity to natural open space areas generally result in increased disturbances from foot, bicycle, and motorized vehicular traffic as well as an increase in trash. Establishment of unauthorized trails is a large management issue in most open space areas in San Diego County, resulting in the loss of vegetation and compaction and erosion of underlying soils. These trails are also routes for the invasion of nonnative species. In some instances, these disturbances can produce severe, virtually permanent habitat degradation. Buildup of trash or litter in and adjacent to the preserve can attract house rats and promote the abundance of mesopredators such as raccoons and skunks. An overabundance of mesopredators can affect nesting success of native birds. Developments and associated roadways result in elevated light and noise levels compared to undeveloped areas, which can alter habitat quality and the behavior of native species. Excessive ambient noise levels can result in reduced reproductive success in songbirds that establish breeding territories and attract mates with vocalizations.

Further discussion of exotic species' threats and threats to wildlife movement is included in Section 4.

Special Issues and Critical Assumptions

This monitoring plan assumes that vegetation communities exhibiting little human disturbance in the form of trails, soil erosion, trampling, trash, etc. are healthier than areas that exhibit this type of disturbance. For species whose permit conditions are habitat-based (Appendix A.2), it is assumed that managing toward a habitat with little evidence of disturbance, as described above, will be sufficient to sustain these species.

It is assumed that human disturbance within 300 ft of Cooper's hawk nests may cause the birds to abandon the nest (MHCP Plan, Volume II). It is anticipated that western bluebirds will respond well to establishment of next boxes and that the installation of devices that exclude starlings from nest boxes and natural cavities will improve bluebird productivity (MHCP Plan, Volume II).

3.4.2 Available Management Actions

There are several management actions available to address the threats identified above and to minimize potentially negative impacts. Responses to management actions will be predicted *a priori*, and results will be monitored in any circumstances where there is some measure of uncertainty in either the success of implementation or effectiveness of the action. Management actions will be modified depending on the response. The preserve managers are responsible for reallocating or reprioritizing funds to accommodate changes in management actions on lands they manage. Preserve managers may need to initiate focused research programs to search for correlations or cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Control public access points.
- Establish fencing and signs, and close or redirect trails to protect habitat or species populations from trampling or other adverse, direct impacts.
- Remove invasive exotic plant species to protect native habitats, plant populations, and wildlife values.
- Remove or control nonnative animal species (e.g., feral cats) to protect breeding birds.
- Educate homeowners about keeping pets indoors at night and keeping pet food indoors or in a secured location that does not attract animals from the preserve.
- Enhance habitat to provide pollinator habitat or breeding areas for wildlife.
- Restore habitat to reverse the effects of habitat disturbance and improve habitat quality for covered species where natural regeneration processes are expected to be unacceptably slow or delayed.
- Tag oak trees that are infested with borer beetles and monitor the beetles and health of trees. Work with the state Food and Agriculture Department and the

U.S. Department of Agriculture to determine possible methods of biological control for the beetles.

- Develop and implement a fire management plan that identifies appropriate fire suppression practices for the preserve and prioritizes areas for fire suppression and, where appropriate, for prescribed burns.
- Test the efficacy of prescribed burns to eliminate nonnative annual grasses in open oak woodlands.
- Control water sources and urban runoff within the reserve through an educational program that informs residents of the detrimental effects of certain types of landscaping plants and watering regimes on adjacent biological resources and offers literature on alternatives such as xerophytic plantings and drip irrigation. Additional recommendations may be appropriate for new developments, such as requiring the use of French drains to minimize seepage on slopes, diverting runoff away from the reserve, and restricting irrigation and certain types of plantings adjacent to the reserve.
- Redirect urban runoff away from the preserve to minimize moist soils that provide habitat for Argentine ants.
- Restrict equestrian and mountain bike activity to existing maintained roads. Test the effect of closing roads to equestrians and mountain bikes for 3 days following rainfall events greater than 1 inch.
- Prevent human disturbance within 300 ft of Cooper's hawk nests.
- Establish next boxes for western bluebirds, and install devices that exclude starlings from nest boxes and natural cavities.
- Install water bars across dirt roads to control erosion.
- Prohibit unauthorized motor vehicles.
- Prohibit feeding of wildlife.
- Arrange for regular trash pickup.
- Patrol for illegal uses in the preserve.
- Direct all lighting sources away from the preserve, and restrict night-time activities in the preserve.
- Restrict construction noise and other noises >60 dB during the breeding season.
- Also see management actions in Section 4 relative to wildlife movement and exotic species.

3.4.3 Monitoring at All Preserve Areas

Baseline Surveys and Vegetation Mapping

Baseline surveys and vegetation mapping will be conducted at all preserve areas where oak woodlands occur, as outlined in Appendix B.

Engelmann Oak, Harbison's Dun Skipper, Cooper's Hawk, Western Bluebird, Southern Mule Deer, and Mountain Lion

Permit conditions for Engelmann oak, Harbison's dun skipper, Cooper's hawk, western bluebird, southern mule deer, and mountain lion are habitat-based, i.e., the permit assumes that managing the habitat will be sufficient to maintain the species (MHCP Plan, Volume II).

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the following questions:

1. Are these species present in individual preserve areas?
2. What are the site conditions that may influence spatial patterns in the population dynamics of these species?

Monitoring Protocol. The locations of these species' populations will be mapped as part of annual systematic presence-absence survey efforts. Condition and degree of disturbance to the habitat will be observed and recorded, and management actions will be monitored for their effectiveness in reducing habitat disturbance. The wildlife agencies will determine the level of effort for the presence-absence surveys.

3.5 VERNAL POOLS

3.5.1 Conceptual Community Model

Vernal Pool Description

Vernal pools in the MHCP planning area are small, isolated complexes of seasonal wetlands formed in depressions in soils overlying a clay hardpan. Currently, the majority of the vernal pools within the City of San Marcos, with the exception of one area near Bent Avenue, are not included in the MHCP and are therefore not addressed in this monitoring plan.

Three vernal pool complexes have been documented in the City of Carlsbad: (1) adjacent to the Poinsettia Lane Train Station, (2) north of Palomar Airport (Hieatt property), and (3) east of El Camino Real south of Palomar Airport Road (Manzanita Partners property). The San Marcos vernal pools in the MHCP are south of State Route 78 and west of Bent Avenue.

The El Camino Real pools are on a 6.8-acre preserve where mitigation measures included enhancement of seven existing degraded vernal pools and adjacent disturbed native upland mima mound and coastal sage scrub habitat. The mitigation project was completed in February 2000, and the 5-year maintenance and monitoring period formally began in April 2000. Thus far, there has been very little monitoring, because of drought. The pools do not support any endangered or threatened species, but do support water-starwort (*Callitriche marginata*), chaffweed (*Centunculus minimus*), pygmyweed

(*Crassula aquatica*), annual hairgrass (*Deschampsia danthonoides*), and woolly marbles (*Psilocarphus tenellus*). A number of common weedy exotic species occur in and around the pools; these are being controlled by a landscape contractor. A silt fence helps to control weed invasion into the pools and captures wind-blown trash and debris.

MHCP covered species in the Carlsbad Poinsettia pools include spreading navarettia, San Diego button-celery, California Orcutt grass, Riverside fairy shrimp, and San Diego fairy shrimp. Land uses surrounding the pools are a railroad station and rail corridor and medium density residential housing.

The vernal pools on the Hieatt property north of Palomar Airport do not contain listed plant species but do contain the indicator plant species dwarf woolly-heads (*Psilocarphus brevissimus* var. *brevissimus*), stone-crop (*Crassula aquatica*), chaffweed (*Centunculus minimus*), and grass poly (*Lythrum hyssopifolium*). The pools provide potential habitat for San Diego fairy shrimp. The pools occur within coastal sage scrub and native grassland communities on the mesa top. The development footprint will avoid the watersheds of the vernal pools.

In San Marcos, the MHCP vernal pool complex consists of 15 small vernal pools south of State Route 78 and west of Bent Avenue. The pools contain debris, tire ruts, gopher damage, and exotic plant species and are in need of restoration. Some contouring is needed to deepen some pools and restore historic drainage patterns. Commercial or industrial development is proposed for the area surrounding the pools.

Physical and Biological Processes that Support Vernal Pools and Species

Zedler (1987) refers to vernal pools as a "sequence of ecosystems" because the pool itself is only one of the phases of this habitat type. Keeley and Zedler (1998) define vernal pools as "precipitation-filled seasonal wetlands inundated during periods when temperature is sufficient for plant growth, followed by a brief waterlogged-terrestrial stage and culminating in extreme desiccating soil conditions of extended duration." The source, duration, and timing of inundation are the most important environmental factors affecting the composition of flora and fauna in individual pools. Because the source of inundation is primarily rainwater, natural vernal pools in undisturbed watersheds tend to have low nutrient levels (Keeley and Zedler 1998). Vernal pool flora and fauna have evolved an annual summer dormancy cycle and can remain dormant for several years in succession. The vernal pool ecosystem is connected to the ecosystem of the vegetation communities that surround them, which comprises their watershed (USFWS 1998b).

MHCP Covered Species in Vernal Pools

Animals	Plants
Riverside fairy shrimp*	Thread-leaved brodiaea*
San Diego fairy shrimp*	San Diego button celery*
Western spadefoot toad	Little mousetail*
	Spreading navarretia*
	California Orcutt grass*

* Narrow endemic species

Threats to Vernal Pools, Covered Species, and Processes

Vernal pools are subject to a variety of impacts, including bicycle and foot traffic, off-road vehicles, plant collection, exposure to herbicides, watershed alterations (e.g., trenching), littering and vandalism, summer water runoff from adjacent irrigated landscapes, invasive exotic plants, and feral animals (Clark et al. 1998). Runoff from adjacent irrigated areas or paved areas may contain significant amounts of fertilizer or other constituents (e.g., metals, oil and grease), which could substantially influence the flora and fauna of the pool. In years of little or no inundation, grassland species are able to colonize pool basins (Bauder 1987a and 1987b, cited in Keeley and Zedler 1998). This could alter vernal pool watersheds in ways that reduce the period of inundation of the pools and allow these grassland species to displace native vernal pool plants. The vernal pools in the MHCP planning area are threatened by exotic species, runoff from adjacent urban areas, and isolation from other native habitats.

Special Issues and Critical Assumptions

The MHCP Plan assumes that the level of survey effort for vernal pools species in the planning area has been relatively high. The plan also assumes that there is sufficient conserved habitat for seed dispersal agents and pollinators of vernal pool plant species in the vicinity of the vernal pools. However, for many of the vernal pool plant species, the specific pollinators are not known. Annual fluctuations in population size and levels of recruitment are not known for most of the covered plant species.

The MHCP Plan assumes that the watersheds of the conserved vernal pools are also conserved and that intensive management will prevent hydrological and water quality impacts to the vernal pool watersheds from recreation and adjacent land uses. This monitoring plan assumes that watershed disturbances and exotic plant species pose the largest threat to covered plant species, and that human disturbance allows or facilitates invasion by exotic plants. The current necessary levels of weed management to eradicate or control these exotic species have not been predicted for these areas, and the impacts of weed management on other species have not been evaluated.

The MHCP Plan assumes that adequate upland habitat will be maintained around aquatic breeding habitats for spadefoot toads. It is assumed that mosquito control measures will harm toads and should be avoided in or near the preserve.

3.5.2 Available Management Actions

There are several management actions available to address the threats identified above and to minimize potentially negative impacts. Responses to management actions will be predicted *a priori*, and results will be monitored in any circumstances where there is some measure of uncertainty in either the success of implementation or effectiveness of the action. Management actions will be modified depending on the response. The preserve managers are responsible for reallocating or reprioritizing funds to accommodate changes in management actions on lands they manage. Preserve managers may need to initiate focused research programs to search for correlations or cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Control public access points, especially during the wet season.
- Establish fencing and signs, and close or redirect trails to protect habitat or species populations from trampling or other adverse, direct impacts.
- Conduct maintenance activities during the dry season, using care to avoid disturbance of the soil surface which may contain fairy shrimp cysts.
- Remove invasive exotic plant species, by hand, to protect native habitats, plant populations, and wildlife values. Weed removal should be conducted only by individuals trained to distinguish true weeds from vernal pool plants.
- Restore habitat to reverse the effects of habitat disturbance and improve habitat quality for covered species where natural regeneration processes are expected to be unacceptably slow or delayed.
- Develop a public education program to inform the public about the conservation value and fragility of vernal pool ecosystems.
- Control water sources and urban runoff within the reserve through an educational program that informs residents of the detrimental effects of certain types of landscaping plants and watering regimes on adjacent biological resources and offers literature on alternatives such as xerophytic plantings and drip irrigation. Additional recommendations may be appropriate for new developments, such as requiring the use of French drains to minimize seepage on slopes, diverting runoff away from the reserve, and restricting irrigation and certain types of plantings adjacent to the reserve.
- Redirect urban runoff away from the preserve to minimize moist soils that provide habitat for Argentine ants.
- Prohibit equestrian and mountain bike activity and dogs within the watershed.
- Develop and implement a fire management plan that identifies appropriate fire suppression practices for the preserve and prioritizes areas for fire suppression and, where appropriate, for prescribed burns.
- Prohibit unauthorized motor vehicles.

- Prohibit feeding and collecting of wildlife.
- Arrange for regular trash pickup.
- Patrol for illegal uses in the preserve.
- Direct all lighting sources away from the preserve, and restrict night-time activities in the preserve.
- Also see management actions in Section 4 relative to exotic species.

3.5.3 Monitoring at All Vernal Pools

Natural environmental variation, such as drought, can play an important role in determining the distribution and the population responses of vernal pool flora and fauna. Therefore, it is important to monitor pools in both dry and wet years and track changes associated with hydrologic variability.

Baseline Surveys, Mapping of Pools, and Vegetation Mapping

Baseline surveys, mapping of pools, and vegetation mapping will be conducted as outlined in Appendix B.

San Diego Button-celery, California Orcutt Grass, Thread-leaved Brodiaea, and Spreading Navarretia

The vernal pool covered plant species are narrow endemics with site-specific permit conditions (MHCP Plan, Volume II). San Diego button-celery and California Orcutt grass are both federally and state listed as endangered; thread-leaved brodiaea is federally threatened and state endangered, and spreading navarretia is proposed for federal listing as threatened. The objective of the vernal pool species monitoring is to annually track their distribution and abundance in all preserves where they occur. The effects of factors hypothesized to influence populations of the covered plants will be tested as well as the efficacy of management treatments such as exotic species removal, erosion control, fencing, and seed collection.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data for vernal pool plants to evaluate the following questions:

1. What is the distribution of vernal pool plant species in the MHCP preserve?
2. What is the density of individual populations, and how does density change over time?
3. What is the density of nonnative plant species in and adjacent to these populations, and how does density change with and without management measures?
4. What are the site conditions that may influence spatial patterns in the population dynamics of the vernal pool plant species?

The areal extent of vernal pool plants will be mapped as part of baseline inventory efforts and monitored annually following dedication of the land to the preserve. Each year's

distribution will be maintained in the database to allow tracking of the population's spatial dynamics. Within all of the mapped population areas, population density or relative abundance will be estimated using appropriate sample techniques.

Monitoring Protocols. A meaningful monitoring objective for annual herbaceous species such as the MHCP vernal pool species is to assess changes in density of the individuals in the population. Density provides a useful metric for management purposes, in that it can be directly related to changes in nonnative plant cover. Total population size can be projected from density estimates, if the area occupied by the population is known. In addition, sampling effort can be allocated to obtain statistical comparisons with adequate power.

This protocol is a variation of the methods described in the MSCP Biological Monitoring Plan (Ogden 1996). This protocol uses the relevé quadrat survey method (Braun-Blanquet 1932) and has been used in monitoring conducted by Scott McMillan for the City of San Diego (McMillan and CBI 2002). This monitoring will be conducted annually at each preserve where the species occur. See an example monitoring form in Appendix C.1.

Determine the number of quadrats by the population size and distribution of the population. Distribute quadrat plots across the observed range of rare plant densities at each locality (i.e., stratified sampling based on visual estimates of density). Place quadrats in areas with low, medium, and high densities of the target rare plant species and at varied distances from the center of the population. Note: For small populations, the entire population should be counted. In this instance, quadrats would be used primarily to estimate densities of nonnative species.

Quadrats should not be permanently marked but rather should be redistributed throughout the population each monitoring period. Reallocating sampling units each monitoring period will provide an assessment of the change in the average condition of the area from one sampling period to the next, instead of the change in condition of the fixed quadrat locations. In addition, permanent quadrats can result in more foot traffic disturbance from repeated visits in the monitored areas, thus contributing to an increase in nonnative plant cover. It is likely that the results of monitoring permanent quadrat locations would be influenced by the repeated presence of the field investigator, rather than changes associated with natural variability or other stresses.

Recommended quadrat size for these species is 1 m^2 but quadrat size should be reassessed following pilot monitoring efforts. In each quadrat, count the number of rare plant species, and estimate the percent cover of native and nonnative species. In very small populations, all individuals should be counted and the quadrats can be used to estimate native and nonnative cover. This approach allows the density of the target plant species and the average cover of native and nonnative species to be estimated for the monitored population.

In addition to counting numbers of individuals of a rare plant species, estimate percent of individuals in vegetation, flower, and fruit for each quadrat. Also record the slope and

slope aspect (slope direction) for each quadrat, and the percent native cover, nonnative cover, and bare ground. Describe the habitat surrounding the population, noting specific management problems and disturbances. Monitor management actions for their effectiveness in reducing disturbance.

Flag the monitored populations in the field, and map the perimeter of each population using a GPS (Global Positioning System) unit for better geographic accuracy and improved relocation of each population. Knowing the exact boundary of each population will make it easier to detect changes in the size and shape of the population. This will also allow calculation of the total area for each population which, in combination with knowing the plant densities, will allow for a more accurate estimate of the total population size.

Riverside Fairy Shrimp, San Diego Fairy Shrimp, and Western Spadefoot Toad

The MHCP vernal pools are known to support the Riverside fairy shrimp, San Diego fairy shrimp, and western spadefoot toad. Both fairy shrimp are federally endangered and are considered narrow endemic species with site-specific permit requirements (MHCP Plan, Volume II). Permit requirements for the western spadefoot toad are habitat-based. Monitoring for these species will provide information on the diversity of the pools across the MHCP planning area.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data for these species to evaluate the following questions:

1. What is the distribution of these species in the MHCP?
2. What are the factors that may influence spatial patterns in the population dynamics or distribution of these species?

Monitoring Protocol. The locations of these species' populations will be mapped as part of the baseline inventories. Thereafter, observations of western spadefoot toad eggs, larvae, and individuals should be mapped annually. Sampling frequencies and protocols for fairy shrimp have not yet been determined.

Hydrology and Water Quality

Monitoring Question. Monitoring data will be used to evaluate the following question, which may provide insight to fluctuations in vernal pool species populations (i.e., whether the fluctuations are caused by human disturbance or by other physical factors, such as hydrology):

1. What is the relationship between vernal pool hydrology and water quality and the presence or estimated abundance of the vernal pool species being monitored?

Monitoring Locations. Two vernal pool complexes in Carlsbad have existing mitigation monitoring programs for 5 years following implementation of the restoration and enhancement efforts for vernal pools (Poinsettia Avenue and El Camino Real). However, long-term funding for these efforts is not assured. There has not been any restoration or monitoring of the Bent Avenue pools in San Marcos (Mason pers. comm.).

Monitoring Protocols. Preserve managers will measure depth of inundation via staff gages installed in all pools. Staff gages will be installed to accommodate pool expansion during the wettest years. Install two staff gages: a "deep" staff at the deepest point in the pool and a "shallow" gage. If the pool is fairly uniform in depth, only one gage is needed. Depth of water will be recorded to the nearest 0.01 ft at each staff gage, and the percent of the pool area that is inundated will be estimated.

During the annual inundation period, monitors will record weekly:

1. Duration of inundation to develop a hydrograph for each pool. The hydrograph will show pool depth over the inundation period.
2. Area of inundation – Record the surface area of each pool during the period of inundation by measuring pool lengths and widths at multiple locations as pool depth changes.
3. Water quality – Record temperature, dissolved oxygen, conductivity in each pool.

The wildlife agencies will correlate these data with climate data collected at existing weather stations to determine if pool hydrology or water quality appears to be altered by adjacent land uses.

4.0 SPECIAL ISSUES

4.1 WILDLIFE CORRIDORS

4.1.1 Corridor Functions

The MHCP preserve was designed to maintain connections between each of the major lagoon and estuary systems with larger blocks of inland habitats to allow movement of wildlife species. In addition to allowing for demographic and genetic exchange by all species between preserve areas, this design was intended to facilitate access by larger predators (particularly coyotes and bobcats) between upland scrub and chaparral habitats and coastal habitats. Top predators like coyotes and bobcats are particularly vulnerable to extirpation from fragmented habitats (Soulé et al. 1992, Noss 1983), which can precipitate further changes to ecological communities. Dominant carnivores can suppress smaller carnivore populations through both competition and predation. Consequently, the decline of top predators in fragmented areas may lead to increased populations of smaller predators (mesopredators), such as gray foxes, raccoons, striped skunks, opossums, and house cats (i.e., mesopredator release, Soulé et al. 1988, Crooks 2000). Unchecked by larger predators, mesopredator populations may negatively impact populations of such MHCP species as California least terns, western snowy plovers, and light-footed clapper rails, all of which nest in the lagoon and estuarine habitats.

Numerous constrained sections, or "pinch points," exist along the riparian corridors within the MHCP area, including major road crossings. These pinch points may decrease use of corridors by some species, but may also serve to concentrate wildlife movement into a small area where their presence can be relatively easily sampled. As future development reduces and further fragments the available inland habitats, populations of larger carnivores may be reduced, along with their access to coastal habitats. Furthermore, as traffic volumes increase, road crossings could become greater deterrents to movement and greater sources of mortality (road kill). Therefore, one of the objectives of MHCP wildlife corridor monitoring may be to assess species' use of corridors and road kill incidence at selected major road crossings. Results of these surveys may be used to suggest remedial actions that would ensure continued access to coastal habitats by larger carnivores and reduce road kill (e.g., improved road underpasses or construction of fences to funnel wildlife away from road hazards). In concert with other monitoring data collected at the coastal lagoons and estuaries, results of these efforts may suggest management actions necessary to maintain populations of MHCP covered species in coastal ecosystems.

Description

The MHCP planning area includes six east-west riparian corridors that drain to the coast. These include the San Luis Rey River to the mouth at Oceanside, Buena Vista Creek to Buena Vista Lagoon, Agua Hedionda Creek to Agua Hedionda Lagoon, San Marcos Creek and Encinitas Creek to Batiquitos Lagoon, and Escondido Creek to San Elijo Lagoon. In all cases, the riparian vegetation communities are fairly narrow, depending on

the drainage, and range from riparian scrub to riparian woodland and forest. The riparian vegetation communities are bordered by residential, commercial, and industrial development, as well as major highways. The riparian vegetation along these drainages is assumed to function as primary habitat as well as movement corridors for coyotes and smaller mammals, birds, herpetofauna, and invertebrates (e.g., butterflies). Different species will need different types of corridors for different reasons.

Threats and Impacts

As urbanization causes increasing habitat loss and fragmentation, wildlife that once roamed freely across habitat patches is being restricted to narrow corridors designed to link conserved habitat patches. These narrow corridors are highly susceptible to edge effects of urban land uses, including runoff from impermeable surfaces carrying urban pollutants, dumping of trash, artificial lighting and increased noise that may disrupt movement patterns, and increased presence of humans and domestic pets. Increased traffic in the vicinity of these habitats, including roads that cross riparian habitats, can also affect movement patterns and cause mortality.

