

**Management Plan for the
Barry Jones (Skunk Hollow) Wetland Mitigation Bank**

Prepared for:

Pacific Bay Homes

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THE BARRY JONES WETLAND MITIGATION BANK MANAGEMENT PLAN

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LIST OF ACRONYMS

CDFG	California Department of Fish and Game
CEMP	Rancho Bella Vista Comprehensive Environmental Management Plan
CEQA	California Environmental Quality Act
CNLM	Center for Natural Lands Management
CNPS	California Native Plant Society
COE	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
HCPSKR	Habitat Conservation Plan for the Stephens' Kangaroo Rat in Western Riverside County
MBRT	Mitigation Bank Review Team
MOA	Memorandum of Agreement
MSHCP	Western Riverside County Multi-Species Habitat Conservation Plan
NASA	National Aeronautics and Space Administration
NCCP	Natural Communities Conservation Planning Program
PAR	Property Analysis Records

1. Executive Summary

The Rancho Bella Vista Project, a 798-acre master planned community in southwestern Riverside County, is being developed by Pacific Bay Homes. The project area includes a variety of sensitive biological resources, including Skunk Hollow -- a 33-acre vernal pool, supported by a currently functioning watershed of approximately 153 acres. The Barry Jones Wetland Mitigation Bank has been established to protect and conserve these sensitive resources. The Mitigation Bank complies with the Federal Guidelines for the Establishment, Use, and Operation of Mitigation Banks, dated November 28, 1995.

The Barry Jones Wetland Mitigation Bank protects the entire 33-acre (13.4 ha) vernal pool along with approximately 107 ac (43.3 ha) of the pool's watershed. The watershed being preserved within the Bank represents approximately 90 percent of the currently functioning watershed for the pool. An additional 13 ac (5.3 ha) are preserved outside of the Mitigation Bank, bringing to approximately 98 percent, the amount of the pool's watershed under permanent protection. The Bank also affords protection to several state and/or federally-listed plant and animal species known to occur on or adjacent to the property, including California orcutt grass (*Orcuttia californica*), Riverside fairy shrimp (*Streptocephalus wootoni*), vernal pool fairy shrimp (*Branchinecta lynchi*), coastal California gnatcatcher (*Poliophtila californica californica*) and Stephens' kangaroo rat (*Dipodomys stephensi*).

The Bank also provides open space that links the vernal pool (and adjacent Riversidean sage scrub) with the Metropolitan Water District's Lake Skinner East Side Reservoir Preserve via Santa Gertrudis Creek and the open spaces of the Johnson Ranch and Roripaugh Ranch projects to the south and east.

This Management Plan addresses the short- and long-term management activities for the Mitigation Bank as specified in the Center for Natural Lands Management (CNLM) Property Analysis Record (PAR). In addition to describing the required management program, the PAR provides a detailed line-item budget for a long-term endowment sufficient to cover average annual operating expenses.

The specific goals and objectives for management of the Mitigation Bank include: 1) maintain the overall diversity and abundance of the native flora and fauna within the preserve; 2) control invasive exotic plant species; 3) protect the hydrologic quality and integrity of the vernal pool; and, 4) increase awareness and build a supportive constituency for the Skunk Hollow preserve within the planned communities adjacent to the property.

Management activities that will be implemented in order to achieve the goals and objectives include: 1) annual biological resource monitoring studies to identify changes in habitat and any trends in species composition, diversity, and abundance; 2) use of fire, grazing, or other tools, as necessary and appropriate, that mimic historic natural disturbance processes to which the

vernal pool/grassland community is adapted; 3) use of buffers and coordination of road maintenance and hydrological protection measures within neighboring communities to maintain quality and integrity of vernal pool system; 4) development of a public access program that will limit access of people, vehicles, and domestic pets to the vernal pool area, but direct such access to specific trails and interpretive facilities; 5) development of interpretive materials and programs to educate the public on the values of the property; 6) monitoring of developments bordering the preserve as they are planned and implemented; 7) identification of opportunities for restoration and enhancement of the vernal pool/grassland community; and, 8) development of a fire management program in consultation with the County of Riverside Fire Marshall and appropriate wildlife agencies.