Special Issues and Critical Assumptions

The linear configuration of riparian habitats often provides the only remaining movement corridor through urban and agricultural areas for many species. As such, riparian habitats provide the primary connection between coastal lagoon and inland upland habitats. The MHCP Plan assumes that, by allowing top predators to control mesopredators in small coastal lagoon systems, nest predation on ground-nesting birds will be reduced. Therefore, maintaining connections between coastal lagoons and inland habitats, primarily for coyote movement, was a specific element of the MHCP preserve design. The riparian vegetation along drainages in the MHCP planning area is assumed to function as primary habitat as well as movement corridors for coyotes and smaller mammals, birds, herpetofauna, and invertebrates. Different species will need different types of corridors for different reasons. It is assumed that the corridors allow both for intergenerational movement and gene flow between populations as well as provide habitat for individual animals. It is not known if coyotes use the riparian habitats as seasonal movement corridors between habitat patches or for daily movement within an individual's home territory, or both.

Deer and mountain lions are assumed to be present in the eastern portions of the MHCP planning area (e.g., San Marcos, Daley Ranch, Lake Wohlford) and were not a major consideration in MHCP linkage design.

4.1.2 Available Management Actions

There are several management actions available to address the threats identified above and to minimize potentially negative impacts. Responses to management actions will be predicted *a priori*, and results will be monitored in any circumstances where there is some measure of uncertainty in either the success of implementation or effectiveness of

the action. Management actions will be modified depending on the response. The preserve managers are responsible for reallocating or reprioritizing funds to accommodate changes in management actions on lands they manage. . Preserve managers may need to initiate focused research programs to search for correlations or cause-effect relationships behind changes in resource status.

Potential management actions may include the following:

- Provide additional vegetative cover on either end of bridges and culverts.
- Monitor and control the deposition of sediment under bridges and in culverts, which may decrease the height of the structure relative to ground surface. Remove sediment as necessary to maintain clearance.
- Erect fencing along the edge of housing developments and along roads to discourage entrance by dogs, cats, bikes, and people into the habitat area and to discourage wildlife from crossing roads where there are alternative undercrossings.
- Extend the wing fencing on either side of tunnels and culverts, where necessary to keep wildlife off the roads.
- Remove debris in the creeks and adjacent to the creeks to decrease flooding of the corridors. Control the abundance of vegetation under the bridges to maintain passable areas for wildlife.
- Patrol corridors to enforce restrictions requiring dogs to be on leashes, to enforce legal recreational uses, and to ensure that immigrant traffic does not encroach into conserved habitat areas.
- Enforce dumping restrictions.
- Monitor the effects of equestrian use in corridors, and prohibit equestrian use where necessary.
- Initiate a regular trash removal program.
- Ensure that hiking trails do not interfere with wildlife movement.
- Collect road-kill data to evaluate the effectiveness of undercrossings.
- Establish a community education program to inform residents about the need to protect wildlife corridors.

4.1.3 Monitoring Questions and Protocols

Monitoring Questions

The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the following questions:

1. What mammalian predators are currently using selected roadway underpasses?
2. Is there a difference in use based on the length or width of the riparian corridor?
3. Does incidence of corridor and underpass use change over time with habitat loss in the MHCP planning area?
4. What is the current level of road kill along selected major roadways crossing riparian corridors, and what locations have the highest incidence of road kill?

Sampling Strategy

The monitoring program will use (1) standardized track survey and remote camera survey methods to obtain indices of use by different carnivore species at pinch points. and (2) data collected from Caltrans and MHCP cities to assess relative road kill hazard by species and location. This paired approach will facilitate analysis of trends and correlations, such as whether increased road kill is associated with dysfunctional road underpasses, or whether decreased use of underpasses occurs concomitant with decreased road kill incidence (e.g., if predator populations decrease due to habitat loss). Remote cameras will be used only in secure locations.

Monitoring Locations

A minimum of two sample locations will be established along each major creek draining into the four coastal lagoons, as well as along the San Luis Rey River. One sample site per drainage will be associated with the first major road crossing upstream of the lagoon (or San Luis Rey river mouth). At least one additional sample site per drainage will be located at another significant road crossing upstream of the first. These additional crossing sites will be located to provide meaningful comparisons with the downstream location, such as the first major road crossing downstream from an inland core preserve area that might support bobcats. For very long corridors with multiple pinch points or road crossings, additional sample points will be established in order to determine where the major constraints to carnivore movement may be.

The following sample locations will be established, subject to refinement as monitoring proceeds. Additional sample locations may be added when new roads are constructed across the corridors, or if warranted based on preliminary monitoring results.

San Luis Rey River, at

- *Pacific Street* – First major road crossing upstream from the river mouth if the proposed bridge, west of Interstate 15, is constructed.
- *Interstate 15* – First major road crossing upstream from river mouth.
- *Foussat Road* – This represents a constraint in a stretch of the river still relatively well connected to large habitat blocks capable of supporting bobcats.
- *College Boulevard* – This represents a constraint at the upstream boundary of the U.S. Army Corps of Engineers flood management project. It is in an area currently just downstream of wide riparian habitats and extensive agriculture, but also subject to extensive development in the near future.

Buena Vista Creek, at

- *Jefferson Street* – First major road crossing upstream of Buena Vista Lagoon.

- *El Camino Real* – Second major road crossing upstream of the lagoon, and near the downstream end of large habitat blocks capable of supporting bobcats (Sherman property, South Coast Materials property).

Agua Hedionda Creek watershed, at

- *Cannon Road* – Road crossing of Macario Creek upstream of Agua Hedionda Lagoon.
- *El Camino Real* – First major road crossing of Agua Hedionda Creek upstream of Agua Hedionda Lagoon.
- *Rancho Carlsbad Drive* (east edge of trailer park north of El Camino Real) – First major pinch point (park and trailer park) downstream of extensive habitat and agricultural areas (Sunny Creek, Holly Springs properties).

San Marcos Creek, at

- *El Camino Real* – First major road crossing upstream of Batiquitos Lagoon on San Marcos Creek, forming the downstream edge of a golf course that might serve as a movement corridor from the La Costa habitat preserve area).
- *Rancho Santa Fe Road* – Major pinch point and road crossing between major core and linkage areas (La Costa area in Carlsbad, University Commons and San Elijo Ranch areas in San Marcos).

Encinitas Creek, at

- *La Costa Boulevard* (near intersection with El Camino Real) – First major road crossing/pinch point upstream of Batiquitos Lagoon along Encinitas Creek.
- *El Camino Real* (near intersection with Olivenhain Road) – Second major road crossing/pinch point upstream of lagoon and near upland habitat blocks potentially capable of supporting bobcats (Encinitas Ranch, Green Valley areas).
- *Rancho Santa Fe Road* – Major road crossing in an area of development along a long wildlife corridor, midway between La Costa/Olivenhain preserve areas and Encinitas Ranch/Green Valley preserve areas.

Escondido Creek, at

- *La Bajada* ("dip") – First major road crossing upstream of San Elijo Lagoon.
- *El Camino del Norte* – Second major road crossing upstream of San Elijo Lagoon, in an area having wider riparian habitats and better connectivity to upland preserve areas and agricultural land in the unincorporated area.

Monitoring Protocols

Underpass (Pinch-point) Surveys. At each of the corridor pinch-points or underpasses, standardized track stations and remotely triggered camera stations will be established. Track stations will be constructed near each opening of each underpass to detect animal movement on both sides of the undercrossing. Each track station will consist of a 1-m diameter circle of freshly sifted gypsum, 1 cm deep. In addition, to monitor animals traveling through an underpass, wildlife sign surveys will be conducted through presumed wildlife corridors (including under overpasses). Gypsum powder will be used in specific locations as necessary to improve the clarity of tracks. All tracks will be identified and measured, and direction of travel will be noted.

Each track station will be sampled for a minimum of 5 consecutive days during each of two sampling periods per year (summer and fall). For each undercrossing, relative abundance will be expressed as the total number of recorded visits for each species divided by the total sampling effort (Linhart and Knowlton 1975; Diefenbach et al. 1994). Surveys of mammal sign will be conducted once during each 5-day track station survey.

Remotely triggered infrared cameras will also be stationed at selected undercrossings. Although it would be valuable to have camera stations at all undercrossings, camera locations may need to be restricted to relatively concealed locations to minimize the possibility of camera theft or vandalism. Camera systems will serve to positively identify carnivore species present in the area and provide verification of track identifications at track stations.

Road-Kill Surveys. If possible, historical and current road-kill records will be obtained throughout the planning area from Caltrans and local cities that collect such information. Compilation and mapping of road kill information will help identify animal crossing locations, areas of high hazard for wildlife crossing roads, and possibly effects of increasing traffic over time. This information can be correlated with results of the track and camera sampling to identify areas where carnivores appear to be crossing over roads rather than using undercrossings.

4.2 EXOTIC SPECIES

Invasive, exotic species are hypothesized to be among the greatest threats to covered species and the ecological integrity of the preserve system. Careful monitoring and adaptive management will be necessary to identify invasions or expansions of these exotic pests and hopefully to control them or minimize their impacts on native resources.

4.2.1 Threats and Impacts

Invasive Nonnative Plants

Invasive weed species pose one of the greatest threats to the characteristics of ecosystems. These species can dominate and cause permanent damage to vegetation communities by altering natural processes and reducing biodiversity (BLM 1999, TNC 2000). Invasive weeds can destroy wildlife habitat; displace many threatened, endangered, or sensitive species; and result in reduced plant and animal diversity where they form monocultures.

Direct competition between native and exotic plant species is well documented (Alberts et al. 1993). Furthermore, the successful invasion of exotic species may alter habitats and lead to displacement or extinction of native species over time. For example, exotic invasions have been shown to alter hydrological and biochemical cycles and disrupt natural fire regimes (MacDonald et al. 1988; Usher 1988; Vitousek 1990; D'Antonio and Vitousek 1992; Alberts et al. 1993). Vitousek and Walker (1989) noted that aggressive nonnative species might displace native species by altering soil fertility.

MacDonald et al. (1988) reported that reserves surrounded by development areas supporting populations of exotic species are most subject to invasion. However, in studies on the effects of urban encroachment into natural areas in the Santa Monica Mountains, Sauvajot and Buechner (1993) found that direct habitat alteration or disturbance within natural areas is a more significant factor in the extension of edge effects into those areas than proximity to urban development alone. Several other studies have also correlated invasions by alien plants into nature reserves with elevated levels of disturbance, high light conditions, and, in some cases, increased water availability (Laurance 1991; Tyser and Worley 1992; Brothers and Spingarn 1992).

Invasive weeds vary in the level of change they can exert on natural ecosystems. Weeds can be native or nonnative, invasive or noninvasive, and noxious or not noxious. Legally, a noxious weed is any plant designated by federal, state, or local governments as injurious to public health, agriculture, recreation, wildlife, or property (BLM 1999, Sheley et al. 1999 in BLM 1999). Federal noxious weed species, as designated by the U.S. Department of Agriculture, are subject to federally funded prevention, eradication, or containment efforts (CalEPPC 1999).

Invasive or potentially invasive weed species detected in the MHCP planning area that may pose threats to native species include tamarisk (*Tamarix* spp.), Pampas grass (*Cortaderia selloana*), eucalyptus (*Eucalyptus* spp.), giant reed (*Arundo donax*), mustard (*Brassica* spp.), African fountaingrass (*Pennisetum setaceum*), tocalote (*Centaurea melitensis*), purple falsebrome (*Brachypodium distachyon*), artichoke thistle (*Cynara cardunculus*), castor bean (*Ricinus communis*), fennel (*Foeniculum vulgare*), ice plant (*Mesembryanthemum chilensis*), and others (see MHCP Plan, Volume I, Section 6).

Invasive Nonnative Animals

The effect of nonnative animal species on biological resources within reserves has been well documented (e.g., Gates and Gysel 1978; Brittingham and Temple 1983; Wilcove 1985; Andren and Angelstam 1988; Langen et al. 1991; Donovan et al. 1997); most of this literature pertains to effects on wildlife species. For example, both domestic dogs and cats are known to adversely impact native wildlife, with effects ranging from harassment to disturbance of breeding activities to predation (Kelly and Rotenberry 1993; Spencer and Goldsmith 1994). Domestic dogs have been observed within reserves at a distance of greater than 325 ft from the edge, while cats have been observed within reserves more than 1 mile from human dwellings in Riverside County (Kelly and Rotenberry 1993). An increase in nonnative predators as a result of development adjacent to the preserve could potentially affect populations of rodents (e.g., pocket mice, pocket gophers) that may act as seed dispersal agents or play a role in bioturbation.[1] In a study of two populations of house cats on a suburban-desert interface near Tucson, Arizona, Spencer and Goldsmith (1994) suggested that impacts of cats on native wildlife are concentrated within 100-200 ft of the urban-wildland interface in the presence of predators (e.g., coyotes), but may extend further in their absence.

Disturbed habitats are often considered vulnerable to Argentine ant invasions. There is evidence that this exotic species rapidly invades disturbed areas within stands of native habitat (Erickson 1971; Ducote 1977 in Suarez et al. 1998; Ward 1987; DeKock and Giliomee 1989; Knight and Rust 1990; Suarez et al. 1998). Suarez et al. (1998) found Argentine ants most abundant along the edge of urban preserve areas, with densities of ants in the preserve decreasing with distance from the edge. They found that ant activity was highest within about 325 ft of the nearest urban edge, whereas areas sampled beyond 650 ft contained few or no Argentine ants. However, Argentine ants have also been found at distances of approximately 1,300 ft and 3,280 ft from the edge, respectively, in other urban reserves in southern California (Suarez et al. 1998).

Argentine ants appear to be confined to low elevation areas with permanent soil moisture (Erickson 1971; Tremper 1976 in Suarez et al. 1998; Ward 1987; Knight and Rust 1990; Holway 1995, 1998). Tremper (1976) reported that Argentine ants desiccate more easily and are less tolerant of high temperatures than native ants. Suarez et al. (1998) indicated that the presence of the Argentine ants in urban reserves might be dependent on water runoff from developed areas. Holway (1998) found that the rate of Argentine ant invasion is primarily dependent on abiotic conditions (e.g., soil moisture), rather than on disturbance. He suggested that disturbed areas are often a point of introduction, but encourage invasions only if they increase the availability of a limiting resource such as water. Blachly and Forschler (1996) found Argentine ants thriving in areas disturbed by human activity, but indicated that their presence is also related to added ground cover, permanent water supplies, and a simplified native ant fauna.

Invasive faunal species (e.g., Argentine ants, parasites) have the potential to negatively impact pollinator populations. Loss or limitation of pollinators may adversely affect the

[1] Bioturbation is the aeration and mixing of soil by organisms.

long-term survivability of rare plant species by reducing seed output (e.g., reproductive failure) if there is no selfing (Jennersten 1988; Bawa 1990) or decreasing the effective population size through reduced gene flow (Bawa 1990; Menges 1991; Aizen and Feinsinger 1994). Some studies have shown that pollinator limitation can reduce seed output by 50-60% (Jennersten 1988; Pavlik et al. 1993; Bond 1995). Jules and Rathcke (1999) demonstrated that pollinator limitation was significantly related to reduced recruitment of a native plant species within 200 ft of a forest/clearcut edge.

The Argentine ant is known to displace native ant species (Erickson 1971; Tremper 1976 in Suarez et al. 1998; Ward 1987; Holway 1995; Human and Gordon 1996; Suarez et al. 1998). Ants may also function as primary or secondary dispersers of seeds (Roberts and Heithaus 1986; Louda 1989). They have been reported to contribute to the spatial heterogeneity of seed distribution (Reichman 1984, 1979) and they decrease seed abundance of some numerically dominant ruderal species in relation to less dominant native annual species (Inouye et al. 1980). Displacement of native ant species by the Argentine ant could negatively affect persistence of rare native plant species by reducing seed number and distribution.

4.2.2 Available Management Actions

Invasive Nonnative Plants

The primary objective in exotic plant control in the MHCP planning area should be to monitor and control the abundance and affect of invasive plant species, particularly around populations of sensitive plants and in riparian areas, testing the effectiveness of mechanical or chemical methods or prescribed burns. Management options are described in *Invasive Plants of California's Wildlands* (Bossard et al. 2000), BLM 1999, and TNC 2000, among others.

Argentine Ants and Fire Ants

The only effective management action currently known for Argentine ants and fire ants is preventing invasion of the preserve by controlling water runoff into the preserve and inspecting landscaping for ants prior to installation. Localized treatment with pesticides may be effective in isolated cases. However, pesticides that kill ants can cause a replacement of native ants by nonnative ant species because the nonnative ants can re-invade and re-establish faster than the native species (Swartz pers. comm.).

Other Exotic Animals

Other nonnative animals that may be a threat to covered species in the preserve include red fox, opossum, cats, dogs, black rats, cowbirds, bullfrogs, African clawed frogs, nonnative turtles, and nonnative fish. The presence and relative abundance of these species in the preserve should be observed and recorded during annual monitoring.

4.2.3 Monitoring at All Preserves

Invasive Nonnative Plants

Control and removal of exotic invasive plant species is critical at all preserve areas. The objective of this monitoring is to annually track the distribution of invasive plant species in the preserve and to test methods to most effectively control them. Preserve managers should prioritize management actions annually based on the species, relative abundance, and degree of threat. A partial list of common invasive exotic plant species in the MHCP area is included in Table 6-1 of the MHCP Plan.

Monitoring Questions. Monitoring data will be used to evaluate the following questions, as determined to be necessary for effective preserve management by the cities, MHCP conservancy, or wildlife agencies:

1. In which preserve areas are invasive plant species present, what invasive plants are present, and what is the distribution of each invasive plant species?
2. How do covered species respond to control or removal of nonnative plants?
3. How effective are specific management actions in controlling invasions and removing nonnative species?

Monitoring Protocols. The primary objective in exotic plant control should be to monitor and control the abundance of invasive plant species, particularly around populations of sensitive plants and in riparian areas, using mechanical or chemical methods or prescribed burns. Continued monitoring of exotic species populations, abundance, and locations will assist in determining which management options are most appropriate, many of which are described in *Invasive Plants of California's Wildlands* (Bossard et al. 2000).

Locations of exotic plant species will be mapped as part of the baseline vegetation mapping. Thereafter, survey these locations annually to prioritize treatment for control or removal. Annually re-draw polygon boundaries, if warranted, and estimate percent composition of exotic species to evaluate response to management treatments. See example data form in Appendix B.

Argentine Ants and Fire Ants

Argentine ants and fire ants are exotic pests known to have detrimental effects on terrestrial communities in southern California. The objective of this monitoring is to annually document the presence of exotic ants in the preserve and to test methods for minimizing their distribution or impacts on native wildlife.

Monitoring Questions. The cities, MHCP conservancy, or wildlife agencies will use monitoring data to evaluate the following questions:

1. In which preserve areas are exotic ants present?
2. How far into preserve areas do the ants penetrate from urban edges? What is the relationship between presence or abundance of covered species and presence of exotic ants?
3. How does the distribution of exotic ants change over time (i.e., where do they occur in the preserve, next to the edges of the preserve or in the interior, and is their presence becoming more widespread over time)? What factors, identified *a priori* (e.g., edges, soil moisture), are associated with this change?
4. How effective are specific management actions in controlling invasions?

Monitoring Protocols. During field surveys and monitoring for other resources, note and describe the distribution of exotic ants in the preserve. If present throughout the preserve, simply record this observation in field notes rather than preparing a map. If exotic ants are present only in certain locations of the preserve, map these locations and reassess distribution annually. By mapping locations of Argentine ants and fire ants, evaluate whether runoff into the preserve from adjacent lands or other adjacent land uses may be contributing to exotic ant invasions. Monitoring will address whether and where these species are in the reserve and whether their presence correlates with identifiable edge effects and declines in covered species presence or relative abundance. Monitoring will track the distribution of exotic species over time and the effectiveness of specific management actions in controlling invasions. The wildlife agencies will determine the level of effort for the presence-absence surveys.

Other Exotic Animals

Preserve managers should annually observe and record the relative abundance of red fox, opossum, cats, dogs, black rats, cowbirds, bullfrogs, African clawed frogs, nonnative turtles, and nonnative fish in the preserve and areas of highest use.

4.3 WEATHER AND CLIMATE

Plant and animal populations are influenced by climatic parameters, such as temperature and rainfall, over short and long time scales. For example, California gnatcatcher populations can experience large yearly fluctuations depending on short-term weather events such as cold temperatures and precipitation. Likewise, many annual plant species germinate in response to moisture and temperature cues, with population sizes fluctuating widely from year-to-year based on weather conditions in the days and months preceding germination. Under unfavorable conditions, these species may not germinate at all, yet are able to persist as a viable soil seedbank. Longer-term climatic patterns can affect reproductive potential of perennial plant species, thereby influencing species composition and, ultimately, vegetation trends. Monitoring of population trends for the covered species cannot rely on population size alone, but must correlate this size to the factors that influence it. The objective of analyzing the trends in temperature and precipitation over time is to provide information for interpreting changes in covered species populations.

If it is determined to be necessary by the wildlife agencies or their designated data manager, temperature and precipitation data will be collected from four existing weather stations in the MHCP planning area (Oceanside Marina, Vista 1 NE, Escondido, Escondido 2). Weather data will be input and maintained in digital format in a central repository. Additional weather data may be necessary to test hypotheses. This information should be used to analyze population trend data obtained from qualitative and quantitative sampling efforts. At a minimum, monthly weather information is recommended, but daily information may be required for some analyses. The product of this task will be a digital database of temperature and precipitation information that can be easily accessed by preserve managers and researchers. These data can then be analyzed to assess the relationship between weather variables and species abundance and will be important in establishing baseline ranges of variability.

5.0 MONITORING AND MANAGEMENT PROGRAM FUNCTIONS, RESPONSIBILITIES, AND STAFFING

Effectively implementing the MHCP monitoring and management program is the joint responsibility of the wildlife agencies and the cities and is expected to require the technical capabilities described in this section. Estimated costs of implementing the monitoring and management program described herein are presented in Volume I of the MHCP Plan, Section 7. The cities' responsibilities outlined in this plan will be funded by the individual cities (initially) and through a regional funding source established by the cities and is estimated to cost approximately $2.4 million annually (in year 2002 dollars).

Until the regional funding source is in place, the cities must individually fund management and monitoring within their subareas. Therefore, prior to receiving approval for take authorizations, each city must demonstrate to the wildlife agencies that sufficient funding sources are available to fund the initial phases of its monitoring and management program. Individual implementing agreements should identify what level of monitoring and management is needed for species where take coverage is not initially granted and which rely on subsequent approval of another city's subarea plan before coverage will be granted.

Costs to the wildlife agencies for implementing their responsibilities on federal and state lands and for conducting MHCP data management and analysis are not included in this estimate. In conformance with the federal No Surprises Policy for Section 10(a) permits, the wildlife agencies will assume financial responsibility for any additional costs associated with future changes in management and monitoring that are unforeseen at the time of permit issuance.

5.1 IMPLEMENTATION TRACKING

5.1.1 MHCP Cities

Responsibilities

Each city is responsible for accounting of vegetation communities and species (described in Section 2) on preserve lands for which it is responsible (see Figure 1). Responsibilities include maintaining and annually updating a database of baseline conservation lands (those lands conserved prior to MHCP implementation), lands conserved through MHCP implementation, and impacted lands (HabiTrak) and a database of conserved species locations and population boundaries, as described in Section 2.

Staffing

One GIS staff person will be required for each city to maintain and update GIS data for the MHCP.

5.1.2 Wildlife Agencies

Responsibilities

The wildlife agencies are responsible for accounting of vegetation communities and covered species (described in Section 2) on preserve lands for which they administer. Responsibilities include maintaining and annually updating a database of baseline conservation lands (those lands conserved prior to MHCP implementation), lands conserved through MHCP implementation, and impacted lands (HabiTrak) and a database of conserved species locations and population boundaries, as described in Section 2. In addition, the agencies are responsible for annually integrating the HabiTrak data received from each of the cities and distributing updated subregional maps and accounting data back to the cities and to the public.

Staffing

One GIS staff person, dedicated to MHCP, will be required for the agencies to perform the functions described above. This could be the same staff person described in Section 5.4.2, or this responsibility could be delegated to a Regional Environmental Information Center (see Section 5.4.2).

5.2 PRESERVE MANAGEMENT

5.2.1 MHCP Cities

Responsibilities

Each city is responsible for ensuring that preserves are adequately managed and monitored to meet all permit conditions (see MHCP Plan, Volume II). The cities may delegate this responsibility to a preserve manager or outside consultant hired by the city, or to a local land conservancy, property owner, homeowners' association, mitigation bank, or developer for a given property. The MHCP cities may propose to delegate coordination of preserve management and monitoring responsibilities for most of the preserve to an MHCP conservancy. The cities or MHCP conservancy may contract out portions of the technical requirements.

The cities have prepared framework management plans as part of their subarea plans that identify resource priorities for management in various portions of their subareas. The preserve managers will be responsible for preparing and implementing area-specific management plans, conducting baseline and other monitoring surveys, performing routine patrol and enforcement actions, identifying threats to biological resources, and identifying and implementing management actions to address these threats. MHCP conservation and management goals are based on the ecology of the species, which is independent of political boundaries. Some management goals are specific to individual subareas, while other goals require the cooperation and coordination of management across multiple subareas, depending on the species' distribution.

Each city will ensure that baseline surveys conducted as part of CEQA requirements are in conformance with its subarea plan and provide adequate biological information to evaluate biological management and monitoring needs.

Staffing

Adaptive management of preserves will require various types of specialists who perform the functions listed below. These specialists may be staff of the cities or a conservancy, whose responsibility is management and monitoring of the MHCP preserves, or the work could be contracted out to scientists and a habitat management organization. There should be scientific oversight and coordination between subareas to ensure consistency of the management and monitoring program over time.

Adaptive Management:

- Vegetation mapping (includes validating satellite or aerial imagery)
- Plant and animal surveys (field data collection)
- Assessment of habitat and species management needs
- Restoration (project design, implementation, and data collection)
- Weed abatement
- Pest control
- Fire management
- Testing efficacy of management actions

Law Enforcement, Maintenance, and Public Relations:

- Enforcement of land uses and public access
- Physical maintenance (e.g., constructing and repairing fences, placing and maintaining signs, removing trash, and installing erosion controls)
- Public outreach and volunteer coordination

Enforcement of preserve land uses will be required to ensure that unauthorized activities do not degrade biological resource values. Enforcement actions will include patrolling the MHCP preserve system and enforcing, as appropriate, prohibited land uses, recreational activities, and public access. Enforcement will require a minimum of one full-time staff position for the MHCP to assist preserve managers in monitoring public use of the preserves.

5.2.2 Wildlife Agencies

Responsibilities

The USFWS and CDFG will be responsible for performing the same functions described above on lands they administer (e.g., the lagoons and other lands they acquire).

Staffing

The USFWS and CDFG will appoint preserve managers to manage and monitor federal and state preserve lands. The wildlife agency preserve managers may be assisted by other technical staff specialists who perform the functions listed below. Alternatively, the

wildlife agencies could provide sufficient funding to the cities or an MHCP conservancy for preserve management on state and federal MHCP preserve lands.

Adaptive Management:

- Vegetation mapping (includes validating satellite or aerial imagery)
- Plant and animal surveys (field data collection)
- Assessment of habitat and species management needs
- Restoration (project design, implementation, and data collection)
- Weed abatement
- Pest control
- Fire management
- Testing efficacy of management actions

Law Enforcement, Maintenance, and Public Relations:

- Enforcement of land uses and public access
- Physical maintenance (e.g., constructing and repairing fences, placing and maintaining signs, removing trash, and installing erosion controls)
- Public outreach and volunteer coordination

Enforcement of preserve land uses will be required to ensure that unauthorized activities do not degrade biological resource values. Enforcement actions will include patrolling the preserve and enforcing, as appropriate, prohibited land uses, recreational activities, and access. Enforcement will require a minimum of one full-time agency staff position for the MHCP to assist preserve managers in monitoring public use of the preserves.

5.3 PRESERVE MONITORING

5.3.1 MHCP Cities

Responsibilities

The cities are responsible for conducting all of the monitoring activities described in Sections 3 and 4 on lands they own. The cities will coordinate with other cities so that data are collected consistently among all preserves where questions span those preserves. Cities are responsible for demonstrating that all monitoring requirements are being met. All field data will be input to a database and provided to the wildlife agencies for review and analysis.

Staffing

Preserve managers, assisted by the scientists and technical specialists listed in Section 5.2.1, will conduct the biological monitoring. These specialists may be staff of the cities or a conservancy, whose responsibility is monitoring of the MHCP preserve. Specific tasks could be contracted out to scientists or a habitat management organization.

5.3.2 Wildlife Agencies

Responsibilities

The USFWS and CDFG will be responsible for conducting all of the monitoring activities described in Sections 3 and 4 on lands they administer. The agencies also will ensure that data are collected consistently among all preserves, using the same sampling techniques and sampling intervals, and that all monitoring requirements are being met. Where not described herein, the agencies will work with the cities or an MHCP conservancy to provide the required field data sheets, sampling protocols, and sampling intervals for the various resources to be monitored.

Staffing

The USFWS and CDFG will appoint agency staff to monitor federal and state preserve lands. The wildlife agency staff may be assisted by other technical specialists who perform the functions listed in Section 5.2.2. Alternatively, the wildlife agencies could provide sufficient funding to the cities or a conservancy for biological monitoring on state and federal MHCP preserve lands.

5.4 DATABASE MANAGEMENT AND ANALYSIS

5.4.1 MHCP Cities

Responsibilities

Preserve management and monitoring will generate a large array of quantitative and spatial data on biological resources and other attributes on each preserve area. Responsibilities include creating, maintaining, and documenting the preserve database on a continual basis, as well as assisting other staff in extracting and using the data for analyses and reporting. Each city will be responsible for establishing a relational database structure, inputting monitoring data into the database for each preserve, implementing quality assurance/quality control (QA/QC) procedures, and extracting data from the database for analysis.

Each city also will create a GIS database to store spatially explicit data, such as vegetation and species distribution maps. The GIS database will overlap and be integrated with the numerical, relational database. Responsibilities include integrating the preserve-specific GIS data into the city-wide GIS database, implementing QA/QC procedures, providing GIS data for analyses, generating maps for fieldwork, reports, and presentations, helping integrate the GIS database with the relational database, and other general database maintenance and documentation requirements. Each city will also make this information available to the public through a MHCP web page.

Each city will provide the quantitative and spatial databases to the wildlife agencies for subregional analysis. Each city will analyze site-specific information necessary for on-the-ground adaptive management decisions for individual preserve areas.

Staffing

The functions described above will require two staff positions at each city to be responsible for the following tasks:

- Monitoring and management database maintenance
- GIS vegetation and species database maintenance
- Web page design and maintenance

Alternatively, an MHCP conservancy would hire two full-time staff positions dedicated for work on the MHCP quantitative and spatial databases.

5.4.2 Wildlife Agencies

Responsibilities

The MHCP monitoring program will generate a huge array of quantitative data on biological resources and other attributes across the MHCP subregion, as well as spatially explicit data, such as vegetation and species distribution maps, which are most appropriately stored in a GIS format. The wildlife agencies are responsible for providing the following functions to meet their subregional/regional monitoring responsibilities:

- Subregional/regional database maintenance. Functions include establishing a relational database structure, inputting monitoring data into the database, implementing QA/QC procedures, extracting data from the database for analysis, assisting staff with using the database, and other database maintenance and documentation requirements. The agencies will also provide guidance to the cities on the format for submitting data.
- Subregional GIS database maintenance. Functions include integrating the preserve-specific GIS data into the subregional and regional GIS database, implementing QA/QC procedures, providing GIS data for analyses, generating maps for field work, reports, and presentations, helping integrate the GIS database with the relational database, and other general database maintenance and documentation requirements. The agencies will also provide guidance to the MHCP cities on the format for submitting data.

- Data analysis. Functions include:

  - Analyses of data collected on lands managed by the wildlife agencies, analyses on the aggregated preserve-level data for the entire MHCP area, and analyses of subregional monitoring data collected in selected locations;
  - Estimating population size and distribution;
  - Identification of potential management issues;
  - Testing the efficacy of management actions; and
  - Model validation.

- Data dissemination and reporting. Functions include updated data dissemination on an annual basis, providing access to the database, and preparing summary reports.
- Quality assurance and coordination. Functions include reviewing all data provided by the cities or an MHCP conservancy for accuracy, reviewing all agency data for accuracy, and coordinating data maintenance and analysis for the subregion. The agencies will also provide oversight for field methods to ensure consistency across all MHCP preserves.

Staffing

The wildlife agencies may delegate some of their monitoring, analysis, and reporting responsibilities, while retaining responsibility for regulatory oversight of the program. The agencies are considering partnering with a proposed Regional Environmental Information Center (REIC) to carry out or assist with subregional and regional database management, analysis, and reporting. A group of science advisors within the REIC, or as an external advisory body, would be available for assistance with analysis, interpretation of results, and evaluation of monitoring protocols. The REIC would also make available synthesized and summarized information to the cities and to university faculty. Additionally, information could be used in education programs and other forms of public outreach.

It is anticipated that the agencies or REIC will hire, at a minimum, three full-time staff for database development, management and maintenance, GIS database updates and maintenance, and data dissemination and reporting efforts related to the MHCP.

5.5 REPORTING

Monitoring results will be presented at annual public workshops and available via public access to the GIS, monitoring databases, and the MHCP website.

5.5.1 MHCP Cities

Responsibilities

Each city is responsible for collecting and reporting compliance data (including species and habitat data) and making adaptive management changes based on that information. Each city must summarize results of compliance monitoring in annual reports to the wildlife agencies. The annual compliance monitoring reports will summarize conservation and take of habitat (HabiTrak reports) and species over the past year, as well as all monitoring and management actions and results during that period. This information will also be presented at an annual MHCP public workshop.

In addition, the cities or an MHCP conservancy will develop a website that provides information on public access to the preserve, maps on conservation status, habitat management plans for individual preserves, summary monitoring data tables, and opportunities for volunteer stewardship activities.

Staffing

The reporting function could be provided by each city's preserve manager(s). Additional staffing will be needed for website development, public outreach, and volunteer coordination.

5.5.2 Wildlife Agencies

Responsibilities

The wildlife agencies are responsible for annually reporting compliance data (including species and habitat data) and making adaptive management changes based on that information for the lands they administer. The wildlife agencies will also annually present the results of management experiments and other projects (e.g., estimating population size).

The wildlife agencies will aggregate the preserve-level reports from the cities, develop a composite of habitats conserved and lost by all MHCP participants, both in ledger and map format, and present the results of management experiments and other projects at the annual MHCP public workshop.

Staffing

This reporting function could be fulfilled by the wildlife agency preserve managers and data managers, with input from science advisors of the REIC.

5.5.3 3-Year Summaries

Every 3 years, the cities and wildlife agencies (or REIC) will aggregate the preserve-level reports and prepare comprehensive monitoring reports summarizing the resource status and any significant subregional trends in covered species or resources that could significantly impact covered species. The reports will describe how the MHCP is progressing toward it goals, the effectiveness of management, and the status of covered species on a subregional and regional scale.

The city-agency reports may also direct revisions to monitoring protocols and sampling designs based on the results. The 3-year reports should thus provide direction for focused research efforts that may be required to answer specific questions about trends or management effectiveness and should prioritize monitoring and research efforts for the next 3-year period, complementing the ongoing assessment of research needs. The cities and wildlife agencies (or REIC) would also make available synthesized and summarized information to university faculty, the MHCP website, and the public for use in education, research, and outreach.

5.6 FUTURE PROGRAM REVIEW AND REFINEMENT

The MHCP monitoring and management program is still in the process of development. Some of the questions are still being refined, sampling strategies are being formulated, and some protocols are being tested in the field. Data from ongoing monitoring programs (e.g., the USGS herpetofauna monitoring and the USFWS coastal sage scrub bird monitoring) are being analyzed to better understand the appropriate number of sampling points, duration, monitoring intervals, etc. for meaningful analysis and interpretation. Therefore, for the next several years, the monitoring program will continue to be reviewed and refined, as baseline data are collected and management plans are prepared for the preserves. The wildlife agencies and cities will refine the monitoring plan together to ensure that it meets the needs for preserve managers, permit compliance, and implementation feasibility and cost. This process of refining the monitoring plan will require approval by the wildlife agencies and agreement by the cities.

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APPENDIX A

MHCP COVERED SPECIES AND MONITORING STRATEGIES

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A.1 MHCP COVERED SPECIES WITH SITE-SPECIFIC PERMIT CONDITIONS (INDIVIDUAL POPULATIONS TO BE TRACKED USING GIS)

Plants
San Diego thorn-mint*
San Diego ambrosia*
Del Mar manzanita*
Encinitas baccharis*
Thread-leaved brodiaea*
Orcutt's spineflower*
Del Mar Mesa sand aster*
Blochman's dudleya
*Short-leaved dudleya**
San Diego button-celery**
Orcutt's hazardia*
Nuttall's lotus*
Little mousetail**
Spreading navarretia**
California Orcutt grass**

Animals
San Diego fairy shrimp**
Riverside fairy shrimp**
Arroyo toad
Light-footed clapper rail
Western snowy plover
California least tern
Southwestern willow flycatcher
Least Bell's vireo
Coastal cactus wren*
California gnatcatcher
Belding's Savannah sparrow
Stephens' kangaroo rat
*Pacific pocket mouse**

* Narrow endemic species
** Vernal pool species (also narrow endemics)
Species in italics are not currently known to occur in the MHCP planning area.

A.2 MHCP COVERED SPECIES WITH HABITAT-BASED PERMIT CONDITIONS (TO BE TRACKED AS HABITAT, USING HABITRAK)

Plants	**Animals**
Wart-stemmed ceanothus	Harbison's dun skipper*
Summer holly	Salt marsh skipper
Sticky dudleya	Western spadefoot toad
Cliff spurge	Southwestern pond turtle
San Diego barrel cactus	Orange-throated whiptail
San Diego marsh-elder	California brown pelican
Torrey pine	White-faced ibis
Nuttall's scrub oak	Elegant tern
Engelmann oak	Cooper's hawk
Parry's tetracoccus	Osprey
	Golden eagle
	Peregrine falcon
	Western bluebird
	Yellow-breasted chat
	Rufous-crowned sparrow
	Large-billed Savannah sparrow
	Bell's sage sparrow
	Northwestern San Diego pocket mouse
	San Diego black-tailed jackrabbit
	Mountain lion
	Southern mule deer

* Narrow endemic species.
Species in italics are not currently known to occur in the MHCP planning area.

A.3 SUMMARY OF MONITORING STRATEGIES

RESOURCE	MONITORING STRATEGIES	FREQUENCY
CSS, Chaparral, Grassland	**All Preserve Areas**	
San Diego thorn-mint[1] San Diego ambrosia[1] Orcutt's spineflower[1] Del Mar Mesa sand aster[1] Thread-leaved brodiaea[1] Orcutt's hazardia[1] Short-leaved dudleya[1,2]	• Delineate population boundaries (GIS). • Measure density (quadrats). • Assess condition and degree of disturbance to habitat.	Annual
Del Mar manzanita[1] Encinitas baccharis[1]	• Delineate population boundaries (GIS). • Identify nonnative species and disturbance attributes. • Measure relative abundance. • Assess condition and degree of disturbance to habitat.	5 years
Blochman's dudleya Sticky dudleya Cliff spurge San Diego barrel cactus Parry's tetracoccus[2] Wart-stemmed ceanothus Summer holly Torrey pine Nuttall's scrub oak	• Map general distribution (GIS). • Assess condition and degree of disturbance to habitat.	Annual
California gnatcatcher Coastal cactus wren[1]	• Map general distribution (GIS). • Measure abundance (number of pairs). • Assess condition and degree of disturbance to habitat.	Annual
Orange-throated whiptail Golden eagle California rufous-crowned sparrow Bell's sage sparrow Northwestern SD pocket mouse Stephen's kangaroo rat[2] Pacific pocket mouse[1,2] SD black-tailed jackrabbit Mountain lion Southern mule deer	• Map general distribution (GIS) of individuals or sign. • Assess condition and degree of disturbance to habitat.	Annual
CSS, Chaparral, Grassland	**Selected Preserve Areas**	
Avian CSS Community	• Conduct bird point counts. • Collect vegetation data.	TBD
California Gnatcatcher Dispersal	• TBD	TBD
Herpetofauna	• Conduct pitfall trapping. • Collect vegetation data.	TBD

A.3 SUMMARY OF MONITORING STRATEGIES (CONTINUED)

RESOURCE	MONITORING STRATEGIES	FREQUENCY
Riparian Habitats	**All Preserve Areas (where resource occurs)**	
Southwestern willow flycatcher Least Bell's vireo Yellow-breasted chat Cooper's hawk	• Map nest sites (GIS). • Census number of breeding pairs. • Assess condition and degree of disturbance to habitat.	Annual
Arroyo toad[2]	• Map potential habitat (GIS).	Annual
San Diego marsh-elder Harbison's dun skipper butterfly[1] Western spadefoot toad Southwestern pond turtle White-faced ibis Mountain lion Southern mule deer	• Map general distribution (GIS). • Assess condition and degree of disturbance to habitat.	Annual
Riparian Habitats	**Selected Preserve Areas**	
Avian Community	• Assess number and fate of nests. • Assess incidence of nest parasitism and predation.	TBD
Vegetation Community Structure	• Assess vegetation composition and vertical and horizontal structure.	TBD
Hydrology and Water Quality	• Compile existing information.	TBD
Lagoon Species	**All Preserve Areas (where resource occurs)**	
Western snowy plover California least tern	• Delineate boundaries of breeding habitat (GIS). • Census number of breeding pairs. • Measure nest productivity.[3] • Assess condition and degree of disturbance to habitat.	Annual
Belding's Savannah sparrow	• Census number of breeding pairs. • Assess condition and degree of disturbance to habitat.	Annual
Large-billed Savannah sparrow	• Census number of individuals. • Assess condition and degree of disturbance to habitat.	Annual
Light-footed clapper rail	• Measure relative abundance. • Assess condition and degree of disturbance to habitat.	Annual
Nuttall's lotus[1]	• Delineate population boundaries (GIS). • Measure density (quadrats). • Assess condition and degree of disturbance to habitat.	Annual

A.3 SUMMARY OF MONITORING STRATEGIES (CONTINUED)

RESOURCE	MONITORING STRATEGIES	FREQUENCY
Lagoon Species (continued)	**All Preserve Areas (where resource occurs)**	
Salt marsh skipper Elegant tern California brown pelican White-faced ibis Osprey Peregrine falcon	• Map general distribution (GIS). • Assess condition and degree of disturbance to habitat.	Annual
Waterfowl and shorebirds at lagoons	• Conduct presence/absence surveys. • Measure relative abundance by zone. • Assess condition and degree of disturbance to habitat.	Annual
Mammalian and Avian Predators	• Conduct presence/absence surveys. • Record observations by zone.	Annual
Hydrology and Water Quality	• Compile existing information.	TBD
Oak Woodland	**All Preserve Areas (where resource occurs)**	
Engelmann oak Harbison's dun skipper[1] Western bluebird Cooper's hawk Southern mule deer Mountain lion	• Map general distribution (GIS). • Assess condition and degree of disturbance to habitat.	Annual
Vernal Pools	**All Preserve Areas (where resource occurs)**	
Thread-leaved brodiaea[1] San Diego button-celery[1] Little mousetail[1] Spreading navarretia[1] California Orcutt grass[1]	• Delineate population boundaries (GIS). • Measure density (quadrats). • Assess condition and degree of disturbance to habitat.	Annual
San Diego fairy shrimp[1] Riverside fairy shrimp[1] Western spadefoot toad	• Map general distribution (GIS). • Assess condition and degree of disturbance to habitat.	Annual
Exotic Species	**All Preserve Areas (where resource occurs)**	
Nonnative plants Nonnative ants Red fox Opossum Black rats Cowbirds Bullfrogs Cats Dogs	• Conduct presence/absence surveys. • Map general distribution (GIS). • Measure relative abundance.	Annual

A.3 SUMMARY OF MONITORING STRATEGIES (CONTINUED)

RESOURCE	MONITORING STRATEGIES	FREQUENCY
Wildlife Corridors	**Selected Preserve Areas**	
Mountain lion Southern mule deer	• Determine use of specific chokepoints and underpasses. • Collect roadkill data.	TBD

[1] Narrow endemic species.
[2] No known locations in MHCP.
[3] Nest productivity will be monitored if additional funding becomes available.

APPENDIX B

BASELINE SURVEYS AND VEGETATION MAPPING

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APPENDIX B
BASELINE SURVEYS AND VEGETATION MAPPING

Vegetation communities will be monitored to provide information for a variety of different purposes, including identifying and prioritizing management actions, tracking the response of communities to management actions, assessing systematic vegetation community patterns that may be an expression of human-induced stresses, and evaluating vegetation patterns that may help explain observed distributions and abundance of wildlife species.

B.1 MONITORING QUESTIONS

Vegetation community monitoring data will be used to evaluate the following questions, as determined to be necessary for effective preserve management by the cities, MHCP conservancy, or wildlife agencies:

1. What is the distribution of vegetation communities, seral phases, and levels of disturbance, and how do these change over time? Disturbance factors include relative abundance of exotic species, vehicular traffic, trampling, erosion, urban runoff, trash, habitat loss as a result of development activities, etc.
2. How are changes in vegetation communities related to changes in covered species distributions?
3. What changes in vegetation communities require management actions, and what are the responses to management actions?

B.2 BASELINE SURVEYS

Initial, comprehensive surveys of all preserve lands will serve as the "baseline" against which future monitoring efforts will be compared. As this baseline will be unable to account for natural fluctuations and human-induced changes that are currently operating, the emphasis of the monitoring will be to develop an understanding of resource trends, rather than focus on year-to-year changes. For example, the spatial extent of many annual plant populations is known to vary greatly from year to year due to climate or other factors independent of conservation or management actions. The intent of the monitoring program is to identify changes in populations not accounted for by such natural variation and that may therefore require management intervention.

For all lands conserved and dedicated to the MHCP, baseline surveys will be conducted to accurately delineate vegetation communities, describe relevant attributes of vegetation stands (e.g., level of disturbance, relative abundance of exotics, successional stage, etc. -- see example in Appendix B.4), document the presence of covered plants and animals and distribution of covered plants, and document habitat that may support covered species. Predictions about habitat associations will be developed and tested during baseline surveys for all covered species. Information from these surveys will be mapped into a GIS database with appropriate attribute data (see example in Appendix B.5). Baseline surveys will be conducted at the time the lands are dedicated to the preserve, allowing for

surveys at appropriate seasons and during years of average to above-average rainfall. Some existing public lands will be dedicated to the preserve upon signing of the implementing agreement; these lands will also require baseline surveys within 1 year of signing the implementing agreement, allowing for surveys at appropriate seasons and during years of average to above-average rainfall.

The cities should prepare a list of preserve areas that are conserved at the time of signing the Implementing Agreement, and identify with the wildlife agencies which areas need new baseline surveys and which areas have already had recent baseline surveys. Recent surveys conducted as part of environmental analyses (i.e., CEQA or NEPA) may be used as baseline surveys, as long as they are supplemented by data collected on management needs (which typically are not collected as part of technical reports for environmental documentation). The cities may wish to implement a policy requiring that CEQA/NEPA biological analysis be expanded to include the baseline information required for preparing a MHCP management and monitoring plan for the property.

Baseline surveys will use the year 2000 color infrared aerial photography (digital orthophotos, 2-ft resolution) for mapping, or other equivalent or better imagery. Take authorization holders could participate in the SANDAG consortium for imagery acquisition or use other means to obtain the most current and effective imagery for all parts of the MHCP preserve.

The covered species identified in the baseline surveys will be subject to all permit conditions as listed in Volume II of the MHCP Plan. It is the responsibility of the preserve manager to identify the management requirements listed as part of the permit conditions applicable to the specific preserve unit. These management requirements must be included in area-specific management directives for the preserve unit, which must be developed within 2 years of dedication to the preserve and implemented immediately upon approval of the management plan. There is no minimum acreage threshold of preserve lands requiring area-specific management directives, i.e., all preserve lands, regardless of size, require area-specific management directives.