The interagency Memorandum of Agreement Regarding the Establishment, Operation and Use of the Barry Jones Wetland Mitigation Bank requires that monitoring and management will be conducted for a period of 30 years. The frequency of monitoring activities, however, is flexible. Initially, monitoring activities will be conducted annually but adjustments may be warranted in the future based on the study results. Studies will be implemented to monitor: 1) populations of Riverside fairy shrimp and other vernal pool invertebrates through annual wet sampling; 2) overall site conditions using photo-documentation; 3) vegetation within the vernal pool/grassland community using either a frequency or estimated cover class method at randomly placed quadrants; 4) distribution and abundance of *Orcuttia californica*, and additional occurrences of other rare plants, within the preserve including, but not limited to, presence/absence determination, counting of individual plants, and sampling quadrants; 5) general wildlife occurrence within the property by recording incidental observations made during other studies and site visits; and 6) weather conditions including annual precipitation levels, temperature, wind direction/velocity and precipitation amounts for days on which monitoring occurs. Annual reports will be prepared to document the monitoring results and establish any adaptations that may be necessary for the management program.

Funding for the establishment and long-term management of the Mitigation Bank will be provided through a Total Initial and Capital and Ongoing Endowment of \$531,221. This amount includes \$33,455 to cover the costs of initial (first-year) operation costs and capital expenses required for one-time major improvements (Initial and Capital Costs). Initial and capital costs for the site include new fencing and signs, biological surveys, permit acquisition, development of the management plan and other documentation, access control and monitoring, development of interpretive literature, exotic plant control, administrative costs, and equipment. It also includes a total of \$497,766 for "ongoing costs" related to those management activities that will occur regularly in perpetuity to sustain the Bank. This amount for ongoing costs is referred to as the Endowment Account. Ongoing management activities include maintenance and periodic replacement of fencing, ongoing biological surveys and reporting, patrolling, exotic plant control, equipment maintenance, administration, and sanitation control. Funding for ongoing costs is derived from Endowment Deposits to the Endowment Account.

2. Introduction

This Management Plan has been completed as an implementation component of the Barry Jones Wetland Mitigation Bank. This Bank has been established in compliance with the current Federal Wetland Mitigation Banking Guidelines published in November of 1995. The elements of this Management Plan, as itemized in the Center for Natural Lands Management (CNLM) Property Analysis Record (PAR), are the basis for the Management Endowment amount as identified in the *Memorandum of Agreement Regarding the Establishment, Operation, and Use of the Barry Jones Wetland Mitigation Bank* (MOA).

The Barry Jones Wetland Mitigation Bank comprises 140 ac (56.7 ha), including approximately 33 ac (13.4 ha) of vernal pool and 107 ac (43.3 ha) of the pool's watershed. The watershed being preserved within the Bank represents approximately 90 percent of the currently functioning watershed for the pool. An additional 13 ac (5.3 ha) have recently been preserved off-site, bringing to approximately 98 percent, the amount of the pool's watershed under permanent protection.

33 - v. pool
107 - watershed

2.1 Purpose of the Management Plan

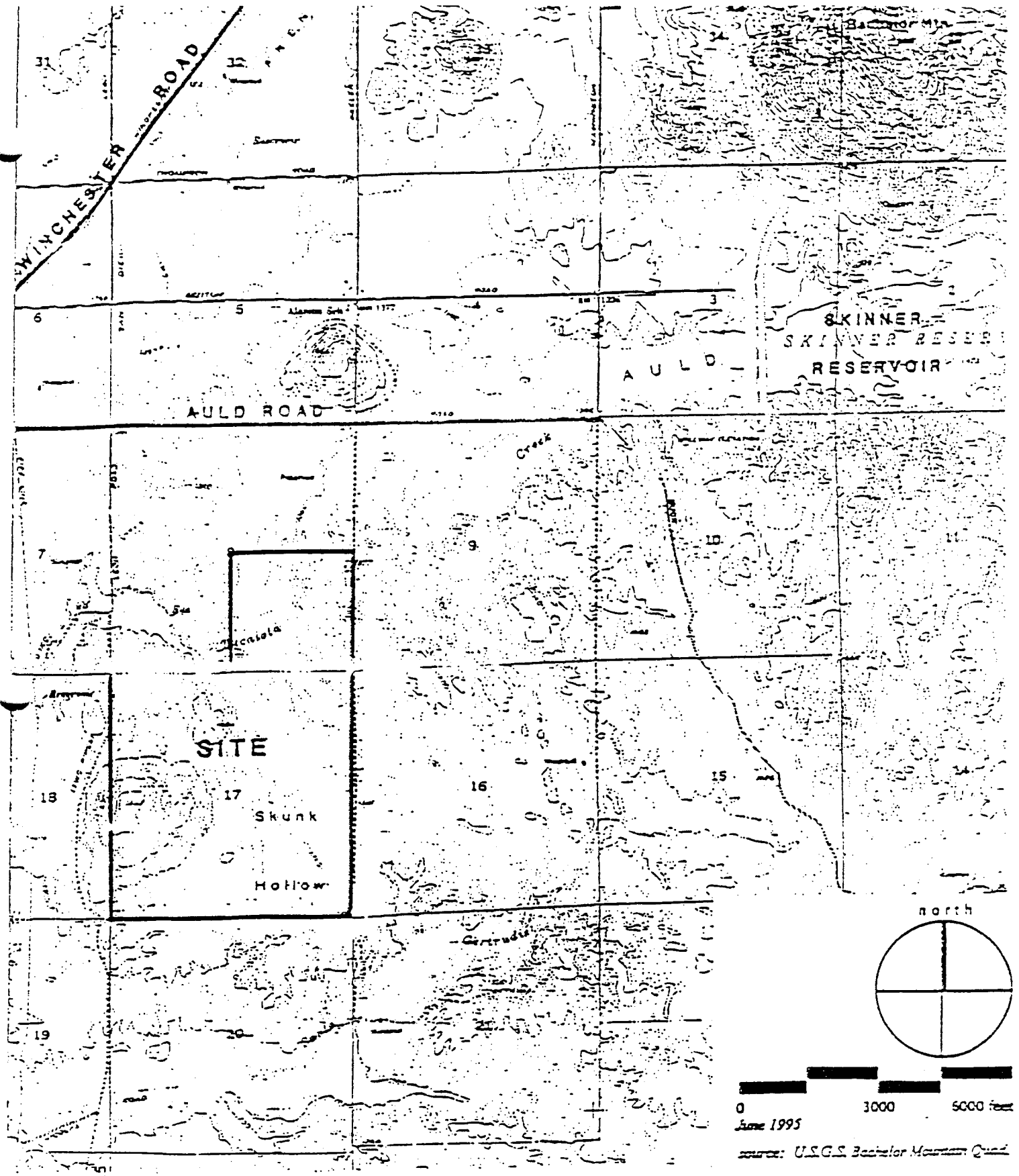
This management plan identifies the short- and long-term management activities to be carried out for the Barry Jones Wetland Mitigation Bank. As mentioned above, the associated costs of management are estimated using the CNLM PAR (Appendix A); a program that provides a detailed listing of required management tasks, associated line-item budget and requirements for funding, and sufficient resources to cover average annual operating expenses.

3. Background

The concept of the Barry Jones Wetland Mitigation Bank was initially presented in the *Comprehensive Environmental Management Plan (CEMP)* prepared for the Rancho Bella Vista Development Project (McCollum Associates *et al.* 1995). As a key component of the CEMP, the Bank will protect the on-site vernal pool and virtually its entire watershed within a wildlife corridor that links the pool and adjacent Riversidean sage scrub with the Metropolitan Water District's Lake Skinner East Side Reservoir Preserve via Santa Gertrudis Creek and the open spaces of the Johnson Ranch and Roripaugh Ranch projects to the south and east. The Bank is being established as the first purely "preservation" bank in California under the Federal Wetland Mitigation Banking Guidelines issued in November of 1995.

3.1 Location

The Barry Jones Wetland Mitigation Bank occupies the southeast portion of the Rancho Bella Vista project area, a 798-acre (323 ha) master planned community in southwestern Riverside County (T. 17 S., R. 2 W., SE 1/4 S. 17; San Bernadino Meridian and Baseline). The Rancho Bella Vista project area is located approximately 35 miles (56.3 km) south of the City of Riverside, approximately 30 miles (48.3 km) north of the City of Escondido (Figures 1 and 2).