B.3 VEGETATION MAPPING PROTOCOLS

Vegetation community classification and mapping will be conducted on all preserve units, using both remote sensing information and field verification. The purpose of this mapping is to provide preserve managers with information on the distribution and condition of vegetation communities and habitats to effectively monitor resource status, identify and prioritize potential management actions, and track responses to management. The community classification system and specific attributes to be used must be consistent with those used in other subregions (e.g., MSCP). At this time, the modified Holland classification should be used (see Appendix B.6), unless the wildlife agencies recommend a different classification system in the future. Appendix B.7 outlines suggested mapping rules to be used in assigning vegetation community classifications for selected communities.

In addition to mapping vegetation community polygons, preserve managers will describe relevant attributes for each polygon, such as the dominant species for each area, the health or condition of the patch, and the general level of disturbance (e.g., percent composition of invasive species, percent of bare ground caused by trails or off-road vehicles, evidence of grazing or tilling, etc.). Appendix B.4 shows an example data form for vegetation mapping attributes. The purpose of this descriptive mapping is to develop not just a map and classification of communities but also a description of community features that are relevant for habitat management activities. This method has been modified and simplified from methods used by the City of San Diego, The Nature Conservancy, and California Native Plant Society to describe the structure and condition of various patches of habitat (e.g., see Rapid Assessment Protocol, CNPS 2002).

The minimum mapping unit for all vegetation communities, except coastal sage scrub, chaparral, and coastal sage/chaparral mix, is 0.5 acre. The minimum mapping unit for coastal sage scrub, chaparral, and coastal sage/chaparral mix, is 5 acres.

Vegetation Community Map Updates

At 5-year intervals, preserve managers will refine vegetation community maps to show changes in the boundaries or attributes of vegetation community polygons (e.g., changes in the spatial distribution of vegetation communities or attributes such as level of disturbance). It may be desirable to refine maps more frequently if vegetation community changes occur more frequently (e.g., by fire, flood disturbance, adjacent development, or frequent recreational activities). All vegetation map updates will be on the same schedule every 5 years (e.g., 2005, 2010, 2015, etc.), with refinements, as necessary in other years.

The objectives of refining the vegetation community mapping at preserve areas every 5 years (or more frequently, as necessary) are to:

1. Document changes in the distribution or characteristics of habitats (e.g., level of exotic species, type change as a result of urban runoff) that may trigger preserve management actions.
2. Document changes in habitats that may correlate with factors such as preserve configuration, adjacent land uses, fire, floods, etc.

Volume II of the MHCP Plan describes the habitat requirements for each covered species. Observed changes to the distribution or characteristics of these habitat features should trigger management actions.

Preserve managers will utilize the most recent suitable imagery to refine the map (e.g., color infrared photography from the SANDAG consortium in 2005). The same vegetation community classification and mapping conventions described for baseline mapping will be used and will focus on areas of change in polygon shape or attributes. Automated change detection analyses using digital imagery may be helpful in updating vegetation maps and monitoring habitat changes; however, a number of issues presently exist that prevent drawing conclusions regarding the applicability of these approaches.

Fire History

Each preserve manager will review the CDF burn data and other available fire history data when preparing site-specific fire or fuel management guidelines for each preserve area (e.g., where to establish fuel breaks or mowing for public safety purposes). Brush clearing will be implemented pursuant to the guidelines of the Wildland/Urban Interface Task Force. CDF burn data will also be used, as necessary, in updating vegetation community maps and attributes every 5 years. Field monitoring conducted as part of the habitat management efforts will include assessments of the post-fire recovery of habitats and covered species. The following maps, at a minimum, will be prepared for each preserve area to aid in reviewing the fire history for each area: (1) number of fires by region of the preserve area, (2) number of years since the last fire, (3) fires in the preserve area by year, and (4) proportion of habitat burned per fire or per year. In addition, preserve managers will tabulate the number of acres burned per year. In preparing fire management plans, preserve managers should also contact the Border Agency Fire Council for knowledge relating to fire management.

B.4 EXAMPLE VEGETATION MAPPING FIELD DATA FORM

Observer:_____. **Date:_____.**

Polygon#:_____.

Vegetation Community:_____.

Dominant native species (% cover):

Non-native species composition (% cover):

Disturbance factors and intensity:

Sensitive species observed or potential:

Comments:

B.5 EXAMPLE VEGETATION ATTRIBUTE TABLE (INPUT TO GIS)

Polygon no.	Veg. Type/Code	Date	Dominant Native Species #1 (%cover)	Dominant Native Species #2 (%cover)	Nonnative Species #1 (%cover)	Nonnative Species #2 (%cover)	Disturbance Factor #1	Disturbance Factor #2	Sensitive Species #1	Sensitive Species #2

B.6 MODIFIED HOLLAND CLASSIFICATION SYSTEM

Suggested by Thomas Oberbauer (February 1996)

10000 NON-NATIVE VEGETATION, DEVELOPED AREAS, OR UNVEGETATED HABITAT

- 11000 Non-Native Vegetation
  - 11100 Eucalyptus Woodland
  - 11200 Disturbed Wetland
  - 11300 Disturbed Habitat
- 12000 Urban/Developed
- 13000 Unvegetated Habitat
  - 13100 Open Water
    - 13110 Marine
      - 13111 Subtidal
      - 13112 Intertidal
    - 13120 Bay
      - 13121 Deep Bay
      - 13122 Intermediate Bay
      - 13123 Shallow Bay
    - 13130 Estuarine
      - 13131 Subtidal
      - 13132 Intertidal
      - 13133 Brackishwater
    - 13140 Freshwater
  - 13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe
  - 13300 Saltpan/Mudflats
  - 13400 Beach
- 18000 General Agriculture
  - 18100 Orchards and Vineyards
  - 18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches
  - 18300 Extensive Agriculture - Field/Pasture, Row Crops
    - 18310 Field/Pasture
    - 18320 Row Crops

20000 DUNE COMMUNITY

- 21000 Coastal Dunes
  - 21100 Active Coastal Dunes (occurred at one time but now nearly extirpated)
  - 21200 Foredunes
    - 21230 Southern Foredunes (tiny fragments remaining in Imperial Beach and Los Peñasquitos Lagoon)
- 22000 Desert Dunes
  - 22100 Active Desert Dunes (very little in Borrego Valley)
  - 22300 Stabilized and Partially-Stabilized Desert Sand Field (mostly in the eastern part of Borrego Valley; may be large enough to map from aerials)
- 24000 Stabilized Alkaline Dunes*****

29000 ACACIA SCRUB*

30000 SCRUB AND CHAPARRAL

- 31000 Coastal Bluff Scrub
  - 31200 Southern Coastal Bluff Scrub (mappable on Point Loma and Torrey Pines State Park)

- 32000 Coastal Scrub
  - 32400 Maritime Succulent Scrub (Point Loma, etc.)
  - 32500 Diegan Coastal Sage Scrub
    - 32510 Coastal form*
    - 32520 Inland form (>1,000 ft. elevation)*
  - 32700 Riversidian Sage Scrub
    - 32710 Riversidian Upland Sage Scrub (scrub on Banner Grade may fit this category)
    - 32720 Alluvial Fan Scrub
- 33000 Sonoran Desert Scrub
  - 33100 Sonoran Creosote Bush Scrub
  - 33200 Sonoran Desert Mixed Scrub
    - 33210 Sonoran Mixed Woody Scrub
    - 33220 Sonoran Mixed Woody and Succulent Scrub
    - 33230 Sonoran Wash Scrub*
  - 33300 Colorado Desert Wash Scrub*
  - 33500 Calcicolous Scrub*
  - 33600 Encelia Scrub*
- 34000 Mojavean Desert Scrub
  - 34300 Blackbush Scrub (micro locations on eastern edge of mountains)
- 35000 Great Basin Scrub
  - 35200 Sagebrush Scrub
    - 35210 Big Sagebrush Scrub
- 36000 Chenopod Scrub
  - 36110 Desert Saltbush Scrub
  - 36120 Desert Sink Scrub (in Borrego sink)
- 37000 Chaparral
  - 37100 Upper Sonoran Mixed Chaparral
    - 37120 Southern Mixed Chaparral
      - 37121 Granitic Southern Mixed Chaparral
      - 37122 Mafic Southern Mixed Chaparral (occurs on Las Posas and Boomer soils)
    - 37130 Northern Mixed Chaparral*
      - 37131 Granitic Northern Mixed Chaparral*
      - 37132 Mafic Northern Mixed Chaparral*
  - 37200 Chamise Chaparral
    - 37210 Granitic Chamise Chaparral*
    - 37220 Mafic Chamise Chaparral*
  - 37300 Red Shank Chaparral (near Campo and Chihuahua Valley)
  - 37400 Semi-Desert Chaparral (same as Desert Transition Chaparral; occurs in areas like Jacumba)
  - 37500 Montane Chaparral
    - 37510 Mixed Montane Chaparral
    - 37520 Montane Manzanita Chaparral
    - 37530 Montane Ceanothus Chaparral
    - 37540 Montane Scrub Oak Chaparral
  - 37800 Upper Sonoran Ceanothus Chaparral
    - 37810 Buck Brush Chaparral
    - 37830 Ceanothus crassifolius Chaparral
  - 37900 Scrub Oak Chaparral
  - 37A00 Interior Live Oak Chaparral
  - 37B00 Upper Sonoran Manzanita Chaparral
  - 37C00 Maritime Chaparral
    - 37C30 Southern Maritime Chaparral (occurs in coastal San Diego County and has been described as Coastal Mixed Chaparral)

- 37G00 Coastal Sage-Chaparral Scrub
- 37K00 Flat-topped Buckwheat
- 39000 Upper Sonoran Subshrub Scrub

40000 GRASSLANDS, VERNAL POOLS, MEADOWS, AND OTHER HERB COMMUNITIES

- 42000 Valley and Foothill Grassland
  - 42100 Native Grassland
    - 42110 Valley Needlegrass Grassland
    - 42120 Valley Sacaton Grassland
  - 42200 Non-Native Grassland
  - 42300 Wildflower Field (this is actually a subset of the above, but would be pertinent in the Cuyamaca Lake and Mataguay Valley areas)
  - 42400 Foothill/Mountain Perennial Grassland*
    - 42470 Transmontane Dropseed Grassland*
- 44000 Vernal Pool
  - 44300 Southern Vernal Pool
    - 44320 San Diego Mesa Vernal Pool
      - 44321 San Diego Mesa Hardpan Vernal Pool (northern mesas)
      - 44322 San Diego Mesa Claypan Vernal Pool (southern mesas)
- 45000 Meadow and Seep
  - 45100 Montane Meadow
    - 45110 Wet Montane Meadow
    - 45120 Dry Montane Meadows
  - 45300 Alkali Meadows and Seeps
    - 45320 Alkali Seep
  - 45400 Freshwater Seep
- 46000 Alkali Playa Community
  - 46100 Badlands/Mudhill Forbs

50000 BOG AND MARSH

- 52000 Marsh and Swamp
  - 52100 Coastal Salt Marsh
    - 52120 Southern Coastal Salt Marsh
  - 52300 Alkali Marsh
    - 52310 Cismontane Alkali Marsh
  - 52400 Freshwater Marsh
    - 52410 Coastal and Valley Freshwater Marsh
    - 52420 Transmontane Freshwater Marsh (San Felipe Creek)
    - 52430 Montane Freshwater Marsh
    - 52440 Emergent Wetland

60000 RIPARIAN AND BOTTOMLAND HABITAT

- 61000 Riparian Forests
  - 61300 Southern Riparian Forest
    - 61310 Southern Coast Live Oak Riparian Forest
    - 61320 Southern Arroyo Willow Riparian Forest
    - 61330 Southern Cottonwood-willow Riparian Forest
  - 61500 Montane Riparian Forest
    - 61510 White Alder Riparian Forest (Cold Spring in the Cuyamaca Mountains)
  - 61800 Colorado Riparian Forest
    - 61810 Sonoran Cottonwood-willow Riparian Forest (Coyote Canyon)
    - 61820 Mesquite Bosque (Borrego Sink)

62000 Riparian Woodlands
- 62200 Desert Dry Wash Woodland
- 62300 Desert Fan Palm Oasis Woodland
- 62400 Southern Sycamore-alder Riparian Woodland (Pauma and Pala areas)

63000 Riparian Scrubs
- 63300 Southern Riparian Scrub
  - 63310 Mule Fat Scrub
  - 63320 Southern Willow Scrub
- 63500 Montane Riparian Scrub
- 63800 Colorado Riparian Scrub
  - 63810 Tamarisk Scrub
  - 63820 Arrowweed Scrub

70000 WOODLAND

71000 Cismontane Woodland
- 71100 Oak Woodland
  - 71120 Black Oak Woodland (Cuyamaca and Mesa Grande)
  - 71160 Coast Live Oak Woodland
    - 71161 Open Coast Live Oak Woodland
    - 71162 Dense Coast Live Oak Woodland
  - 71180 Engelmann Oak Woodland
    - 71181 Open Engelmann Oak Woodland
    - 71182 Dense Engelmann Oak Woodland
- 71200 Walnut Woodland
  - 71210 California Walnut Woodland (micro locations occur, such as in De Luz)

72000 Pinon and Juniper Woodlands
- 72300 Peninsular Pinon and Juniper Woodlands
  - 72310 Peninsular Pinon Woodland
  - 72320 Peninsular Juniper Woodland and Scrub

75000 Sonoran Thorn Woodland
- 75100 Elephant Tree Woodland (micro locations such as Indian Wash)

77000 Mixed Oak Woodland

78000 Undifferentiated Open Woodland

79000 Undifferentiated Dense Woodland

80000 FOREST

81000 Broadleaved Upland Forest
- 81100 Mixed Evergreen Forest (Palomar Mountain)
- 81300 Oak Forest
  - 81310 Coast Live Oak Forest
  - 81320 Canyon Live Oak Forest (may be represented in San Diego County in some form but apparently is intended for more northern areas)
  - 81340 Black Oak Forest (as described in Holland represents apparent patches of oak in the midst of coniferous forests)

83000 Closed-cone Coniferous Forest
- 83100 Coastal Closed-cone Coniferous Forest
  - 83140 Torrey Pine Forest (not actually a closed cone pine)
- 83200 Interior Closed-cone Coniferous Forest
  - 83230 Southern Interior Cypress Forest (83330, typo in Holland)

84000 Lower Montane Coniferous Forest
- 84100 Coast Range, Klamath and Peninsular Coniferous Forest*
  - 84140 Coulter Pine Forest
  - 84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest

84200 Sierran Coniferous Forest
84230 Sierran Mixed Coniferous Forest
84500 Mixed Oak/Coniferous/Bigcone/Coulter*
85000 Upper Montane Coniferous Forest
85100 Jeffrey Pine Forest

B.7 SUGGESTED MAPPING RULES FOR VEGETATION AND LAND COVER TYPES

Suggested by John O'Leary, SDSU, for MCAS Miramar

Diegan Coastal Sage Scrub
Greater than 50% ground cover of low, soft-woody subshrubs, i.e. *Artemisia californica, Eriogonum fasciculatum, Salvia mellifera, S. apiana, Mimulus aurantiacus,* and *Hazardia squarrosa* along with *Malosma laurina* and *Rhus integrifolia*. Lacking significant cover of bare ground and/or non-native herbs. Dry wash areas tend to contain most of the above species along with substantial cover of *Baccharis sarothroides*. Holland: 32500. Paysen et al.: Coastal Sagebrush Series and Baccharis Series. MHCP: Coastal Sage Scrub.

Disturbed Diegan Coastal Sage Scrub
From 20% to 50% ground cover of low, soft-woody subshrubs, i.e. *Artemisia californica, Eriogonum fasciculatum, Salvia mellifera, S. apiana, Mimulus aurantiacus,* and *Hazardia squarrosa* along with *Malosma laurina* and *Rhus integrifolia*. Dry wash areas tend to contain most of the above species along with substantial cover of *Baccharis sarothroides*. Indication of disturbance present in the form of significant percentage cover of bare ground and/or non-native herbs such as, *Avena* spp., *Bromus madritensis, Hemizonia fasciculata,* and *Erodium* spp.. Holland: 32500. Paysen et al.: Coastal Sagebrush Series and Baccharis Series. MHCP: Disturbed Coastal Sage Scrub.

Chamise Chaparral
Greater than 70% ground cover attributable to evergreen sclerophyllous shrubs and drought- deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with chamise (*Adenostoma fasciculatum)* contributing greater than 50% of the cover. Lacking significant cover of disturbance specialty species or bare ground. Includes recently burned stands with lower coverage values and few non-native species. Holland: 37200. Paysen et al.: Chamise Series. MHCP: Chaparral.

Disturbed Chamise Chaparral
From 50% to 70% ground cover attributable to evergreen sclerophyllous shrub species and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with chamise (*Adenostoma fasciculatum*) contributing greater than 50% of the cover. Disturbance indicated by a significant amount of bare ground and/or coverage by disturbance specialist species (e.g. *Eriodictyon crassifolium, Avena* spp., *Bromus madritensis, Erodium* spp., and *Hemizonia fasciculata,* etc.). Holland: 37200. Paysen et al.: Chamise Series. MHCP: Disturbed Chamise Chaparral.

Ceanothus Chaparral
Greater than 70% ground cover attributable to evergreen sclerophyllous shrubs and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute

>60% of the relative cover) with *Ceanothus tomentosus* and/or *C. verrucosus* contributing greater than 50% of the cover. Holland: no analogue. Paysen et al.: Ceanothus Series. MHCP: Chaparral.

Disturbed Ceanothus Chaparral
From 50% to 70% ground cover attributable to evergreen sclerophyllous shrubs and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with *Ceanothus tomentosus* and/or *C. verrucosus* contributing greater than 50% of the cover. Disturbance indicated by a significant amount of bare ground and/or coverage by disturbance-specialist species (e.g. *Eriodictyon crassifolium, Avena* spp., *Bromus madritensis, Erodium* spp., *Hemizonia fasciculata,* etc.). Holland: no analogue. Paysen et al.: Ceanothus Series. MHCP: Disturbed Chaparral.

Scrub Oak Chaparral
Greater than 70% ground cover attributable to evergreen sclerophyllous shrub species and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with scrub oak (*Quercus dumosa*) contributing greater than 50% of the cover. Holland: 37900. Paysen et al.: Scrub Oak Series. MHCP: Chaparral.

Disturbed Scrub Oak Chaparral
From 50% to 70% ground cover attributable to evergreen sclerophyllous shrub species and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with scrub oak (*Quercus dumosa*) contributing greater than 50% of the cover. Disturbance indicated by a significant amount of bare ground and/or coverage by disturbance-specialty species (e.g. *Eriodictyon crassifolium, Avena* spp., *Bromus madritensis, Erodium* spp., *Hemizonia fasciculata,* etc.). Holland: 37900. Paysen et al.: Scrub Oak Series. MHCP: Disturbed Chaparral.

Southern Mixed Chaparral
Greater than 70% ground cover attributable to evergreen sclerophyllous shrubs and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with no single species contributing greater than 50% of the cover. Holland: 37120. Paysen et al.: No analogue. MHCP: Chaparral.

Disturbed Southern Mixed Chaparral
From 50% to 70% ground cover attributable to evergreen sclerophyllous shrub species and drought-deciduous malacophyllous subshrubs (evergreen sclerophyllous shrubs constitute >60% of the relative cover) with no single species contributing greater than 50% of the cover. Disturbance indicated by a significant amount of bare ground and/or coverage by disturbance-specialty species (e.g. *Eriodictyon crassifolium, Avena* spp., *Bromus madritensis, Erodium* spp., *Hemizonia fasciculata,* etc.). Holland: 37120. Paysen et al.: no analogue. MHCP: Disturbed Chaparral.

Coastal Sage Scrub-Chaparral
Greater than 70% ground cover attributable to evergreen scleropyllous chaparral species and drought-deciduous malacophyllous sage scrub species (40% relative cover ≤ coastal sage scrub species or chaparral species ≤ 60% relative cover; where both types are admixed). Holland: 37600. MHCP: Coastal Sage – Chaparral Scrub.

Disturbed Coastal Sage Scrub-Chaparral
From 30% to 70% ground cover attributable to evergreen scleropyllous chaparral species and drought-deciduous malacophyllous sage scrub species (40% relative cover ≤ coastal sage scrub species or chaparral species ≤60% relative cover; where both types are admixed). Disturbance indicated by a significant amount of bare ground and/or coverage by disturbance-specialty species (e.g. *Eriodictyon crassifolium, Avena* spp., *Bromus madritensis, Erodium* spp., *Hemizonia fasciculata,* etc.). Holland: 37600. MHCP: Coastal Sage – Chaparral Scrub.

Non-Native Grassland
Greater than 40% cover of grasses and forbs, with greater than 2/3 cover attributable to non-native annual grasses. Characteristic species are *Avena* spp. and *Bromus madritensis,* although *Nassella* spp. and native/non native annual forbs may be admixed. Holland: 42200. Paysen et al.: Bromegrass Series and Wild Oats Series. MHCP: Grassland.

Disturbed Non-Native Grassland
From 20% to 40% cover of grasses and forbs of which greater than 2/3 of the cover is attributable to non-native annual grasses. Characteristic species are *Avena* spp. and *Bromus madritensis*, although *Nassella* spp. and native/non-native annual forbs may be admixed. Evidence of recent mechanical disturbance such as tilling or mowing. Significant amounts of bare ground may be present. Holland: 42200. Paysen et al.: Bromegrass Series and Wild Oats Series. MHCP: Disturbed Grassland.

Native Grassland
Greater than 40% ground cover of grasses and forbs of which greater than 2/3 cover is attributable to *Nassella* spp. although native and introduced annual herbs may be admixed. Holland: 42100. Paysen et al.: Needlegrass Series. MHCP: Grassland.

Disturbed Native Grassland
From 20% to 40% ground cover of grasses and forbs of which greater than 2/3 cover is attributable to *Nassella* spp. although native and introduced annual herbs may be admixed. Evidence of mechanical disturbance. Significant amounts of bare ground may be present. Holland: 42100. Paysen et al.: Needlegrass Series. MHCP: Disturbed Grassland.

Non-Native/Native Grassland
Greater than 40% ground cover of grasses and forbs, with greater than 2/3 relative overall ground cover attributable to native and non-native grasses of which 1/3 relative grass cover < *Nassella spp.* or introduced grasses <2/3 relative grass cover. No evidence of

recent mechanical disturbance. Holland: no analogue. Paysen et al.: no analogue. MHCP: Grassland.

Disturbed Non-Native/Native Grassland
From 20%-40% ground cover of grasses and forbs, with greater than 2/3 relative overall ground cover attributable to native and non-native grasses of which 1/3 relative grass cover < *Nassella* spp. or introduced grasses <2/3 relative grass cover. Evidence of recent mechanical disturbance may occur. Significant amounts of bare ground may occur. Holland: no analogue. Paysen et al.: no analogue. MHCP: Grassland.

Vernal Marsh
Strongly dominated by *Juncus bufonius,* with lesser amounts of assorted forbs and graminoids such as *Lythrum hyssopifolium, Ambrosia psilostachya, Eleocharis macrostachya,* and *Rumex acetosa* admixed. Subject to seasonal inundation. Holland: 52500. Paysen et al.: Wiregrass Series. MHCP: Disturbed Wetlands.

Disturbed Vernal Marsh
Strongly dominated by *Juncus bufonius,* with lesser amounts of assorted forbs and graminoids such as *Lythrum hyssopifolium, Ambrosia psilostachya, Eleocharis macrostachya,* and *Rumex acetosa* admixed. Subject to seasonal inundation. Holland: 52500. Paysen et al.: Wiregrass Series. MHCP: Disturbed Wetlands.

Coastal and Valley Fresh Water Marsh
Dominated by perennial, emergent monocots such as cattails (*Typha latifolia, T. domingensis*), bullrushes (*Scirpus americana, S. robusta, S. californicus*) and species of smart weed (*Persicaria* spp.) and dock (*Rumex* spp.). Occurring on sites lacking significant current, permanently flooded by permanent water (rather than brackish, alkaline, or variable). Holland: 52410. Paysen et al.: Wiregrass Series. MHCP: Freshwater Marsh.

Disturbed Coastal and Valley Fresh Water
Dominated by perennial, emergent monocots such as cattails (*Typha latifolia, T. domingensis*), bullrushes (*Scirpus americana, S. robusta, S. californicus*) and species of smart weed (*Persicaria* spp.) and dock (*Rumex* spp.). Occurring on sites lacking significant current, permanently flooded by permanent water (rather than brackish, alkaline, or variable). Holland: 52410. Paysen et al.: Wiregrass Series. MHCP: Freshwater Marsh.

Southern Coast Live Oak Riparian Forest
Greater than 40% cover by Coastal Live Oak (*Quercus agrifolia*). May be associated with an understory of chaparral shrub species such as *Quercus dumosa, Adenostoma fasciculatum, Ceanothus tomentosus, Malosma laurina, Rhus integrifolia* etc., and vines such as *Toxicodendron diversilobum.* Holland: 61310. Paysen et al.: Coast Live Oak Series. MHCP: Oak Riparian Forest.

Disturbed Southern Coast Live Oak Riparian Forest
From 25% to 45% cover of Coastal Live Oak (*Quercus agrifolia*) with a discontinuous understory of chaparral shrub species such as *Quercus dumosa, Adenostoma fasciculatum, Ceanothus tomentosus, Malosma laurina, Rhus integrifolia* etc. and vines such as *Toxicodendron diversilobum*. Evidence of past mechanical disturbance and/or significant invasion by non-native species such as *Arundo donax, Tamarix* spp., *Eucalyptus* spp., *Cortaderia* spp., etc. Holland: 61310. Paysen et al.: Coast Live Oak Series. MHCP: Disturbed Oak Riparian Forest.

Southern Arroyo-Willow Riparian Forest
Greater than 60% ground cover of *Salix* spp., that average greater than 20 ft in height. Holland: 61320. Paysen et al.: Willow Series. MHCP: Riparian Forest.

Disturbed Southern Arroyo-Willow Riparian Forest
From 40% to 60% overstory cover of *Salix* spp. that average greater than 20 ft tall. Evidence of past mechanical disturbance, and/or significant invasion by non-native species such as *Arundo donax, Tamarix* spp., *Eucalyptus* spp., *Cortaderia* spp., etc. Holland: 61320. Paysen et al.: Willow Series. MHCP: Disturbed Riparian Forest.

Riparian Forest (Sycamore Woodland)
A tall, open, broadleaved, winter-deciduous streamside woodland dominated by *Platanus racemosa*, with an overstory cover greater than 25%. Usually associated with the understory shrubs *Baccharis sarothroides, B. salicifolia,* and *Eriogonum fasciculatum.* Scattered individuals of *Salix* spp. and *Populus fremontii* may be present. Holland: 62400. Paysen et al.: Sycamore Series. MHCP: Riparian Woodland.

Disturbed Riparian Forest (Disturbed Sycamore Woodland)
A tall, open, broad-leaved, winter-deciduous streamside woodland dominated by *Platanus racemosa* with an overstory cover ranging from 15% to 25%. *Baccharis sarothroides, B. salicifolia,* and to a lesser extent, *Salix* spp. and *Populus fremontii.* Evidence of past mechanical disturbance and/or significant invasion by non-native species such as *Arundo donax, Tamarix* spp., *Eucalyptus* spp., *Cortaderia* spp., etc.. Holland: 62400. Paysen et al.: Sycamore Series. MHCP: Disturbed Riparian Woodland.

Southern Willow Scrub
Dense (greater than 60%) cover, broadleaved, winter deciduous riparian thickets dominated by several species of *Salix* that average less than 20 ft high. Holland: 63320. Paysen et al.: Willow Series. MHCP: Riparian Scrub.

Disturbed Southern Willow Scrub
Less-dense (from 30% to 60% coverage), broadleaved, winter deciduous riparian thickets dominated by several species of *Salix* spp. that average less than 20 ft high. Evidence of past mechanical disturbance and/or significant invasion by non-native species such as *Arundo donax, Tamarix* spp., *Eucalyptus* spp., *Cortaderia* spp., etc. Holland: 63320. Paysen et al.: Willow Series. MHCP: Disturbed Southern Willow Scrub.

Mulefat Scrub
A "depauperate" (greater than 50% cover), tall, "herbaceous," riparian scrub strongly dominated by *Baccharis salicifolia*. An early seral community maintained by frequent flooding; occurs on intermittent stream channels with fairly coarse substrate and moderate depth to water table. Holland: 63310. Paysen et al.: Baccharis Series. MHCP: Riparian Scrub.

Disturbed Mulefat Scrub
A "depauperate" (20%-50% cover), tall, "herbaceous," riparian scrub strongly dominated by *Baccharis salicifolia.* An early seral community maintained by frequent flooding; occurs on intermittent stream channels with fairly coarse substrate and moderate depth to water table. Evidence of past mechanical disturbance and/or significant invasion by non-native species such as *Arundo donax, Tamarix* spp., *Eucalyptus* spp., *Cortaderia* spp., etc. Holland: 63310. Paysen et al.: Baccharis Series. MHCP: Disturbed Riparian Scrub.

Coast Live Oak Woodland
Greater than 25% overstory cover of *Quercus agrifolia* found on north-facing slopes and in moist ravines. May contain a discontinuous understory of shrubs/vines such as *Prunus illicifolia, Heteromeles arbutifolia, Ribes indecorum, Sambucus mexicana,* and *Toxicodendron diversilobum.* Holland: 71160. Paysen et al.: no analogue. MHCP: Oak Woodland – Dense Phase.

Disturbed Coast Live Oak Woodland
From 15% to 25% overstory cover of *Quercus agrifolia* found on north facing slopes and in moist ravines. May contain a discontinuous understory of shrubs/vines such as *Prunus illicifolia, Heteromeles arbutifolia, Ribes indecorum, Sambucus mexicana,* and *Toxicodendron diversilobum.* Evidence of mechanical disturbance and/or invasion by nonnative shrubs or trees. Holland: 71160. Paysen et al.: no analogue. MHCP: Disturbed Oak Woodland – Dense Phase.

Eucalyptus Woodland
Greater than 25% overstory cover by *Eucalyptus* spp., though individuals of *Acacia melanoxylon* may be admixed. Paysen et al.: Eucalyptus Series. MHCP: Eucalyptus Woodland.

Open Water
Greater than 0.3 acre of perennially standing water. MHCP: Open Water.

Natural Flood Channel/Streambed
Unvegetated or sparsely (<30% cover of shrubs and trees) vegetated natural flood channel or scoured streambed. MHCP: Natural Flood Channel/Streambed.

Disturbed
Past or present physical disturbance prevalent (e.g. brushing, tilling, vehicular disturbance, etc.). Typically comprised of a mixture of grasses and forbs with grasses contributing <2/3 of the relative cover and with non-native forbs like *Erodium botrys*, *Hypocheris glabra*, *Foeniculum vulgare*, and *Salsola kali* being common dominants. Native shrub/subshrubs (e.g. *Eriogonum fasciculatum*, *Baccharis sarothroides*, *Eriodictyon crassifolium*, and *Lotus scoparius*) and non-native shrubs (e.g., *Ricinus communis*) may be patchily admixed. Substantial amounts of bare ground may exist. Potential for colonization and succession of native plant communities exists. If area is fragmented, it must have reasonable proximity to native seed sources. MHCP: Disturbed.

Developed
Little or no short-term potential for the colonization and succession of native plant communities. Includes maintained (irrigated) exotic landscapes, buildings, pavement, exposed bedrock, and recently graded surfaces. MHCP: Developed.

B.8 MHCP AREA-SPECIFIC MANAGEMENT AND MONITORING DIRECTIVES

As described in Section 6 of the MHCP Plan, each city must prepare an area-specific monitoring and management plan or area-specific management and monitoring directives for all areas that are currently conserved. In addition, as individual areas are dedicated to the preserve, each city must prepare an area-specific monitoring and management plan or directives for the newly conserved areas within its subarea. There is no minimum acreage for which area-specific monitoring and management directives must be prepared; all areas of the preserve must have area-specific directives.

Depending on the size and resources of the preserve, an area-specific monitoring and management plan may be a separate document, or the directives may be in the form of a brief attachment to the city's subarea plan that includes a map of resources on the preserve property, describes site-specific threats to resources, and identifies site-specific management and monitoring actions to address these threats (see example below). This format could also be used for reporting on annual management and monitoring actions.

MHCP AREA-SPECIFIC MANAGEMENT AND MONITORING DIRECTIVES
(example)

Preserve Property: (name)_____
(attach map of biological resources)

Vegetation Community:

Condition and Threats: (For each polygon of habitat or area of the preserve, describe level of disturbance, degree of recruitment, condition of vegetation, abundance of exotics, soil disturbances, illegal recreation or land uses, dumping, trampling, runoff, etc. May be attached as an attribute in GIS database.)
_____
_____
_____

Management and Monitoring Actions to Address Threats: (Refer to monitoring plan and permit conditions.)_____
_____
_____

Fire History and Recommendations (attach map)**:**_____
_____
_____

MHCP Covered Species Present (map locations):_____
_____

Example:

> **San Diego Thornmint**
> ***Acanthomintha ilicifolia***
> (narrow endemic)
>
> **MHCP Critical Location?** (yes or no -- refer to MHCP Plan Vol. II)
>
> **Condition and Threats:** (Describe level of disturbance, degree of recruitment, condition of population, abundance of exotics, soil disturbances, illegal recreation or land uses, dumping, trampling, runoff, etc.)
>
> **Avoidance Requirements: (**Specify measures to ensure that impacts to narrow endemic species are avoided to the maximum extent practicable.)
>
> **Management Requirements:** Conduct baseline surveys. Include specific guidelines for managing edge effects. Edge effects may include (but are not limited to) trampling, dumping, vehicular traffic, competition with invasive species, parasitism by cowbirds, predation by domestic animals, noise, collecting, recreational activities, and other human intrusion.
>
> **Monitoring Requirements:** Annual site-specific monitoring of density and condition (refer to monitoring plan and permit conditions in MHCP Plan, Vol. II)._____
> _____
>
> **Enhancement Recommendations:** _____
> _____

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APPENDIX C

EXAMPLE FIELD DATA COLLECTION FORMS

C.1 Rare Plant Density Data Form

C.2 Survey Data Form for Selected Covered Bird Species

C.3 a. Point Count Data Form
b. Point Count Vegetation Form

C.4 a. Herpetofauna Data Form
b. Vegetation Data Form for Herpetofauna Surveys

C.5 Arroyo Toad Monitoring Data Form

C.6 Lagoon Avian Survey Form

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APPENDIX C.1
RARE PLANT DENSITY DATA FORM

General Locality: USGS Quad:
Surveyors: Date
Species:

QUAD (1 sq.m)	1	2	3	4	5	6	7	mean
Count								
% Flowering								
% Fruiting								
% Vegetative								
Slope								
Aspect								
% Native Cover								
% Nonnative Cover								
% Bare Ground								
Soil Types								
Dominants								
Associates								
Notes on habitat quality:								
Notes on disturbances:								
Other management issues:								

APPENDIX C.2

SURVEY DATA FORM FOR SELECTED COVERED BIRD SPECIES

(California gnatcatcher, cactus wren, least Bell's vireo, southwestern willow flycatcher, and yellow-breasted chat)

Monitoring Site ID: _____ **Date:** _____

Observer(s): _____ **Time Start:** _____ **Time Finish:** _____

Weather:	**Minimum**	**Maximum**
Temperature (°F):	_____	_____
Wind (mph):	_____	_____
Cloud Cover (%):	_____	_____
Precipitation/fog:	_____	_____

Habitat and Habitat Condition:_____

_____

Map Sighting No.	Species	Time Start Sighting	Time Finish Sighting	# of Prs	Single Males	Single Females	# of Unk Sex	# Heard	Comments (Continue on Back)

Comments should include information on banding status, breeding activity, plumage, and any interesting observations.

APPENDIX C.3a
POINT COUNT DATA FORM

State Region Location Month Day Year

Observer: Point coordinates:

									≤ 50 m		> 50 m		Fly-Overs			
Point #	Time				Species				0-5 min	5-8 min	0-5 min	5-8 min	0-5 min	5-8 min	Breeding Obs.	Habitat Type

Comments:

Breeding Obs. Codes: C=Copulation, M=Material Carry, FC=Food Carry, N=Nest Found, FL=Fledgling, FS=fecal sac carry, DD=distraction display
Habitat Codes: C=Chaparral, S=Coastal Sage, O=Oak Woodland, G=Grassland, R=Riparian, F=Forest, A=Agricultural, U=Urban

Weather Information: Please estimate temperature, cloud cover (% of sky covered by clouds), and approximate wind speed.

_________° F or ° C (circle one) _________% _________mph, knots, or kmph (circle one)

Temperature Cloud Cover Wind Speed

ENTERED_______________PROOFED_____________

APPENDIX C.3b
POINT COUNT VEGETATION FORM

Point #: **Date: /01** **Collector:** **Photo #:**
Plot Radius: 100m **Substrate:**
Water: standing? Y or N running? Y or N
Aspect: **Slope: %**
Road: Y or N **Road Width:** m **% Road: %** **Road Type:** paved / dirt / gravel

	Trees/ Shrubs	Herb/ Grass	Lawn	Build.	Pave.	Dirt/ Rock	Water
General % Cover:							

	Chap	CSS	Grass	Oak	Rip	Ag	Urban
Habitat % Cover:							
Dominant Species:							
Native % Cover:							
Maximum Veg Height (m):							

Type of Urban:
Low Resid.
High Resid.
Rural Resid.
Bus./Shop.
Indust.
Other _____

Adjacent Land Use: _____
Comments: _____

APPENDIX C.4a
HERPETOFAUNA DATA FORM

Date _____	Date _____	Date _____	Date _____
Site Name _____	Site Name _____	Site Name _____	Site Name _____
Array Number _____	Array Number _____	Array Number _____	Array Number _____
Bucket Number _____	Bucket Number _____	Bucket Number _____	Bucket Number _____
Snake Trap # _____	Snake Trap # _____	Snake Trap # _____	Snake Trap # _____
Species _____	Species _____	Species _____	Species _____
Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?
Wt (gms.) _____	Wt (gms.) _____	Wt (gms.) _____	Wt (gms.) _____
Length (mm/cm) _____	Length (mm/cm) _____	Length (mm/cm) _____	Length (mm/cm) _____
Marks _____	Marks _____	Marks _____	Marks _____
Toeclip number _____	Toeclip number _____	Toeclip number _____	Toeclip number _____
Recap? yes / no / ?	Recap? yes / no / ?	Recap? yes / no / ?	Recap? yes / no / ?
Collector _____	Collector _____	Collector _____	Collector _____
Disposition released / dead/ escaped	Disposition released / dead/ escaped	Disposition released / dead/ escaped	Disposition released / dead/ escaped
Tissue sample yes / no	Tissue sample yes / no	Tissue sample yes / no	Tissue sample yes / no

Date _____	Date _____	Date _____	Date _____
Site Name _____	Site Name _____	Site Name _____	Site Name _____
Array Number _____	Array Number _____	Array Number _____	Array Number _____
Bucket Number _____	Bucket Number _____	Bucket Number _____	Bucket Number _____
Snake Trap # _____	Snake Trap # _____	Snake Trap # _____	Snake Trap # _____
Species _____	Species _____	Species _____	Species _____
Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?	Sex M / F / ? A / J / ?
Wt (gms.) _____	Wt (gms.) _____	Wt (gms.) _____	Wt (gms.) _____
Length (mm/cm) _____	Length (mm/cm) _____	Length (mm/cm) _____	Length (mm/cm) _____
Marks _____	Marks _____	Marks _____	Marks _____
Toeclip number _____	Toeclip number _____	Toeclip number _____	Toeclip number _____
Recap? yes / no / ?	Recap? yes / no / ?	Recap? yes / no / ?	Recap? yes / no / ?
Collector _____	Collector _____	Collector _____	Collector _____
Disposition released / dead/ escaped	Disposition released / dead/ escaped	Disposition released / dead/ escaped	Disposition released / dead/ escaped
Tissue sample yes / no	Tissue sample yes / no	Tissue sample yes / no	Tissue sample yes / no

APPENDIX C.4b
VEGETATION DATA FOR HERPETOFAUNA SURVEYS

Caller: Recorder:

Site Name: Array #: Location:

Slope:(N-S) (E-W) Loc. Date: Trans. Date

Incidentals:

N	Canopy Height (m)	Tree	Tree	Species Shrub	Shrub	Shrub	Species Herb	Species Herb	Species Herb	Substrate	Leaf litter height(cm)
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
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41											
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44											
45											
46											
47											
48											
49											
50											

APPENDIX C.4b
VEGETATION DATA FOR HERPETOFAUNA SURVEYS

Caller: Recorder:

Site Name: Array #: Location:

Slope:(N-S) (E-W) Loc. Date: Trans. Date

Incidentals:

N	Canopy Height (m)	Tree	Tree	Species Shrub	Species Shrub	Species Shrub	Species Herb	Species Herb	Species Herb	Substrate	Leaf litter height(cm)
51											
52											
53											
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C.5 Arroyo Toad Monitoring Data Sheet

Date		Start time		Sunset time		Wind high		Max clouds	
Observers		End time		Moon		Wind low		Min clouds	
Site location:									

Time	Age class	Activity	Habitat	Microhabitat	Sex	Temp	Comments
(24 hr, record on map)	(eggs, tadpole, toadlet, adult, etc.)	(call, foraging, burrowing, amplexus, ect.)	(creekbed, upland, veg type, etc.)	(soil type, pool, under oak, etc.)	(male, female, unknown)	(air temp at toad loc-ation)	(note behaviors, size, color, disturbances, condition of surrounding habitat, streambank steepness, etc.)

APPENDIX C.6
LAGOON AVIAN SURVEY FORM

Sampling Program Information			
Date: Time Begin: Time End:	ZONE:	STAFF:	PAGE ______ of ______

TIME	ZONE	SPECIES	NUMBER	HABITAT	ACTIVITY	COMMENTS/DOUBLE CTS.

HABITAT ID		
OW- Open Water: >1ft. deep	**EG**- Eelgrass Beds	**WR**- Willow Riparian: willow & mulefat
SW- Shallow Water: <1 ft. deep	**AB**- Algal Beds	**BS**- *Baccharis* scrub: *Baccharis/Haplopappus* dom.
MF- Mud Flat: exposed & unvegetated	**SM**- Salt Marsh	**SS**- Sage Scrub
SB- Sand Beach/Intertidal	**CM**- Cattail/Tule Marsh: fresh water	**UP**- Uplands: non-wetlands habitat
	BM- Brackish Marsh: mixed fresh & salt plants	

ACTIVITIES- **F**oraging, **R**esting, **Fl**ying, **C**ourting

APPENDIX D

USFWS 5-POINT POLICY 2000

Federal Register

Thursday,
June 1, 2000

Part IV

Department of the Interior

Fish and Wildlife Service

Department of Commerce

National Oceanic and Atmospheric Administration

Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process; Notice

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[Docket No. 981208299–0049–02]

RIN:1018–AG06, 0648–XA14

Notice of Availability of a Final Addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process

AGENCIES: Fish and Wildlife Service, Interior, and National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Commerce.

ACTION: Notice of final policy.

SUMMARY: The Fish and Wildlife Service and the National Marine Fisheries Service (the Services) are publishing a final addendum to the Handbook for Habitat Conservation Planning and Incidental Take Permitting Process (HCP Handbook). This addendum, which is also known as the five-point policy guidance, is printed entirely within this notice. Like the HCP Handbook, the addendum provides clarifying guidance for the Services in conducting the incidental take permit program and for those applying for an incidental take permit under section 10(a)(1)(B) of the Endangered Species Act (ESA). This guidance will promote efficiency and nationwide consistency within and between the Services and improve the Habitat Conservation Planning program.

DATES: This policy is effective July 3, 2000.

ADDRESSES: Chief, Division of Endangered Species, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, Room 420, Arlington, Virginia 22203 (facsimile 703/358–1735); or Chief, Endangered Species Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, Maryland 20910 (facsimile 301/713–0376).

FOR FURTHER INFORMATION CONTACT: Nancy Gloman, Chief, Division of Endangered Species, U.S. Fish and Wildlife Service (telephone 703/358–2171, facsimile 703/358–1735), or Wanda Cain, Chief, Endangered Species Division, National Marine Fisheries Service (telephone 301/713–1401, facsimile 301/713–0376) at the above addresses.

SUPPLEMENTARY INFORMATION:

Background

The Endangered Species Act (ESA) was amended in 1982 to allow the Secretaries to authorize the taking of listed species incidentally to an otherwise lawful activity by non-Federal entities such as states, counties, local governments, and private landowners (section 10(a)(1)(B)). To receive a permit, the applicant submits a conservation plan (also referred to as an HCP) that meets the criteria included in the ESA and its implementing regulations (50 CFR parts 17 and 222).

The section 10 incidental take permitting process (or HCP process) provides additional flexibility for landowners by including planning for unlisted species, which enables the process to embrace an ecosystem and landscape-level approach. This proactive approach can reduce future conflicts and may even preclude listing of species, furthering the purposes of the ESA. As the Services have made many refinements to the process, we have also experienced tremendous growth in the demand for Habitat Conservation Plans (HCPs) in recent years. In 1992, 14 HCPs had been approved. As of today, we have more than 260 HCP permits covering more than twenty million acres of land, providing conservation for approximately 200 listed species. More than 200 HCPs are under some stage of development. The HCP process provides an opportunity to develop strong partnerships with local governments and the private sector.

Based on the Services' experience in developing HCPs and lessons learned since 1983, the Services developed comprehensive guidance on conducting the incidental take permit program. This guidance was developed into the HCP Handbook, which was made available for public review and comment on December 21, 1994 (59 FR 65782). It was issued in final form on December 2, 1996 (61 FR 63854).

With the 1982 amendments, Congress envisioned and allowed the Federal government to provide regulatory assurances to non-Federal property owners through the section 10 incidental take permit process. We decided that a clearer policy associated with the permit regulations in 50 CFR 17.22, 17.32, and 222.307 regarding the assurances provided to landowners entering into an HCP was needed. This prompted us to develop the ''No Surprises'' policy, which was based on the 1982 Congressional Report language and a decade of working with private landowners during the development and implementation of HCPs. The Services believed that non-Federal property owners should be provided economic and regulatory certainty regarding the overall cost of species conservation and mitigation, provided that the affected species were adequately covered, and the permittee was properly implementing the HCP and complying with the terms and conditions of the HCP, permit, and Implementing Agreement (IA), if used. The Services codified the ''No Surprises'' policy into a final rule, 50 CFR 17.22(b)(5), 17.32(b)(5) and 222.307(g), on February 23, 1998 (63 FR 8859). It was at this time that the Services announced our intent to revise the HCP Handbook, both to reflect the final No Surprises rule and to further enhance the effectiveness of the HCP process in general through expanded use of five concepts, including permit duration, public participation, adaptive management, monitoring provisions, and biological goals.

On March 9, 1999, the Services published the draft five-point policy (64 FR 11485) for public review and comment. This notice establishes the five-point policy as a final addendum to the HCP Handbook. The addendum supplements the HCP Handbook and No Surprises final rule and will be applied within the context of the existing statute and regulations. This final addendum is considered agency policy, and the Services are fully committed to its implementation. The concepts and definitions of terms used in the addendum are found in the ESA, implementing regulations, and HCP Handbook. Further information about HCPs may be obtained from the FWS webpage at http://www.fws.gov/r9endspp/hcp/hcp.html.

Summary of Comments Received

The Services received more than 200 letters of comment on the draft addendum from individuals, conservation groups, trade associations, local governments, Federal and State agencies, businesses and corporations, and private organizations. Because most of these letters included similar comments (many were form letters) we grouped the comments according to issues. We further divided these issues into two sets. The issues in the first set deal with the policy as a whole and HCPs in general. The issues in the second set pertain to the individual sections of the policy and are organized accordingly. The following is a summary of the relevant comments and the Services' responses.

General Five-Point Policy or HCP Issues

Issue 1: Many commenters were concerned that the policy would not be complied with unless it was regulatory in nature and, therefore, suggested codifying the policy into regulation rather than issuing the addendum as policy.