Incho Bella Vista Comprehensive Environmental Management Plan

Figure 2

Location Map

3.2 Conservation Biology Principles Applicable to Skunk Hollow

The science of conservation biology provides a template for the design and management of conservation preserves. The basic principles used to guide the establishment of the Barry Jones Wetland Mitigation Bank include:

- ▶ Manage the preserve so as to maintain or allow continuation of the natural structure and function to the maximum extent possible.
- ▶ Buffer the preserve from harmful human activities as much as possible. Buffering is generally easier if preserve boundaries correspond to natural boundaries such as ridge tops. Watershed lines can provide excellent preserve boundary lines (Hunter 1995). Within urban areas, trails or irrigation canals at the boundaries of natural areas may act as buffers and double as fire breaks. Such buffers do not eliminate all edge effects, but can limit or buffer impacts from more intensive impacts such as housing developments and paved roads.
- ▶ Establish and maintain preserves that allow for natural disturbances (e.g., fire, flood, earthquake, hurricanes) to continue. Disturbances, especially those that initiate ecological succession, are often critical in maintaining the natural structure and function of ecosystems.
- ▶ In managing or mimicking natural disturbance processes (e.g., using prescribed burns, livestock grazing, etc.), it is preferable to match the scale and frequency of the management action to the scale and frequency of the natural disturbances to which the system is adapted. In addition, the scale of a preserve should accommodate the scale of disturbances important to the ecosystems represented within it.
- ▶ Large preserves generally allow a broader array of management activities than small preserves (i.e., small-scale disturbance can take place on large preserves, but large-scale disturbance is generally infeasible).
- ▶ Management tends to be more cost effective on large preserves than on small preserves (e.g., less cost per acre).
- ▶ Small preserves may be important for some species (e.g., to conserve genetic diversity of annual plants with disjunct populations that rarely out cross with one another). However, small isolated preserves generally do not provide all the functions or benefits to their constituent species that larger or inter-connected preserves provide.

3.3 Basis for the Barry Jones Wetland Mitigation Bank

Skunk Hollow and its immediate watershed support one of the most sensitive and unique habitat areas in southern California. Preservation of Skunk Hollow's high biological value is one of the primary concerns of the resource agencies and the Rancho Bella Vista Project. Because of the high development value of the land, however, an incentive mechanism had to be found that would allow Pacific Bay Homes to set aside this site for conservation purposes. The mitigation bank provides such a mechanism. The ability of the landowner to sell "mitigation credits" for the area will not only ensure that the land is set aside in perpetuity, but will also ensure adequate funding for long-term management.

4. Regional Context

This section addresses the conservation goals of the Barry Jones Wetland Mitigation Bank within a regional context. While no approved regional conservation plan presently exists that incorporates Skunk Hollow, such a concept has been proposed and is currently in its developmental stages.

4.1 Regional Corridor Linkage

In addition to preserving the vernal pool system at Skunk Hollow, the CEMP outlines a conservation strategy for Rancho Bella Vista that provides an opportunity for linking habitat on-site with other important habitat areas off-site. Such landscape linkages provide corridors that maximize opportunities for wildlife movement and seed dispersal between core habitat areas.

The CEMP further proposes a corridor through the Rancho Bella Vista site that will connect with the Lake Skinner East Side Reservoir Preserve and the Western Riverside Multiple Species Habitat Conservation Plan. Linkage with the open space on the Johnson and Rompaugh ranches would establish a corridor from the Lake Skinner East Side Reservoir Preserve to Rancho Bella Vista and Skunk Hollow along Santa Gertrudis Creek. In addition to the vernal pool and its watershed, areas of Riversidean sage scrub, a sensitive habitat, would be linked to the corridor and would become a part of a larger regional preserve system. Other areas, such as the riparian habitat along Tualota Creek, would also be protected as open space. This scheme, coupled with the protection of Skunk Hollow as a key preserve is consistent with the overall regional planning goals for wildlife corridors in the area.

4.2 Other Mitigation Programs/Habitat Conservation Plans

Skunk Hollow is located within the boundary of two regional biological planning efforts: the Habitat Conservation Plan for the Stephens' Kangaroo Rat in Western Riverside County (HCPSKR) and the Western Riverside County Multi-Species Habitat Conservation Plan (MSHCP). The Riverside County Habitat Conservation Agency is the lead agency for the HCPSKR and is taking a leadership role in the MSHCP. The

Riverside County Habitat Conservation Agency is a joint powers agency comprised of the County of Riverside and the cities of Corona, Hemet, Lake Elsinore, Moreno Valley, Perris, Riverside, and Temecula.

4.2.1 Habitat Conservation Plan for the Stephens' Kangaroo Rat

The HCPSKR identifies a regional system of seven core preserves for conservation of Stephens' kangaroo rat and the ecosystem upon which it depends. One of these preserves, the Lake Skinner East Side Reservoir Preserve, lies approximately 1.5 miles (2.4 km) from the northeastern corner of the Rancho Bella Vista project site. Areas outside of these preserve areas are allowed to impact Stephens' kangaroo rat habitat provided that a mitigation fee is paid to acquire habitat within the core preserve areas. Rancho Bella Vista lies outside of any preserve and has paid fees in the amount of \$1,247,000 for Stephens' kangaroo rat mitigation. Even so, the watershed for the Skunk Hollow vernal pool watershed being protected in the mitigation bank does provide potential future habitat for the Stephens Kangaroo Rat.

4.2.2 Western Riverside Co. Multi-Species Habitat Conservation Plan

The MSHCP was initially prepared in 1991 and was adopted as a draft strategy by the County of Riverside. Completion of the MSHCP has been delayed pending resolution of the final HCPSKR. However, the Riverside County Habitat Conservation Agency is preparing a Memorandum of Understanding with the U.S. Fish and Wildlife Service (FWS) to agree on the planning process and MSHCP objectives. The MSHCP will include the preserve system established under the final HCPSKR and upon preserves established in cooperation with the Metropolitan Water District such as the Santa Rosa Plateau, Lake Skinner East Side Reservoir Valley, and the Lake Mathews multi-species preserves. The MSHCP is intended to conserve the California gnatcatcher and sage scrub species and will incorporate multiple habitats and species into its preserve system. Key elements of the MSHCP's strategy are to preserve valuable habitat resources and provide connection between these preserves with wildlife corridors.

4.2.3 Connectivity of Skunk Hollow with other Preserves

The proximity of the Barry Jones Wetland Mitigation Bank to the Lake Skinner East Side Reservoir Preserve provides an opportunity to maintain connectivity between the two preserves. Connectivity currently exists through Tualat Creek and across Johnson Ranch, located east and northeast of the project site.

4.3 Adjacent Land Uses/Open Space Linkage

As described previously, two adjacent parcels, Johnson Ranch and Roripaugh Ranch, are currently moving forward with planning for development projects. Johnson Ranch

is a 1,761-acre (712.7 ha) parcel that abuts the eastern and southern boundary of the Rancho Bella Vista project site. In December of 1996, a conservation easement over approximately 300 ac (121.4 ha) of the Johnson Ranch adjacent to Skunk Hollow was dedicated to the University of California, Riverside (see Figure 3). This open space for Johnson Ranch is contiguous with open space on the project site along the southeastern boundary. This open space continues east along Santa Gertrudis Creek and the southern property boundary of Johnson Ranch. The open space then continues north as it follows the eastern property boundary of Johnson Ranch. Open space along the northern boundary of Johnson Ranch is contiguous with the Lake Skinner East Side Reservoir Preserve. Roripaugh Ranch is also proposing open space along the same Santa Gertrudis Creek corridor where Johnson and Roripaugh ranches have contiguous borders. The open space proposed on Rancho Bella Vista will maintain a viable link between the sage scrub and vernal pool habitats on-site with potential off-site habitat areas on the Johnson and Roripaugh ranches to the southeast and ultimately to the Lake Skinner East Side Reservoir Preserve.

The area to the west includes the approved Silverhawk development and the Borel Airpark Center. Property north of the project site is owned by numerous smaller ownerships and the Crown Valley Village Project.