Response 1: We believe that publishing the addendum as policy at this time is appropriate, because, like the HCP Handbook itself, the addendum provides specific guidance for implementation of the statute and regulations. The intent of the addendum is to clarify the concepts identified in existing policy and regulations and ensure consistency in their use. The Services will follow the guidance in the HCP Handbook including this addendum.

Issue 2: Many commenters stated that HCPs should incorporate recovery goals. The comments were primarily referring to the biological goals of the HCP, but also requested the incorporation of recovery goals into adaptive management and monitoring. Other comments included the suggestion of minimum scientific standards for the five points addressed in the addendum or for HCPs in general. Conversely, one commenter stated that biological goals and objectives should simply be that the HCP ''not appreciably reduce the likelihood of survival and recovery,'' which is one of the statutory criteria for permit issuance. Other suggested methods of incorporating recovery into HCPs include developing an overall strategy of recovery that includes HCPs, or tying adaptive management back into the recovery goals of a species.

Response 2: The HCP program standards are contained within the statutory and regulatory criteria. Two of the statutory criteria for obtaining an incidental take permit are that the proposed activity, along with the HCP, does not appreciably reduce the likelihood of survival and recovery of the species, and that the HCP minimizes and mitigates the impact of the taking to the maximum extent practicable. The Services believe that guidance is necessary for identifying biological goals and objectives that translate these statutory and regulatory criteria or standards into meaningful biological measures, specific to a particular HCP situation and in a manner that will facilitate monitoring.

The Services also agree that the biological goals and objectives should be consistent with recovery but in a manner that is commensurate with the scope of the HCP. Under section 10 of the ESA, we do not explicitly require an HCP to recover listed species or contribute to the recovery objectives outlined in a recovery plan, but do not intend to permit activities that preclude recovery. This approach reflects the intent of the section 10(a)(1)(B) incidental take permit process to provide for authorization of incidental take, not to mandate recovery. However, the extent to which an HCP may contribute to recovery is an important consideration in any HCP effort, and applicants should be encouraged to develop HCPs that produce a net positive effect on a species. The Services can use recovery goals to frame the biological goals and objectives. Recovery plans are also used as sources for possible minimization and mitigation measures for the HCP.

If a recovery plan is not available, we must rely upon other available sources of biological information to encourage the development of HCPs that would aid in a species' recovery. If a recovery plan is available, the Services and applicants should refer to it for information on uncertainty associated with the species' biology and/or its conservation in order to determine if an adaptive management strategy is necessary.

By defining what adaptive management means for HCPs in the addendum, we established a standard for its use. An adaptive management strategy is used to address significant uncertainty associated with a particular HCP, but it is not practicable (or possible) to require that all adaptive management strategies impose an elaborate experimental design. However, an adaptive management strategy must be tied to the biological goals and objectives of the HCP and based on the best scientific information available. We may also obtain strategies to deal with the uncertainty from recovery plans that can be incorporated into an HCP's adaptive management program.

Similarly, a monitoring program's standard for HCPs is based on the best scientific information available, but an HCP's monitoring program also is scaled to the particular HCP. The Services should be aware of the types of monitoring programs that are ongoing in order to coordinate efforts between HCPs. It may be more economical for smaller HCPs to participate in larger monitoring programs by contributing to or incorporating those programs.

Issue 3: Many comments referred to the No Surprises policy, requesting either an increase or decrease in the amount of assurances associated with incidental take permits.

Response 3: The Services published the final rule on the No Surprises policy on February 23, 1998 (63 FR 8859). The final rule codified into 50 CFR parts 17 and 222 the nature of the assurances provided to incidental take permittees. All permits issued after March 25, 1998, under section 10(a)(1)(B) of the ESA receive No Surprises assurances as specified in 50 CFR 17.22(b)(5), 17.32(b)(5), 222.307(g), and 222.307(h). This policy addendum does not alter the assurances provided to permittees by regulation.

The No Surprises assurances apply only to incidental take permits issued in accordance with the requirements of the Services' regulations where the HCP is properly implemented. The assurances extend only to those species adequately covered by the HCP. The term ''No Surprises'' refers to regulatory assurances, *not* biological assurances, and applies only to the extent of mitigation required by the incidental take permit in response to unforeseen circumstances or changed circumstances not provided for in the HCP. Specifically, permittees, who are properly implementing their HCP, will not be required to provide additional conservation and mitigation measures involving the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources without their consent.

The No Surprises assurances encourage contingency planning. Changes in circumstances that can be reasonably anticipated during the implementation of an HCP can be planned for in the HCP. Such HCPs should describe the modifications in the project or activity that will be implemented if these circumstances occur. Precisely because nature is so dynamic, planning for changed circumstances and adopting adaptive management strategies within the HCP, permit, or IA, if used, will better serve both the needs of permittees and endangered species conservation.

Issue 4: Based largely on a study on HCPs supported by the American Institute of Biological Sciences and National Center for Ecological Analysis and Synthesis, several commenters raised questions about biological uncertainty in decisions to issue incidental take permits. Some commenters requested a moratorium on issuing 10(a)(1)(B) incidental take permits, stating that there is not enough known about the species to lock in long-term conservation actions provided by HCPs and the assurances given with these permits. One commenter specifically stated that incidental take permits should not be issued if there is any uncertainty. Instead, efforts should

be spent on filling those data gaps before issuing permits.

Response 4: The Services believe that covered species, both listed and unlisted, will be afforded more protection because of the conservation measures gained through the HCP process. Permitting incidental take that includes carefully constructed conservation actions will benefit most covered species. Part of the careful construction of an HCP is incorporation of contingency plans, whether it is through planning for changed circumstances or developing and implementing an adaptive management strategy.

A moratorium on incidental take permits would not serve species or the public well and would not be in accordance with the ESA. Section 10(a)(2)(B) of the ESA states that an incidental take permit that meets the issuance criteria shall be issued. The partnerships this program encourages are needed to promote endangered and threatened species conservation on non-Federal lands.

The Services appreciate the suggestions provided in the study sponsored by the American Institute of Biological Sciences and the National Center for Ecological Analysis and Synthesis. Nevertheless, we believe, and the study confirmed, that the HCPs currently in place are based on the best available scientific and commercial information. If we lack critical information regarding the biological needs of a species proposed to be covered under an HCP, we will not issue the permit until such information is obtained or an acceptable adaptive management strategy is incorporated into the HCP to address the uncertainty.

Issue 5: Some comments stated that the addendum should allow citizen suits to ensure that permittees are properly implementing their HCPs.

Response 5: The addendum does not in any way alter the ability of citizens to bring lawsuits using the citizen suit provision of the ESA.

Issue 6: One commenter stated that the addendum should provide for compensation for loss of Tribal resources due to implementation of HCPs.

Response 6: The Secretarial Order regarding American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act was issued on June 5, 1997, by the Secretaries of the Interior and of Commerce pursuant to the ESA, the Federal-Tribal trust relationship, and other Federal law. This Order clarifies the responsibilities of the Services when ESA actions affect, or may affect, Indian lands, tribal trust resources, or the exercise of American Indian tribal rights. The order does not require HCP applicants to include the tribes in actual negotiations or require compensation for loss of Tribal resources.

Issue 7: One comment stated that the draft addendum did not adhere to the policy on the use of plain English in Government documents.

Response 7: The final addendum is written to incorporate the principles of plain English. However, most of the concepts within this addendum and within the HCP Program are biological or otherwise technical in nature. Therefore, we must use certain terminology that is associated with those concepts.

Issue 8: One commenter suggested that all five points addressed by the addendum should be proportional to the scale of the HCP.

Response 8: The Services agree that application of each of the 5 points (*i.e.,* the biological goals and objectives, an adaptive management strategy, the monitoring program of an HCP, the determination of the duration of an incidental take permit, and the scope of public involvement) should be commensurate with the scope of the HCP. Each individual section within the addendum discusses the relationship between each of the five points and the scope of the HCP.

Biological Goals Issues

Issue 9: There were comments about who should determine the biological goals and objectives of an HCP. One commenter suggested that the person(s) with the most experience with the species should determine the biological goals and objectives of an HCP. Additional comments suggested that we confer with State agencies in determining biological goals and objectives. Another commenter stated that the Services should provide applicants assistance in developing the biological goals and objectives.

Response 9: In addition to the applicants, the Services play an integral role in determining the biological goals and objectives. We agree that species experts should be consulted during development of an HCP, including determining the biological goals and objectives. We have revised the biological goals and objectives section to articulate the methods available for their development. Service biologists frequently confer informally with species experts or other specialty experts (*e.g.,* population modeling, habitat assessment, restoration).

The Services also agree that State agencies should be involved with HCPs, including HCPs that cover non-listed species, and we encourage applicants to include the State wildlife agencies during the development of their HCPs. The addendum reflects this commitment.

Issue 10: There were comments about whether species would benefit more from habitat-based biological goals versus goals specific to the number of individuals or populations. Some suggested that habitat-based goals would be sufficient. Others stated that there should only be species-based goals and that they should account for all life stages of that species and any natural fluctuations in population levels.

Response 10: As discussed in the draft addendum, an appropriate HCP biological goal for a species will depend upon the particular species, the nature of the impact, the nature of the conservation measures in the HCP, and to what extent the populations or other ecological factors fluctuate. The addendum states the following:

> The biological goals and objectives may be either habitat or species based. Habitat-based goals are expressed in terms of amount and/or quality of habitat to be achieved. Species-based goals are expressed in terms specific to individuals or populations of that species. Complex multispecies or regional HCPs may use combination of habitat- and species-specific goals and objectives. However, according to 50 CFR 17.22, 17.32, 222.102, and 222.307, each covered species must be addressed as if it were listed and named on the permit. Although the goals and objectives may be stated in habitat terms, each covered species that falls under that goal or objective must be accounted for individually.

The Services chose to broadly define the application of biological goals and objectives, not only in terms of whether they should be habitat-based or species-based, but also how the goals and objectives should be measured (*e.g.,* numbers, life history stages, acres). This broad definition allows for flexibility in determining appropriate biological goals and objectives. The Services and applicants must determine the appropriate unit of measure such as numbers of individuals at a particular life stage, all lifestages, or quantity or quality of habitat for each individual HCP. The Services and applicants should also consult with appropriate experts to determine those goals (see above discussion).

Regardless of the type of goal used, at some point, all HCPs must undergo a species by species analysis. If an HCP is planned on a habitat basis, a species-by-species analysis must be made to determine if the HCP adequately covers the species. The relationship of habitat goals to specific species will help the

Services and applicant determine if a species is adequately covered by an HCP. Also, this consideration of individual species provides a safety net for those species that may not neatly fit into a purely habitat-based plan. For example, populations of a narrow endemic species that occur within a wider ranging habitat type may not be adequately covered by an HCP that depends solely on amount of habitat conserved in a broad general area and does not specify particular locations where the habitat for that species is conserved.

Issue 11: Some commenters addressed quantifying take within an HCP and during its implementation. Some stated that quantifying take should not be required, and others stated that it should always be required.

Response 11: Although identifying the amount or extent of take within an HCP and the permit does not directly refer to development of biological goals and objectives, it is related and will be addressed here. Section 10(a)(2)(A) requires that an HCP specify the impact which will likely result from the take to be permitted. Both Services require applicants to include certain information about the species to be covered by an HCP. FWS permit application criteria require identification of the number, age, and sex of such species, if known (50 CFR 17.22, 17.32). NMFS application criteria require a description of the anticipated impact, including amount, extent, and type of anticipated taking (50 CFR 222.307). While evaluating an HCP, we use the amount of incidental take as a main indicator of the impact the proposed project will likely have on the species. Identifying the amount of incidental take contributes to the analysis of whether the proposed incidental take permit will appreciably reduce the likelihood of survival and recovery of the species.

There are situations where precisely quantifying the number of individuals that are anticipated to be taken is a less effective method than estimating the amount or extent of take in terms of the amount of habitat altered. What is most important is that we are able to assess the impact of the anticipated take on the species. Regardless of how the incidental take is quantified, it must be indicated in the biological opinion the Services complete for the issuance of the permit and on the permit itself.

Adaptive Management Issues

Issue 12: Many commenters raised the issue as to the correct definition, and, therefore, correct application of adaptive management. Additionally, these commenters stated that under the ''scientific definition'' of adaptive management, true adaptive management is impossible under No Surprises.

Response 12: The Services recognize the use of the term within the scientific literature. However, the phrase ''adaptive management'' is used in many other disciplines and contexts and has different meanings to different people. The scientific definition typically follows Holling (1978) and Walters (1986) (see also Walters and Holling, 1990; McLain and Lee, 1996; Walters 1997). This definition is described as a process that tackles the uncertainty in management of natural resources through experimentation. Most frequently, this involves modeling to determine a course of action for on-the-ground implementation with monitoring to test the model's predictions. Walters (1986) breaks down categories of learning through implementation as ''active'' and ''passive'' adaptive management. Passive adaptation is where information obtained is used to determine a single best course of action. Active adaptation is developing and testing a range of alternative strategies (Walters and Holling 1990). For the purposes of the HCP program, we are defining adaptive management as a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.

The Services are incorporating a broad perspective of adaptive management, with the key components that make an adaptive process in HCPs meaningful. These components include careful planning through identification of uncertainty, incorporating a range of alternatives, implementing a sufficient monitoring program to determine success of the alternatives, and a feedback loop from the results of the monitoring program that allows for change in the management strategies. Because the Services and applicant provide these elements up front in the HCP, they are consistent with No Surprises.

The addendum makes a distinction between adaptive management that would have a more experimental approach versus contingency planning for the implementation of measures in the event of changed circumstances where there is little uncertainty. An HCP can provide provisions for changed circumstances that does not involve adaptive management.

Issue 13: One commenter stated that all HCPs should contain adaptive management.

Response 13: As stated in the addendum, the Services will incorporate adaptive management strategies when appropriate. Adaptive management is necessary for those plans ''that would otherwise pose a significant risk to the species at the time the permit is issued due to significant data or information gaps.'' Not all HCPs warrant adaptive management, although any HCP may incorporate an adaptive management strategy if agreed upon by the applicant and the Services.

In addition, the ability for applicants and the Services to build contingency measures into an HCP's operating conservation strategy does not depend solely on the use of adaptive management. For instance, the No Surprises final rule provides for planning for changed circumstances. This planning involves providing alternative actions for possible events that may alter the ability of an HCP to meet its biological goals and objectives. An adaptive management strategy would not be necessary if there were no significant uncertainty associated with identifying appropriate responses to potential changed circumstances.

Issue 14: One commenter stated that adaptive management not only increases the complexity of an HCP (and, therefore, the time and effort involved in its development and implementation), but the uncertainty poses an economic risk to permittees.

Response 14: We agree that adaptive management may increase the complexity of an HCP. However, adaptive management strategies should be commensurate with the scope of the HCP (*e.g.*, the smaller the scope or impacts, the less complex the HCP and any adaptive management if warranted). Additionally, all HCPs must meet statutory and regulatory issuance criteria prior to approval and issuance of a permit. Adaptive management is one tool available to applicants and the Services that can be used to meet the issuance criteria. It is also a means for increasing the flexibility of an HCP. A results-oriented implementation program lets a permittee apply a number of different methods for achieving a certain goal, rather than adhering to an inflexible list of prescriptions. A results-oriented program actually provides some certainty to the permittee by establishing a framework to modify the operating conservation strategy. Results are periodically assessed, and, if shortcomings are evident, previously agreed-upon alternative strategies are implemented, thereby streamlining

additional discussions between the Services and permittee.

Setting the sideboards and structure during development of the HCP provides applicants certainty in the extent of requirements for implementing an adaptive management strategy. As stated in the No Surprises final rule, we will not require a permittee to make additional mitigation commitments, including any adaptive management provisions, beyond what was agreed to in the HCP, permit, and IA, if used.

Issue 15: One commenter stated that adaptive management should not replace good, up-front conservation measures.

Response 15: The Services agree that adaptive management should not be used in place of developing good up-front conservation measures or to postpone addressing difficult issues. However, adaptive management may be necessary to craft a framework for addressing uncertainty in the operating conservation program to ensure that the measures fulfill the biological goals and objectives of an HCP.

Monitoring Issues

Issue 16: Several commenters stated that the Services should establish minimum standards or require scientific standards for the monitoring program within an HCP.

Response 16: The implementing regulations for an HCP (50 CFR 17.22, 17.32, and 222.307) require a monitoring component. The HCP Handbook includes guidance on what the monitoring component of an HCP should look like. However, we have refined that guidance and have incorporated it into the addendum. The Services agree that any methodology and techniques involved in biological aspects of monitoring should be based on science. The addendum does state that ''The monitoring program will be based on sound science. Standard survey or other previously-established monitoring protocols should be used. Although the specific methods used to gather necessary data may differ depending on the species and habitat types, monitoring programs should use a multispecies approach when appropriate.'' Monitoring approaches that are consistent with the Handbook and addendum should be adequate for assessing whether the HCP is achieving its biological goals and objectives.

Issue 17: Some commenters stated that it was difficult to distinguish between compliance monitoring and effects and effectiveness monitoring.

Response 17: The Services recognize that it may be difficult to distinguish between the two types of monitoring particularly when the actual monitoring actions may overlap. One way to distinguish between the two types is that compliance monitoring verifies that the permittee is carrying out the terms of the HCP, permit, and IA (if one is used) while effects and effectiveness monitoring evaluates the biological effects of the permitted action and determines whether the effectiveness of the operating conservation program of the HCP is consistent with the assumptions and predictions made when the HCP was developed and approved. The permittee is primarily responsible for ensuring that their HCP is working as planned and the Services are primarily responsible for monitoring whether the permittee is complying with permit requirements.

Issue 18: A few commenters suggested that the Services identify, in the addendum, minimum qualifications for personnel conducting monitoring.

Response 18: The addendum does state that the personnel conducting the monitoring should be qualified. However, the necessary qualifications depend upon what is being monitored. Since HCPs are highly variable, the addendum is flexible about the minimum qualifications of personnel conducting the monitoring, and the Services' staff will determine whether the person or company conducting the monitoring is qualified.

Issue 19: One commenter suggested the Services require all monitoring programs to include population counts.

Response 19: Population monitoring may not be appropriate for all HCPs. The scope of any HCP monitoring program should be in proportion to the scope of that HCP. If an HCP affects only a portion of a population, the permittee should not be responsible for monitoring the entire population. In addition, it may or may not be appropriate for a particular HCP to include counting of populations or individuals. The appropriate unit of measure in a monitoring program depends upon the specific impacts and operating conservation program within an HCP and the biological goals and objectives of the HCP. The unit of measure also depends on how the species uses the habitat to be affected. However, the Services should coordinate monitoring programs to obtain a larger picture of the status of a population.

Issue 20: Some commenters suggested that self-reporting should not be used as a means to demonstrate that the permittee is in compliance with the terms of an HCP.

Response 20: We are not limited to self-reporting for compliance monitoring. However, the limited resources available to the Services to conduct monitoring necessitates our reliance on the working relationships between us and the permittees to verify compliance. As discussed in the addendum, where appropriate, we may conduct our own evaluation, including site visits. The Services should be able to use the periodic reports made by permittees as one method in determining whether the permittee is in compliance. Periodic reports may be our first source of information about the implementation of an HCP. From these reports, we may catch discrepancies that alert us to possible implementation problems. Also, the information obtained to determine effects and effectiveness may be the same information needed to determine compliance. We do not want to use limited resources on duplicative monitoring efforts.

Permit Duration Issues

Issue 21: One commenter suggested that the Services link the duration of the permit to recovery of the species covered by an HCP.

Response 21: We assume that this comment refers to linking duration of the permit to completion of recovery goals where HCPs have a ''recovery standard.'' We discuss the relationship of the HCP program and recovery in the above responses.

Issue 22: Some commenters stated that we should not place time limits on mitigation measures.

Response 22: This comment seems to reflect a misunderstanding regarding the duration of an incidental take permit. Permit duration is the length of time during which the permittee has incidental take authorization. HCPs may be designed such that mitigation measures are in effect for longer periods of time, including in perpetuity, than the time the incidental take permit is in effect.

Public Participation Issues

Issue 23: Many comments pertained to whether the Services or the applicant decides who participates in the development of HCPs. Most commenters stated that the applicant should not decide who participates, and offered alternatives including mandatory stakeholder or interested party participation, and leaving the decision up to the Services.

Response 23: The experience of the Services shows that the more public participation in the development phase of an HCP, the more likely it will be accepted by the public. However, we maintain that the inclusion of other

interested parties in the development of an HCP is ultimately the decision of the applicant. The ESA and its implementing regulations do not mandate public participation before an applicant submits a permit application; only a public comment period after it is submitted and published in the **Federal Register**. We strongly encourage applicants to include more public participation at all stages of development.

Issue 24: Some commenters suggested that scientists should be involved in the development of HCPs. Another commenter stated that all HCPs should be subject to peer review.

Response 24: During consideration of whether to issue an incidental take permit, the Services are required to use the best available scientific and commercial information. Such data come from a variety of sources: scientific literature and peer-reviewed publications, in-house expertise, other State or Federal agencies, academia, and non-governmental organizations, to name a few. For listed species, the Services can draw upon a number of existing information sources, all of which have gone through peer and public review. ESA listing packages are used to gain further species-specific biological information, and where possible, the Services will draw upon recovery plans to identify conservation and monitoring measures and objectives for listed species. The addendum encourages applicants to use scientific advisory committees during the development and implementation of an HCP, especially large-scale ones.

The applicant's integration of a scientific advisory committee and perhaps other stakeholders improves the development and implementation of any adaptive management strategy. Advisory committees can assist the Services and applicants in identifying key components of uncertainty and determine alternative strategies for addressing that uncertainty. We also encourage the use of peer-review for an HCP. An applicant, with guidance from the Services, may seek independent scientific review of specific sections of an HCP and its operating conservation strategy to ensure the use of the best scientific information for HCP development.

Issue 25: One commenter requested that the public comment period under the National Environmental Policy Act (NEPA) for HCPs not be extended. Another comment suggested that the Services process incidental take permits with Environmental Impact Statements within nine months, and, if that deadline is not met, we would be required to issue the permit within 30 days.

Response 25: The addendum contains changes to the existing HCP public comment period but does not change any public input required by the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR 1500–1508).

The intent of the addendum is to ensure the public has sufficient opportunity to review and provide comment on all HCPs, regardless of the public review requirements of NEPA. To accomplish this, the addendum lays out the various public review requirements for HCPs with different levels of impact. For example, low-effect HCPs, which are categorically excluded from the NEPA process, will have a minimum 30-day public review and comment period. The public review period for large, complex HCPs is 90 days, unless there is significant public involvement during development. All other HCPs (including large complex HCPs with significant public involvement) will be made available for review and comment for a minimum of 60 days.

The addendum contains target time frames for us to process an incidental take permit application. The target processing time frame for an HCP that includes an Environmental Impact Statement (EIS) is up to one year, including the 90-day comment period (or 60-days if significant public participation has occurred). However, we cannot issue a permit until we have determined that it meets the issuance criteria under section 10(a)(2)(B) of the ESA. Because of the complexity associated with an HCP that has an EIS, we need the target processing time frame of one year to determine whether to issue the permit. One method to reduce the amount of time needed to process a permit application is for an applicant to include up-front public participation during HCP development.

Required Determinations

Regulatory Planning and Review, Regulatory Flexibility Act, and Small Business Regulatory Enforcement Fairness Act

This final policy was subject to Office of Management and Budget (OMB) review under Executive Order 12866.

a. This policy will not have an annual economic effect of $100 million or adversely affect an economic sector, productivity, jobs, the environment, or other units of government. A cost-benefit and economic analysis is not required. The primary purpose of the addendum is to incorporate the 5-point policy, which was published in draft form on March 9, 1999, into the final Handbook for Habitat Conservation Planning and Incidental Take Permitting Process. This HCP Handbook addendum provides additional guidance on five concepts that, although treated only briefly in the handbook, are in widespread use in existing and developing HCPs. The main purpose of this addendum is to provide a consistent approach to these concepts for future HCPs. The five concepts addressed in this addendum include biological goals and objectives, adaptive management, monitoring, permit duration, and public participation.