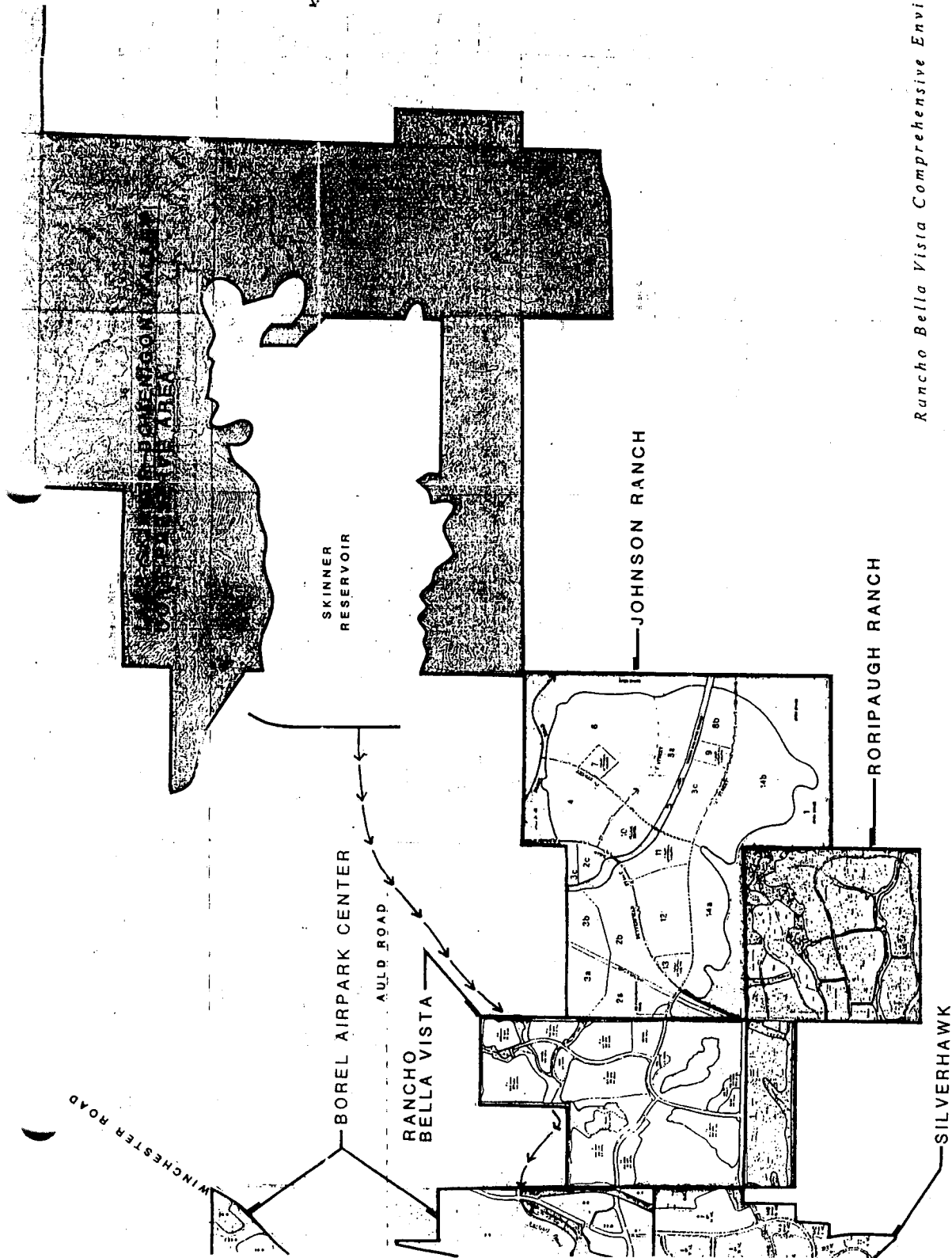
5. Characteristics of Skunk Hollow

The Barry Jones Wetland Mitigation Bank encompasses approximately 140 ac (56.7 ha) vernal pool habitat and surrounding open space within the southeast portion of the 798-acre (323 ha) Rancho Bella Vista planned community. The site is at an elevation of approximately 1,320 ft (402 m).

Several resource assessments have been prepared that described the physical and biological characteristics of Skunk Hollow. These include *Ecological Studies and Management Recommendations for the Skunk Hollow Vernal Pool, Riverside County, California* (Zedler, *et al.* 1990); *Biological Resources Assessment for the Skunk Hollow Site Riverside County, California* (MBA 1993); *Formation of the Skunk Hollow Vernal Pool, Riverside County, California* (Riggan 1989); an ongoing assessment of the site by Sweetwater Environmental Biologists, Inc.; and the *Rancho Bella Vista Comprehensive Environmental Management Plan* (CEMP) (McCollum Associates *et al.* 1995). The following subsections summarize the findings of these studies.