The HCP program and the associated section 10 permits have been in place for approximately 17 years. The 1982 amendments to the ESA created a statutory framework for the HCP program that was built primarily around four permit application criteria and four permit issuance criteria. We promulgated regulations in 1985 in order to implement the Congressionally created HCP program. The statutory and regulatory framework for HCPs has remained unchanged since it was first put into place. The five concepts addressed in this addendum are an outgrowth of the statute and regulations. This addendum does not create these concepts, nor does it change the current regulations or general application of the concepts in practice.

In order to analyze the economic effect of this addendum, we reviewed the potential of this policy to have an effect on HCPs in three different areas: the cost of HCP development, the cost of HCP minimization and mitigation, and The cost of HCP implementation. Past and current experience with the HCP program leads us to predict that we will complete and approve approximately 35 new HCPs each year into the foreseeable future. We expect that the size and complexity of the expected 35 HCPs per year will continue to vary from the extremely small, single-species HCP to multi-species HCPs covering more than a million-acre planning area (see Table 1). Based on past and current experience, we predict that 20 of the expected 35 HCPs per year will be relatively small and simple HCPs covering one or a few listed species (of which 8 may be deemed ''low effect''). The HCPs of medium size and complexity are expected to account for another 12 of the 35 HCPs, and the remaining three HCPs are expected to be large, complex HCPs.

TABLE 1.—SIZE DISTRIBUTION OF HCPS ACCORDING TO PLANNING AREA, AS OF DECEMBER 31, 1999

[Some plans have both short-term and long-term HCPs, where the total amount of area addressed in the short-term HCP is included within the total area of the subsequent long-term HCP. Therefore, the numbers of HCPs accounted for above will not total the number of HCPs that have been issued. A few HCPs were not included in this tally because they addressed the planning areas in linear miles instead of acres.]

Size of HCPs	Number of HCPs
Less than 1 acre	44
Between 1–10 acres	64
Between 10–100 acres	56
Between 100–500 acres	37
Between 500–1,000 acres	11
Between 1,000–10,000 acres	17
Between 10,000–100,000 acres	14
Between 100,000–500,000 acres	10
Between 500,000–1,000,000 acres	4
Greater than 1,000,000 acres	2

The Effect of Additional Policy Guidance on Biological Goals and Objectives

This addendum emphasizes the benefit of explicitly articulating why the minimization and mitigation efforts in an HCP are being provided and what they are expected to accomplish. The thrust of this concept is aimed at the HCP preparation phase. We have no reason to believe it will have any effect on an HCP's minimization and mitigation or on HCP implementation. From the very beginning of the HCP program, biological goals and objectives have been incorporated into HCPs, sometimes in an explicit manner and in other cases in an implicit manner. For example, in the first HCP, which was used by Congress as a model for the 1982 amendments to the ESA, the HCP states that the ''purpose of the [HCP] is to provide for the indefinite perpetuation of the Mission Blue and Callippe Silverspot butterflies on San Bruno Mountain, as well as to conserve * * * the value * * * as a remnant ecosystem. * * * The more pervasive goal is to simultaneously provide for the perpetuation and enhancement of the grassland habitat which supports the butterflies. * * * The focus of preservation is on the grassland because this is thought * * * to be the ancestral native habitat. * * *'' [*San Bruno Mountain Area Habitat Conservation Plan,* Final 1991]. A more recent example from an HCP developed in Texas states ''the main goal of the HCP is to * * * minimize and mitigate the impacts. * * * This main goal is achieved by onsite conservation measures * * * and the acquisition and dedication of preserve lands for the warbler adjacent to an existing habitat preserve and within the same warbler recovery unit as the proposed development.'' [*Environmental Assessment and Habitat Conservation Plan, Issuance of an Endangered Species Section 10(a) Permit for the Incidental Take of the Golden-cheeked Warbler (Dendroica chrysoparia) during construction and Operation of the Approximate 24-acre Single Family Residential Development, Canyon Ridge, Phase A, Section 3, Austin, Travis County, Texas,* December, 1994].

The second issuance criterion in section 10 of the ESA requires a finding that the applicant ''will, to the maximum extent practicable, minimize and mitigate the impacts. * * *'' This criterion inherently requires a discussion of the minimization and mitigation efforts and their relationship to the project impact and the desired outcome of the HCP. We believe that the decision documents examining this criterion are of higher quality when biological goals and objectives are made explicit. This addendum is directed towards agency personnel and does not seek to alter the permit application criteria or otherwise require anything new of permit applicants. We already encourage HCP applicants to provide an explicit discussion of biological goals and objectives, but this addendum will not mandate such a discussion in the HCP. Instead, this addendum will ensure that the agency decision documents that analyze the HCP contain an explicit discussion of biological goals and objectives.

We do not expect that policy guidance requiring an explicit articulation of biological goals and objectives that already exist in some form in the HCP will require any significant additional time or effort. The incorporation of this addendum into the handbook reflects support for existing practice more than it does a new policy development. As such, and given the relative ease of explaining the goals of conservation measures, we believe that this policy will have little to no economic effect on small entities or any other entity. In addition, we have determined that providing a numerical or quantitative description of this deminimus effect is not practical and we have, therefore, provided a narrative analysis instead.

The Effect of Additional Policy Guidance on Adaptive Management

The HCP Handbook already provides policy guidance on adaptive management, and thus this addendum merely provides additional refinement. The concept of adaptive management has been both broadly and narrowly defined by the disciplines that use the concept. We are embracing a somewhat broad definition of the term as supported by the scientific literature, and one of the reasons for additional policy guidance on this concept is to explain our application of the concept of adaptive management compared to the narrower definition favored in some academic circles.

Adaptive management has been widely used in the HCP program from the very beginning. The first HCP, San Bruno Mountain, utilized the concept, stating: ''notwithstanding the considerable knowledge gained through the biological study, the Habitat Conservation Plan, in concept and in implementation, is novel and in many ways, experimental. There are many biological uncertainties which inescapably remain at the outset of such an ambitious undertaking which can only be resolved through an ongoing program of applied research designed specifically to direct Plan implementation.'' [*San Bruno Mountain Area Habitat Conservation Plan,* Final 1991, emphasis in original]. Since the San Bruno plan, many HCPs, especially the larger and more complex HCPs, have utilized adaptive management concepts in one form or another. Examples include the Washington County HCP in Utah and the Plum Creek Timber Company I–90 Corridor HCP in Washington. Arguably some of the measures in these HCPs that can be categorized as adaptive management were included in an attempt to meet regulatory requirements concerning unforeseen and changed circumstances. The section 10 regulations require that permit applicants develop procedures to address unforeseen circumstances (50 CFR 17.22(b)(1)(iii)(B), 17.32(b)(1)(iii)(B) for FWS and 50 CFR 222.307(g) for NMFS) and make the existence of these procedures a precondition to permit issuance. See 50 CFR 17.22(b)(2)(iii) and 17.32(b)(2)(iii) for FWS and 50 CFR 222.307(g) for NMFS. The No Surprises rulemaking expanded on the contingency planning aspects of the HCP program by requiring contingency planning for changed circumstances that are foreseeable [See 63 FR 8859 (February 23, 1998)]. This addendum on adaptive management does not mandate the contingency planning identified above, even if some of the procedures adopted fall under the heading of adaptive management.

The addendum states that adaptive management will be used for HCPs that are faced with significant data gaps. We believe that an HCP that fails to address

significant data gaps will not meet the issuance criteria of the ESA. It is, therefore, not the addendum itself that mandates the use of adaptive management in cases of significant data gaps, but is instead the applicant's need to overcome data gaps and still meet the permit issuance criteria established in the ESA. Current practice on the ground is to rely on adaptive management to overcome data gaps. This addendum provides policy support for this existing practice, but does not change the status quo. We, therefore, determine that the addendum's coverage of adaptive management will not effect small entities to any measurable degree.

The Effect of Additional Policy Guidance on HCP Monitoring

This addendum does not impose any new monitoring requirements. Monitoring is already required by the section 10 regulations. In the preamble to the final rule promulgating the section 10 regulations, we agreed with a commenter that the Service should monitor the implementation of a conservation plan and accordingly finalized revisions to sections 17.22(b)(1)(iii)(B), 17.22(b)(3), 17.32(b)(1)(iii)(B) and 17.32(b)(3) to require that conservation plans specify the monitoring measures to be used and to authorize imposition of necessary monitoring as a condition of each permit.'' 50 FR 39681, 39684 (September 30, 1985). NMFS also included a monitoring requirement in their section 10 regulations (50 CFR 307 (d)).

This addendum seeks to refine existing monitoring policy by organizing the types of monitoring being conducted into categories, including compliance monitoring, effect monitoring, and effectiveness monitoring. The addendum also seeks greater compatibility of monitoring data across HCPs. Neither of these policy additions is expected to have any economic impact. Current practice entails the HCP applicant and the Services working together to arrive at a monitoring program that, based on the specifics of the HCP and the species involved, is robust enough to provide the information the parties feel will be needed. This addendum does not alter current practice and instead reiterates the regulatory requirement and provides policy recognition and support for the current practice.

The Effect of Policy Guidance on Permit Duration

The section 10 regulations provide factors that the Director should consider in determining permit duration. The Handbook did not provide any treatment of the issue of permit duration. This addendum would add a short provision to the Handbook that essentially repeats verbatim the regulatory language on permit duration. Even though the addendum does not expand on the regulations' treatment of permit duration, we believe that the Handbook should provide coverage of all aspects of the program and it will thus be beneficial to include this provision in the Handbook. The policy guidance on permit duration will not affect the current approach to determining permit duration and will, therefore, not have any effect.

The Effect of Additional Policy Guidance on Public Participation

In the area of public participation, this addendum signals a departure from the current practice in the Handbook by increasing the length of the public comment period for many HCPs by thirty days. The ESA requires a minimum of a thirty day public comment period, but does not prohibit longer public comment periods. This addendum provides that ''low effect'' HCPs will, as a general matter, continue to be provided to the public for a thirty day comment period. The addendum thus does not change the current approach for low effect HCPs, which we expect will comprise eight of the predicted thirty-five new HCPs per year. The addendum indicates most other HCPs will be provided to the public for a sixty day comment period. Finally the addendum states that large, complex HCPs will need to have a ninety day public comment period unless the applicant has taken steps to involve the public earlier in the HCP process, in which case the HCP will qualify for the sixty day comment period.

This policy guidance on public participation has the potential to affect twenty-seven HCPs per year. The large, complex HCPs, predicted to account for three of the new HCPs per year, have historically been associated with extensive public notice and involvement, often through the EIS process under NEPA. This type of public involvement would qualify these HCPs for the sixty day comment period. The parallel NEPA process will typically require significant comment time periods, often matching or exceeding the time periods established by this addendum. We have also observed that the large HCPs of the past were noticed for more than the minimum thirty days required by section 10 simply because of their size and complexity and in response to requests for extensions from the public. We have, therefore, determined that this addendum will not alter the current practice with regard to the length of public comment periods and large HCPs. Based on this determination, we conclude that this policy guidance on public participation will not have an economic effect.

Of the remaining twenty-four expected HCPs per year, we expect at least four of those HCPs would have longer than the minimum public comment period because of reasonable public requests for extensions. There are, therefore, twenty HCPs per year that could potentially be effected by the policy guidance on public participation. Of these twenty HCPs, only a small number are expected to actually have all local approvals in hand and be ready to proceed before the conclusion of HCP processing, including the public comment period. Unless an HCP applicant is otherwise ready to begin project implementation, we do not believe an additional thirty days of public comment will have any economic effect. For the small number of HCPs that may be waiting for the HCP process to be completed, the economic effect of a thirty day extension to the process will depend tremendously on the scale and type of project. In addition, many projects will be able to proceed in part prior to permit issuance, providing there is no incidental take of species or a preclusion of the development of reasonable and prudent alternatives. See 16 U.S.C. 1536(d). HCP applicants will be fully aware of the addendum's public participation time lines and will, therefore, be able to factor the additional public comment period into their HCP planning early. This early recognition of the time lines may prove beneficial compared to planning on a thirty day comment period only to find near the end of that period that the Services has decided sound grounds exist for an extension. Based on this narrative analysis, we conclude that an increase in public comment periods will have a negligible economic effect.

In summary, the 5 Point HCP addendum provides recognition and policy support for existing practices in each of the five concept areas discussed above. The addendum does not change the current statutory or regulatory framework and merely provides refinements to existing policy. As a result, the addendum will not have a significant economic effect.

b. This addendum will not create inconsistencies with other agencies' actions. The addendum to the HCP Handbook does change the existing requirements for a HCP. The addendum

is intended to assist Government employees and as such may also assist the public. The only change to the HCP Handbook included in the addendum is to provide adequate time for public comment when developing HCPs.

c. This policy will not materially affect entitlements, grants, user fees, loan programs, or the rights and obligations of their recipients. The addendum to the HCP Handbook was developed solely to provide consistency to the HCP program and is intended as guidance for the Government.

d. This policy will not raise novel legal or policy issues. The addendum to the HCP Handbook was developed to provide clarification for the HCP process and does not change regulations or significantly change existing policy.

The Departments of Interior and Commerce certify that this policy will not have a significant economic effect on a substantial number of small entities as defined under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*). There are more than 248 existing HCPs of which 106 are for small entities and 142 are for corporations or other large entities. The addendum does not change the ability of small entities to develop HCPs in the future. The Services expect small entities will have the same proportion of future HCPs.

This policy is not a major rule under 5 U.S.C. 804(2), the Small Business Regulatory Enforcement Fairness Act. This policy:

1. Does not have an annual effect on the economy of $100 million or more.

2. Will not cause a major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions.

3. Does not have significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprises to compete with foreign-based enterprises. The purpose of the addendum is to provide Federal employees the guidance required for the consistent application of the Handbook for developing HCPs. The addendum will provide some simplification to the HCP Program due to clarification of processes.

Unfunded Mandates Reform Act

In accordance with the Unfunded Mandates Reform Act (2 U.S.C. 1501 *et seq.*):

a. This addendum will not ''significantly or uniquely'' affect small governments. A Small Government Agency Plan is not required. The HCP Handbook provides guidance to Federal employees involved in reviewing and approving incidental take permits that include habitat conservation plans. The HCPs and permits generally are coordinated with appropriate State and local governments to include their views on the activities covered by the permit (in many cases, the activities also require State or local government authorization). In some instances, the applicant is the local government seeking incidental take permits for activities planned and conducted within its area of jurisdiction. The addendum does not change this process by encouraging applicants to coordinate with State agencies. As with all other applications, this addendum will not have an effect on small governments.

b. This policy will not produce a Federal mandate of $100 million or greater in any year, *i.e.*, it is not a ''significant regulatory action'' under the Unfunded Mandates Reform Act. See discussion in the section titled ''Regulatory Planning and Review, Regulatory Flexibility Act, and Small Business Regulatory Enforcement Fairness Act.''

Takings Implication Assessment

In accordance with Executive Order 12630, the policy does not have significant takings implications. A takings implication assessment is not required. The addendum guides employees in the evaluation and approval of applications for incidental take permits under existing law.

Federalism Assessment

In accordance with Executive Order 13132, the policy does not have sufficient Federalism implications to warrant preparation of a Federalism assessment. This addendum does not change the relationship between the Services and applicants, nor does it alter the Services' relationship with State and local governments within the HCP Program.

Civil Justice Reform

In accordance with Executive Order 12988, the Office of the Solicitor has determined that the policy does not unduly burden the judicial system and meets the requirements of sections 3(a) and 3(b)(2) of the Order.

Paperwork Reduction Act.

This addendum does not require an information collection under the Paperwork Reduction Act. A related information collection associated with incidental take permits is covered by existing OMB approvals (#1018–0094 for FWS #0648–0230 for NMFS).

National Environmental Policy Act

The Department of the Interior has determined that the issuance of the policy is categorically excluded under the Department's National Environmental Policy Act procedures in 516 DM 2, Appendix 1.10. The National Oceanic and Atmospheric Administration (NOAA) has determined that the issuance of this guidance qualifies for a categorical exclusion as defined by the NOAA 216–6 Administrative Order, Environmental Review Procedure.

Section 7 Consultation

The Services do not need to complete a section 7 consultation on this final policy. An intra-Service consultation is completed prior to issuing incidental take permits under 10(a)(1)(B) of the Endangered Species Act associated with individual HCPs.

Authority

The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Addendum to The HCP Handbook

The five sections (or five-points) of the final addendum are contained entirely within this notice. The Services will adhere to the guidance provided in the addendum. Nothing in this guidance is intended to supersede or alter any aspect of Federal law or regulation pertaining to the conservation of threatened or endangered species.

Biological Goals And Objectives

What Are an HCP's Biological Goals and Objectives?

HCPs have always been designed to achieve a biological purpose, yet they may not have specifically stated those biological goals. In the future, the Services and HCP applicants will clearly and consistently define the expected outcome, *i.e.,* biological goal(s). This rather simple concept will facilitate communication among the scientific community, the agencies, and the applicants by providing direction for the development of HCPs.

The HCP Handbook discusses identifying biological goals and objectives (Chapter 3). Since biological goals and objectives are inherent to the HCP process, HCPs have had implied biological goals and objectives, and many recent HCPs include explicit biological goals or objectives. Explicit biological goals and objectives clarify the purpose and direction of an HCP's operating conservation program. They create parameters and benchmarks for developing conservation measures,

provide the rationale behind the HCP's terms and conditions, promote an effective monitoring program, and, where appropriate, help determine the focus of an adaptive management strategy.

What Are Biological Goals and Objectives in HCPs?

In the context of HCPs, biological goals are the broad, guiding principles for the operating conservation program of the HCP. They are the rationale behind the minimization and mitigation strategies. For more complex HCPs, biological objectives can be used to step down the biological goals into manageable, and, therefore, more understandable units. Multiple species HCPs may categorize goals by species or by habitat, depending on the structure of the operating conservation program. HCPs that are smaller in scope would have simpler biological goals that may not need to be stepped down into objectives. It should be noted that the biological goals of an individual HCP are not necessarily equivalent to the range-wide recovery goals and conservation of the species. However, if viewed collectively, the biological goals and objectives of HCPs covering the same species should support the recovery goals and conservation.

The biological goals and objectives of an HCP are commensurate with the specific impacts and duration of the applicant's proposed action. For example, low-effect HCPs generally have simple measurable biological goals, such as contributing to a regional preserve design through a mitigation bank or avoiding breeding habitat of a particular species.

How Do I Incorporate Biological Goals and Ojectives Into an HCP?

Determination of the biological goals and objectives is integral to the development of the operating conservation program. Conservation measures identified in an HCP, its accompanying incidental take permit, and/or IA, if used, provide the means for achieving the biological goals and objectives. We will work with the applicant to develop the biological goals and objectives by examining the applicant's proposed action and the overall conservation needs of the covered species and/or its habitat.

The biological goals and objectives are refined as the operating conservation program takes shape. Initial biological goals and objectives of an HCP begin by articulating the rationale behind the operating conservation program. The Services and applicant improve the initial biological goals by compiling the known information of the species, estimating the anticipated effects to the species, and stating any assumptions made. If the operating conservation program is relatively complex, the biological goal is divided into manageable and measurable objectives. Biological objectives are the different components needed to achieve the biological goal such as preserving sufficient habitat, managing the habitat to meet certain criteria, or ensuring the persistence of a specific minimum number of individuals. The specifics of the operating conservation program are the actions anticipated to obtain the biological objectives; therefore, we can use these objectives to strengthen the initial operating conservation program.

Elzinga *et al.* (1998) provide guidance for developing measurable objectives for rare plant monitoring that can be used for other species. Biological objectives should include the following: species or habitat indicator, location, action, quantity/state, and timeframe needed to meet the objective. They can be described as a condition to be met or as a change to be achieved relative to the existing condition. Biological objectives may be addressed in parallel. Conversely, achieving the biological objectives may need to occur in sequence. For instance, parallel objectives may be (1) maintaining the preserve site free of nonnative weeds and (2) enhancing the population from 4 individuals to 7 individuals. Sequential objectives may be (1) restoring of an area of habitat and then (2) reintroducing the species.

The Services and applicants have many resources to draw upon when determining the biological goals and objectives of an HCP. Both can use the available literature, State conservation strategies, candidate conservation plans, draft or final recovery plans or outlines, and other sources of relevant scientific and commercial information as guides in setting biological goals and objectives. Both can consult with species experts, State wildlife agencies, recovery teams, and/or scientific advisory committees.

What Is the Difference Between a Habitat-Based Goal and a Species-Based Goal?

The biological goals and objectives may be either habitat or species based. Habitat-based goals are expressed in terms of amount and/or quality of habitat. Species-based goals are expressed in terms specific to individuals or populations of that species. Complex multispecies or regional HCPs may use a combination of habitat- and species-specific goals and objectives. However, according to 50 CFR 17.22, 17.32, 222.102, and 222.307, each covered species must be addressed as if it were listed and named on the permit. Although the goals and objectives may be stated in habitat terms, each covered species that falls under that goal or objective must be accounted for individually as it relates to that habitat.

Are Permittees Required To Achieve the Biological Goals and Objectives of the HCP?

How the biological goals fit with the implementation of an HCP may be framed as a series of prescriptive measures to be carried out (a prescription-based HCP) or the ability to use any number of measures that achieve certain results (a results-based HCP). A prescription-based HCP outlines a series of tasks that are designed to meet the biological goals and objectives. This type of HCP may be most appropriate for smaller permits where the permittee would not have an ongoing management responsibility. A results-based HCP has flexibility in its management so that the permittee may institute the actions that are necessary as long as they achieve the intended result (*i.e.*, the biological goals and objectives), especially if they have a long-term commitment to the conservation program of the HCP. HCPs can also be a mix of the two strategies.

The Services and the applicant should determine the range of acceptable and anticipated management adjustments necessary to respond to new information. This process will enable the applicant to assess the potential economic impacts of adjustments before agreeing to the HCP while allowing for flexibility in the implementation of the HCP in order to meet the biological goals.

Regardless of the type of goals and objectives used and how they fit within implementation of the HCP, the Services will ensure that the biological goals are consistent with conservation actions needed to adequately minimize and mitigate impacts to the covered species to the maximum extent practicable. Whether the HCP is based on prescriptions, results, or both, the permittee's obligation for meeting the biological goals and objectives is proper implementation of the operating conservation program of the HCP. In other words, under the No Surprises assurances, a permittee is required only to implement the HCP, IA, if used, and terms and conditions of the permit. Implementation may include provisions for ongoing changes in actions in order

to achieve results or due to results from an adaptive management strategy.

Adaptive Management

What Is Adaptive Management?

Adaptive management is an integrated method for addressing uncertainty in natural resource management (Holling 1978, Walters 1986, Gundersen 1999). It also refers to a structured process for learning by doing. The concept is used in a number of different contexts, including the social science aspects of learning and change in natural resource management. The term adaptive management was adopted by Holling (1978) for natural resource management, who described adaptive management as an interactive process that not only reduces, but benefits from, uncertainty. Additionally, Walters (1986) breaks down categories of learning through implementation as ''active'' and ''passive'' adaptive management. Passive adaptation is where information obtained is used to determine a single best course of action. Active adaptation is developing and testing a range of alternative strategies (Walters and Holling 1990). The Services believe that both of these types of adaptive management are appropriate to consider when developing a strategy to address uncertainty. Therefore, we are defining adaptive management broadly as a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned.

Implementation of adaptive strategies has been criticized for failing to resolve uncertainty or effectively implementing good experimental design (Walters 1997; Lee 1999). These failures are typically attributed to agency or stakeholder unwillingness to accept the risk involved in experimentation. The Services do have certain constraints in the HCP Program that may inhibit experimental design. For instance, stakeholder involvement in the development of many HCPs, including the adaptive management design, is largely at the discretion of the applicant.

Another restriction we face collectively (Services, applicants, other stakeholders) is the possible risks to species that may arise with using an experimental design. Many adaptive management processes with public/stakeholder involvement address large-scale management issues (*e.g.*, Florida Everglades, Grand Canyon). This type of process is complicated and involved, but appropriate for the scale of the issue. Similarly, more active and involved approaches to adaptive management are appropriate for large-scale HCPs. However, an active approach may pose too much of a risk to the species; therefore, a more passive approach may be the best course of action. An active approach may also be too cumbersome for the scope of the HCP and, therefore, a passive approach may be more appropriate.

Despite the potential obstacles to incorporating a comprehensive adaptive management strategy in an HCP, the Services incorporate adaptive management strategies when appropriate. We believe it is important that small- to medium-sized HCPs incorporate the flexibility to change implementation strategies after permit issuance. The HCP Program is flexible enough to develop adaptive management strategies that will facilitate and improve the decision-making process for the operating conservation program of a given HCP as well as provide for informative decision-making.

When Should Adaptive Management Be Incorporated Into an HCP?

The Services will consider adaptive management as a tool to address uncertainty in the conservation of a species covered by an HCP. Whenever an adaptive management strategy is used, the approved HCP must outline the agreed-upon future changes to the operating conservation program. Not all HCPs or all species covered in an incidental take permit need an adaptive management strategy. However, an adaptive management strategy is essential for HCPs that would otherwise pose a significant risk to the species at the time the permit is issued due to significant data or information gaps. Possible significant data gaps that may require an adaptive management strategy include, but are not limited to, a significant lack of specific information about the ecology of the species or its habitat (*e.g.*, food preferences, relative importance of predators, territory size), uncertainty in the effectiveness of habitat or species management techniques, or lack of knowledge on the degree of potential effects of the activity on the species covered in the incidental take permit.

Often, a direct relationship exists between the level of biological uncertainty for a covered species and the degree of risk that an incidental take permit could pose for that species. Therefore, the operating conservation program may need to be relatively cautious initially and adjusted later based on new information, even though a cautious approach may limit the number of alternative strategies that may be tested. A practical adaptive management strategy within the operating conservation program of a long-term incidental take permit will include milestones that are reviewed at scheduled intervals during the lifetime of the incidental take permit and permitted action. If a relatively high degree of risk exists, milestones and adjustments may need to occur early and often.

Adaptive management should not be a catchall for every uncertainty or a means to address issues that could not be resolved during negotiations of the HCP. There may be some circumstances with such a high degree of uncertainty and potential significant effects that a species should not receive coverage in an incidental take permit at all until additional research is conducted.

What Are the Elements of an Adaptive Management Strategy in HCPs?

In an HCP, adaptive management strategies can assist the Services and the applicant in developing an adequate operating conservation program and improving its effectiveness. An adaptive management strategy should (1) identify the uncertainty and the questions that need to be addressed to resolve the uncertainty; (2) develop alternative strategies and determine which experimental strategies to implement; (3) integrate a monitoring program that is able to detect the necessary information for strategy evaluation; and (4) incorporate feedback loops that link implementation and monitoring to a decision-making process (which may be similar to a dispute-resolution process) that result in appropriate changes in management. If you are developing adaptive management strategies, we encourage you to review the scientific literature that discusses adaptive management (for a starting point see literature cited at the end of the addendum).

Identifying the uncertainty to be addressed is the foundation of the adaptive management strategy. Other components include a description of the goal of the operating conservation program (*i.e.*, the biological goals and objectives of the HCP) and the identification of the parameters that potentially affect that goal. This requires communication between the applicant and the Services to identify expectations for the adaptive management strategy and may also involve assistance from scientists. After this step, we (the Services, applicants, and any other participants) will develop the range of possible ''experimental'' strategies which may involve some type of

modeling (which can be as simple as a written description of the expected outcomes or as complex as a mathematical model demonstrating expected outcomes) of the resource in question. If modeling is involved, we must clearly articulate the assumptions and limitations of the model used. Many factors may influence the type of alternatives to explore, including, but not limited to, economics, policies and regulations, and amount of risk to the species. This stage may be an appropriate time to involve other stakeholders to help identify the alternative strategies.

Next, a monitoring program needs to be designed that will adequately detect the results of the adaptive management strategy. Integration of the HCP's monitoring program into the adaptive management strategy is essential. The monitoring program plays an essential role of determining whether the chosen strategy(ies) is providing the desired outcome (*i.e.*, achieving the biological goals of the HCP). If a scientific advisory committee is being used, this may be an appropriate item for their review. An applicant may also submit a monitoring program for independent peer review.

Finally, an adaptive management strategy must define the feedback process that will be used to ensure that the new information gained from the monitoring program results in effective change in management of the resource.

How Does Adaptive Management Affect No Surprises Assurances?

HCP assurances (No Surprises) and the use of adaptive management strategies are compatible. The assurances apply once all appropriate HCP provisions have been mutually crafted and agreed upon and approved by the Services and the applicant. Adaptive management strategies, if used, are part of those provisions, and their implementation becomes part of a properly implemented conservation plan. When an HCP, permit, and IA, if used, incorporate an adaptive management strategy, it should clearly state the range of possible operating conservation program adjustments due to significant new information, risk, or uncertainty. This range defines the limits of what resource commitments may be required of the permittee. This process will enable the applicant to assess the potential economic impacts of adjustments before agreeing to the HCP.

Is Adaptive Management the Only Method for Changing the Operating Conservation Program of an HCP?

HCPs may be designed to provide flexibility other than through the use of adaptive management. The No Surprises final rule lays a foundation for contingency planning in HCPs that may or may not include adaptive management. This contingency planning is addressed largely under the topic of ''changed circumstances.'' Changed circumstances are circumstances that can be reasonably anticipated, and the HCP can incorporate measures to be implemented if the circumstances occur. The permittee or another responsible party may need the flexibility provided by the ''changed circumstances'' regulation to employ alternative methods or strategies within the operating conservation program to achieve the biological goals and objectives. This flexibility also allows previously agreed upon management and/or mitigation actions to be implemented or discontinued, as needed, in response to changed circumstances. These actions are not necessarily adaptive management and may be a process for implementing change to the operating program or simply a different conservation measure. The HCP, incidental take permit, and IA, if any, must describe the agreed upon range of management and/or mitigation actions and the process by which the management and funding decisions are made and implemented.

How Can an HCP Use Adaptive Management Without a Large and Expensive Experimental Design?

Adaptive management has traditionally been viewed and designed for large-scale systems. However, in some situations we may want to retain the flexibility of addressing uncertainty through an adaptive management strategy at a smaller scale. In such situations, an adaptive management strategy could take many forms including creating a simple feedback loop so that management changes could be implemented based on results of the HCP's monitoring program. Similarly, the agreed-upon strategy may be integration of an HCP with any ongoing research, recovery planning, and conservation planning by Federal, State, and local agencies. This integration is an efficient way to address uncertainty and provide the information needed to guide changes in small to medium sized HCPs. We can also view smaller, yet similar HCPs collectively across a landscape in order to adapt our approaches in future HCPs (Johnson 1999). This approach will require us to coordinate information among similar HCPs, including communication with the individual applicants regarding their role in such a landscape approach.

Monitoring

What Is Monitoring in the HCP Program?

Monitoring is a mandatory element of all HCPs (See 50 CFR 17.22, 17.32, and 222.307). When properly designed and implemented, monitoring programs for HCPs should provide the information necessary to assess compliance and project impacts, and verify progress toward the biological goals and objectives. Monitoring also provides the scientific data necessary to evaluate the success of the HCP's operating conservation programs with respect to the possible use of those strategies in future HCPs or other programs that contribute to the conservation of species and their habitat. The HCP Handbook already provides guidance for developing monitoring measures (Chapter 3, section B.4.) and discusses reporting requirements (Chapter 6, section E.4.). The following information further clarifies and provides additional guidance for the monitoring component of an HCP, permit, or IA.

What Are the Types of Monitoring That Can Be Incorporated Into HCPs?

The Services and the applicant must ensure that the monitoring program of an HCP provides information to: (1) Evaluate compliance; (2) determine if biological goals and objectives are being met; and (3) provide feedback information for an adaptive management strategy, if one is used. HCP monitoring is divided into two types. *Compliance Monitoring* is verifying that the permittee is carrying out the terms of the HCP, permit, and IA, if one is used. *Effects and Effectiveness Monitoring* evaluates the effects of the permitted action and determines whether the effectiveness of the operating conservation program of the HCP are consistent with the assumptions and predictions made when the HCP was developed and approved; in other words, is the HCP achieving the biological goals and objectives.

Scientific literature discussing monitoring uses similar terms as the addendum but the terms may have different meanings. For instance, the term ''validation monitoring'' is the same concept as the addendum's term ''effectiveness monitoring.'' However, ''effectiveness monitoring'' in the scientific literature simply means measuring the status of species. ''Implementation monitoring'' is roughly equivalent to the addendum's term ''compliance monitoring'' with the added regulatory nature of the involvement of a permit.

What Determines the Extent of a Monitoring Program?

The scope of the monitoring program should be commensurate with the scope and duration of the operating conservation program and the project impacts. Biological goals and objectives provide a framework for developing a monitoring program that measures progress toward meeting those goals and objectives. If an HCP, permit, and/or IA has an adaptive management strategy, integrating the monitoring program into this strategy is crucial in order to guide any necessary changes in management.

Monitoring programs for large-scale or regional planning efforts may be elaborate and track more than one component of the HCP (*e.g.,* habitat quality or collection of mitigation fees). Conversely, monitoring programs for HCPs with smaller impacts of short duration might only need to file simple reports that document whether the HCP has been implemented as described. For example, if an HCP affects only a portion of a population, the permittee should not generally be responsible for monitoring the entire population. In addition, it may not be appropriate for a monitoring program to involve counting of populations or individuals or making an assessment of habitat. The appropriate unit of measure in a monitoring program depends upon the specific impacts and operating conservation program within an HCP. The Services are responsible for ensuring that the appropriate units of measure and protocols are used and should coordinate monitoring programs to obtain a larger view of the status of a population. The applicant and the Services should also design the monitoring program to reflect the structure of the biological goals and objectives.

The monitoring program should reflect the measurable biological goals and objectives. The following components are essential for most monitoring protocols (the size and scope of the HCP will dictate the actual level of detail in each item): (1) Assess the implementation and effectiveness of the HCP terms and conditions (*e.g.,* financial responsibilities and obligations, management responsibilities, and other aspects of the incidental take permit, HCP, and the IA, if applicable); (2) determine the level of incidental take of the covered species; (3) determine the biological conditions resulting from the operating conservation program (*e.g.,* change in the species' status or a change in the habitat conditions); and (4) provide any information needed to implement an adaptive management strategy, if utilized. An effective monitoring program is flexible enough to allow modifications, if necessary, to obtain the appropriate information.

Monitoring programs will vary based on whether they are for low-effect or for regional, multispecies HCPs; however, the general elements of each program are similar. Post-activity or post-construction monitoring, along with a single report at the end of the monitoring period, will often satisfy the monitoring requirements for low-effect HCPs. For other HCPs, monitoring programs will be more comprehensive and may include milestones, timelines, and/or trigger points for change.

Effects and effectiveness monitoring includes, but is not limited to, the following:

1. Periodic accounting of incidental take that occurred in conjunction with the permitted activity;

2. Surveys to determine species status, appropriately measured for the particular operating conservation program (*e.g.,* presence, density, or reproductive rates);

3. Assessments of habitat condition;

4. Progress reports on fulfillment of the operating conservation program (*e.g.,* habitat acres acquired and/or restored); and

5. Evaluations of the operating conservation program and its progress toward its intended biological goals.

What Units Should Be Monitored in an HCP?

Each HCP's monitoring program should be customized to reflect the biological goals, the scope, and the particular implementation tasks of the HCP. In order to obtain meaningful information, the applicant and the Services should structure the monitoring methods and standards so that we can compare the results from one reporting period to another period or compare different areas, and the monitoring protocol responds to the question(s) asked. Monitored units should reflect the biological objective's measurable units (*e.g.,* if the biological objective is in terms of numbers of individuals, the monitoring program should measure the number of individuals). The monitoring program will be based on sound science. Standard survey or other previously-established monitoring protocols should be used. Although the specific methods used to gather necessary data may differ depending on the species and habitat types, monitoring programs should use a multispecies approach when appropriate.

What Role Do the Services Have in Monitoring?

Both the Services and the permittee are responsible for monitoring the implementation of the HCP. The Services' primary monitoring responsibilities (with the assistance of the permittee) are ensuring compliance with the permit's terms and conditions, including proper implementation of the HCP by the permittee. Permittee assistance with compliance monitoring includes monitoring the implementation and reporting their findings/results. The permittee, with the assistance of the Services, is responsible for verifying the effects and effectiveness of the HCP. To monitor all aspects of an HCP effectively, and to ensure its ultimate success, the entire monitoring program should incorporate both types of monitoring. The Services and the applicant should coordinate the two aspects of monitoring, and the monitoring program should also clearly designate who is responsible for the various aspects of monitoring.

The Services are responsible for ensuring that the permittee is meeting the terms and conditions of the HCP, its accompanying incidental take permit, and IA, if any (*i.e.,* compliance monitoring). The Services should verify adherence to the terms and conditions of the incidental take permit, HCP, IA, and any other related agreements and should ensure that incidental take of the covered species does not exceed the level authorized under the incidental take permit. Regulations at 50 CFR §§ 13.45 and 222.301, provide the authority for the Services to require periodic reports unless otherwise specified by the incidental take permit. Also, the Services will ensure that the reporting requirements are tailored for documenting compliance with the incidental take permit (*e.g.,* documentation of habitat acquisition, use of photographs). These reports help determine whether the permittee is properly implementing the terms and conditions of the HCP, its incidental take permit, and any IA, and will provide a long-term administrative record documenting progress made under the incidental take permit.

In addition to reviewing reports submitted by the permittee, it is important for the Services to make field visits to verify the accuracy of monitoring data submitted by the permittees. These visits allow the Services to check for information, identify unanticipated deficiencies or benefits, develop closer cooperative ties with the permittee, prevent accidental violations of the incidental take permit's

terms and conditions, and assist the permittee and Services in developing corrective actions when necessary.

For large-scale or regional HCPs, oversight committees, made up of representatives from significantly affected entities (*e.g.,* State Fish and Wildlife agencies), are often used to ensure proper and periodic review of the monitoring program and to ensure that each program properly implements the terms and conditions of the incidental take permit. For example, the Wisconsin Statewide HCP for the Karner blue butterfly includes an auditing approach to ensure incidental take permit compliance. The lead permittee, Wisconsin Department of Natural Resources (Wisconsin DNR), will initially conduct annual on-site audits of each partner. FWS will audit the Wisconsin DNR in a similar fashion. In addition, FWS will accompany the Wisconsin DNR on the partner audits as appropriate to understand partner compliance levels. Over time, if performance levels are acceptable, Wisconsin DNR will conduct the audits less frequently. Each partner will provide an annual monitoring report and will submit these along with their audit report to FWS.

For large-scale or regional HCPs, oversight committees should periodically evaluate the permittee's implementation of the HCP, its incidental take permit, and IA and the success of the operating conservation program in reaching its identified biological goals and objectives. Such committees usually include species experts and representatives of the permittee, the Services, and other affected agencies and entities. Submitting the committee's findings to recognized experts in pertinent fields (*e.g.,* conservation biologists or restoration specialists) for review or having technical experts conduct field investigations to assess implementation of the terms and conditions would also be beneficial. Because the formation of these committees may be subject to the Federal Advisory Committee Act, the role of the participants and the purpose of the meetings must be clearly identified. Oversight committees should meet at least annually and review implementation of the monitoring program and filing of reports as defined in the HCP, permit, and/or IA, if one is used.

What Role Does the Permittee Have in Monitoring?

Not only do permittees provide regular implementation reports, they are also involved in effects and effectiveness monitoring. Effects monitoring determines the extent of impacts from the permitted activity. Effectiveness monitoring, in the HCP program, assesses progress toward the biological goals and objectives of the HCP (*e.g.,* if the conservation strategies are producing the desired habitat conditions or population numbers). Effects and effectiveness monitoring may also involve assessing threats and population trends of the covered species related to the permitted activities, as well as monitoring the development of targeted habitat conditions. Permittees, with assistance from the Services, should ensure that the HCP includes provisions for monitoring the effects and effectiveness of the HCP. The Services and the HCP permittee will cooperatively develop the effects and effectiveness monitoring program and determine responsibility for its various components. In multi-party HCPs, different parties may monitor different aspects of the HCP. The Services must periodically review any monitoring program to confirm that it is conducted according to their standards.

What Should Be Included in Monitoring Reports?

The Services will streamline the reporting requirements for monitoring programs by requesting all reports in a single document. The HCP, permit, or IA should specifically state the level of detail and quantification needed in the monitoring report and tailor report due dates to the activities conducted under the incidental take permit (*e.g.,* due at the end of a particular stage of the project or the anniversary date of incidental take permit issuance). Most monitoring programs require reports annually, usually due on the anniversary date of incidental take permit issuance. Wherever possible, the Services will coordinate the due dates with other reporting requirements (*e.g.,* State reports), so the permittee can satisfy more than one reporting requirement with a single report. The following list represents the information generally needed in a monitoring report:

1. Biological goals and objectives of the HCP (which may need to be reported only once);
2. Objectives for the monitoring program (which may need to be reported only once);
3. Effects on the covered species or habitat;
4. Location of sampling sites;
5. Methods for data collection and variables measured;
6. Frequency, timing, and duration of sampling for the variables;
7. Description of the data analysis and who conducted the analyses; and
8. Evaluation of progress toward achieving measurable biological goals and objectives and other terms and conditions as required by the incidental take permit or IA.

These elements may be simplified for periods of no activity or low-effect HCPs. If a required report is not submitted by the date specified in the HCP or incidental take permit terms and conditions, or is inadequate, the Services will notify the permittee. The Services have discretion to offer the permittee an extension of time to demonstrate compliance. The Services have examined this reporting guidance under the Paperwork Reduction Act of 1995 and found that it does not contain requests for additional information or an increase in the collection requirements other than those already approved for incidental take permits (OMB approval for FWS, # 1018–0094; for NMFS, # 0648–0230).

How Are Monitoring Programs Funded?

The ESA and the implementing regulations (50 CFR 17 and 222) require that HCPs specify the measures the permittee will adopt to ensure adequate funding for the HCP. The Services should not approve an HCP that does not contain an adequate funding commitment from the applicant/permittee to support an acceptable monitoring program unless the HCP establishes alternative funding mechanisms. The Services and the applicant should work together to develop the monitoring program and determine who will be responsible for monitoring the various components of the HCP. Specific monitoring tasks may be assigned to entities other than the permittee (*e.g.*, State or Tribal agencies) as long as the Services and parties responsible for implementing the HCP approve of the monitoring assignment. The terms of the HCP, incidental take permit, and IA may contain funding mechanisms that provide for a public (*e.g.*, local, State, or Federal) or a private entity to conduct all or portions of the monitoring. This funding mechanism must be agreed upon by the Services and the parties responsible for implementing the HCP.

Permit Duration

How Do We Decide the Length of Time for Which the Permit Is in Place?

Both FWS and NMFS regulations for incidental take permits outline factors to consider when determining incidental take permit duration (50 CFR 17.32 and 222.307). These factors include duration of the applicant's proposed activities and the expected positive and negative

effects on covered species associated with the proposed duration, including the extent to which the operating conservation program will increase the long-term survivability of the listed species and/or enhance its habitat. For instance, if the permittee's action or the implementation of the conservation measures continually occur over a long period of time, such as with timber harvest management, the permit would need to encompass that time period.

The Services will also consider the extent of information underlying the HCP, the length of time necessary to implement and achieve the benefits of the operating conservation program, and the extent to which the program incorporates adaptive management strategies. Significant biological uncertainty may necessitate an adaptive management strategy. The gathering of new information through the monitoring program requires an appropriate period of time for meaningful interpretation of new information into changes in management; this analysis could necessitate a permit with a longer duration. However, if an adaptive management strategy that significantly reduces the risk of the HCP to that species cannot be devised and implemented, then, if the issuance criteria are met, a shorter duration may be appropriate.

The varying biological impacts resulting from the proposed activity (*e.g.,* variations in the length of timber rotations and treatments versus a real estate subdivision buildout) and the nature or scope of the permitted activity and conservation program in the HCP (*e.g.,* housing or commercial developments versus long-term sustainable forestry; conservation easements) account for variation in permit duration. Longer permits may be necessary to ensure long-term active commitments to the HCP and typically include up-front contingency planning for changed circumstances to allow appropriate changes in the conservation measures.

Public Participation

What Is the Public Participation Requirement for HCPs?

As stated in the HCP Handbook in Chapter 6.B, we currently require a minimum 30-day public comment period for all HCP applications. This comment period is required by section 10(c) of the ESA and the implementing regulations at 50 CFR 17 and 222. The Services recognize the concern of the public regarding an inadequate time for the public comment period, especially for large-scale HCPs. With a few exceptions, we are extending the minimum comment period to 60 days for most HCPs. The exceptions to a 60-day comment period would be for low-effect HCPs, individual permits under a programmatic HCP, and large-scale, regional, or exceptionally complex HCPs.

The Services believe the current 30-day public comment period provides enough time for interested parties to review major HCP amendments and low-effect HCPs. Low-effect HCPs have a categorical exclusion from NEPA and, therefore, do not have a NEPA public participation requirement. Similarly, in some cases, individual permits issued under a programmatic HCP may not need additional public review since the larger, programmatic HCP would have undergone more extensive review.

However, for large-scale, regional, or exceptionally complex HCPs, the Services are increasingly encouraging applicants to use informational meetings and/or advisory committees. In addition, the minimum comment period for these HCPs is now 90 days, unless significant public participation occurs during HCP development. With the extension of the public comment periods, the recommended timeline targets for processing incidental take permits are extended accordingly: The target timeline from receipt of a complete application to the issuance of a permit for low-effect HCPs will remain up to 3 months, HCPs with an Environmental Assessment (EA) will be 4 to 6 months, and HCPs with a 90-day comment period and/or an Environmental Impact Statement (EIS) may be up to 12 months.

How Do the Services Let Interested Parties Know About the HCP's Comment Period?

During the public comment period, any member of the public may review and comment on the HCP and the accompanying NEPA document, if applicable. If an EIS is required, the public can also participate during the scoping process. We announce all complete applications received in the **Federal Register**. When practicable, the Services will announce the availability of HCPs in electronic format and in local newspapers of general circulation.

How Do the Services or Applicants Incorporate Public Participation During the Development of an HCP?

The Services will strongly encourage potential applicants to allow for public participation during the development of an HCP, particularly if non-Federal public agencies (*e.g.,* State Fish and Wildlife agencies) are involved. Although the development of an HCP is the applicant's responsibility, the Services will encourage applicants for most large-scale, regional HCP efforts to provide extensive opportunities for public involvement during the planning and implementation process.

The Services encourage the use of scientific advisory committees during the development and implementation of an HCP. The integration of a scientific advisory committee and perhaps other stakeholders improves the development and implementation of any adaptive management strategy. Advisory committees can assist the Services and applicants in identifying key components of uncertainty and determining alternative strategies for addressing that uncertainty. We also encourage the use of peer review for an HCP. An applicant, with guidance from the Services, may seek independent scientific review of specific sections of an HCP and its operating conservation strategy to ensure the use of the best scientific information.

How Do the Services Consider Tribal Interest in an HCP?

We recommend that applicants include participation by affected Native American tribes during the development of the HCP. If an applicant chooses not to consult with Tribes, under the Secretarial Order on Federal-Tribal Trust Responsibilities and ESA, the Services will consult with the affected Tribes to evaluate the effects of the proposed HCP on tribal trust resources. We will also provide the information gained from the consulted tribal government to the HCP applicant prior to the submission of the draft HCP for public comment and will advocate the incorporation of measures that will conserve, restore, or enhance Tribal trust resources. After consultation with the tribal government and the applicant and after careful consideration of the Tribe's concerns, we will clearly state the rationale for the recommended final decision and explain how the decision relates to the Services' trust responsibility.

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[FR Doc. 00–13553 Filed 5–31–00; 8:45 am]

BILLING CODE 4310–55–P; 3510–22–P