5.1 Characteristics of Surrounding Area

The area is surrounded by adjacent specific plans including Johnson Ranch to the east, Silverhawk and Borel Airpark Center to the west, the City of Temecula to the south, and Crow Valley Village and numerous small ownerships to the north. Existing land uses in the surrounding area consist of low density residential housing and several ranches to the north, east, and south of the project area. High density development



Proposed Open Space

Lake Skinner-Domenigoni Valley
Core Preserve Area

Tucajiata Creek Drainage

SKINNER
RESERVOIR

JOHNSON RANCH

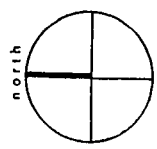
RORIPAUGH RANCH

SILVERHAWK

BOREL AIRPARK CENTER

RANCHO
BELLA VISTA

AULD ROAD



0 3000 6000 feet
June 1995
Source: U.S.G.S. Bachelor Mountain
Quad/Area Plans

Rancho Bella Vista
(John L. Chapman Land Planning)
Roripaugh Ranch
(The Keith Companies)
Johnson Ranch
(James Fergus Planning/
Development)

Rancho Bella Vista Comprehensive Environmental Management Plan
Figure 3
Regional Preserve

occurs to the west of the site. The area is located approximately 1.5 miles (2.4 km) southwest of Lake Skinner East Side Reservoir Preserve, with connectivity to this preserve provided by Tule Creek and Tule Creek. Tule Creek is a large, perennial stream that flows through the project site. Tule Creek traverses the northern portion of the Rancho Bella Vista property, and this drainage supports many sensitive resources off-site to the west, including both Riversidean sage scrub and riparian habitats. The rural property between Lake Skinner East Side Reservoir Preserve and Rancho Bella Vista consists primarily of non-native grasslands and dry crops.

5.2 Physical Characteristics

The unique physical characteristics of the Barry Jones Wetland Mitigation Bank are described in the following subsections.

5.2.1 Topography

The Skunk Hollow vernal pool occupies a shallow basin with two primary depressions. The pool, as described topographically, covers approximately 33 ac (13.4 ha), although the size of the pool may vary dramatically depending on the amount of rainfall in a given year. Based on the distribution of obligate pool organisms, Zedler *et al.* (1990) estimated the size of the pool to be at least 28.4 ac (11.5 ha). A well-defined break in topography occurs at about 15.7 in (40 cm) above the lowest point in the pool. Tilling of the adjacent upland may have caused a buildup of soil at the pool perimeter; although the pool clays have rarely been tilled and only during drought years. The surrounding uplands exhibit low relief.

5.2.2 Geomorphology

The geologic origin of Skunk Hollow is uncertain, but it lies at the juncture of Quaternary alluvial fan deposits and bedrock controlled topography of Mesozoic granodiorite (to the north) and basic intrusive gabbroic rocks (northwest and west). The prominent faults that run through the region roughly parallel to the long axis of Skunk Hollow suggest that the pool originated because of tectonic activity. No other explanation is apparent for the presence of a large undrained depression at a position of relatively high local elevation.

5.2.3 Soils

Three main soil types surround Skunk Hollow: the Las Posas clay loam derived from weathered bedrock, the Wyman clay loam formed in the Quaternary alluvium, and the Willows soil that occupies the lowest part of the basin. The heavy Willows clay soil beneath the pool is mottled and extremely hard when dry but easily penetrated to a depth of about 39 in (1 m) when saturated. Large shrinkage fissures appear in the clay when dry that may be up to 0.8-1.2 in (2-3 cm) wide at the surface and extend to 3.9 ft (1.2 m) in depth. At this depth the

clay integrates into silty or sandy clay that extends to depths of 5.6 to 6.6 ft (1.7 to 2.0 m) where it is underlain by reddish-brown sand. The fissures tend to isolate polyhedrons of clay up to several meters wide. Voids up to 7.9 in (20 cm) in diameter and 11.8 in (30 cm) deep sometimes form at the intersection of fissures. Shallow depressions 3.9-7.9 in (10-20 cm) wide and 0.4-0.8 in (1-2 cm) deep may surround the fissure network. When the soil is dry these depressions are often underlain by a crumb structure with considerable void space that must be filled before the surface pool can form.

Surrounding upland areas exhibit low relief. They are dominated by two soil types: the Las Posas clay loam, derived from gabbro and granitic rocks, and the Wyman clay loam, derived from the alluvial Pauba formation. The tilled zone contains loose and powdery material and the subsoil is extremely hard when dry yet easily penetrated when wet. A clay loam occurs between 17.7 and 35.4 in (45 and 90 cm) depth in these Wyman series soils.

5.2.4 Watershed

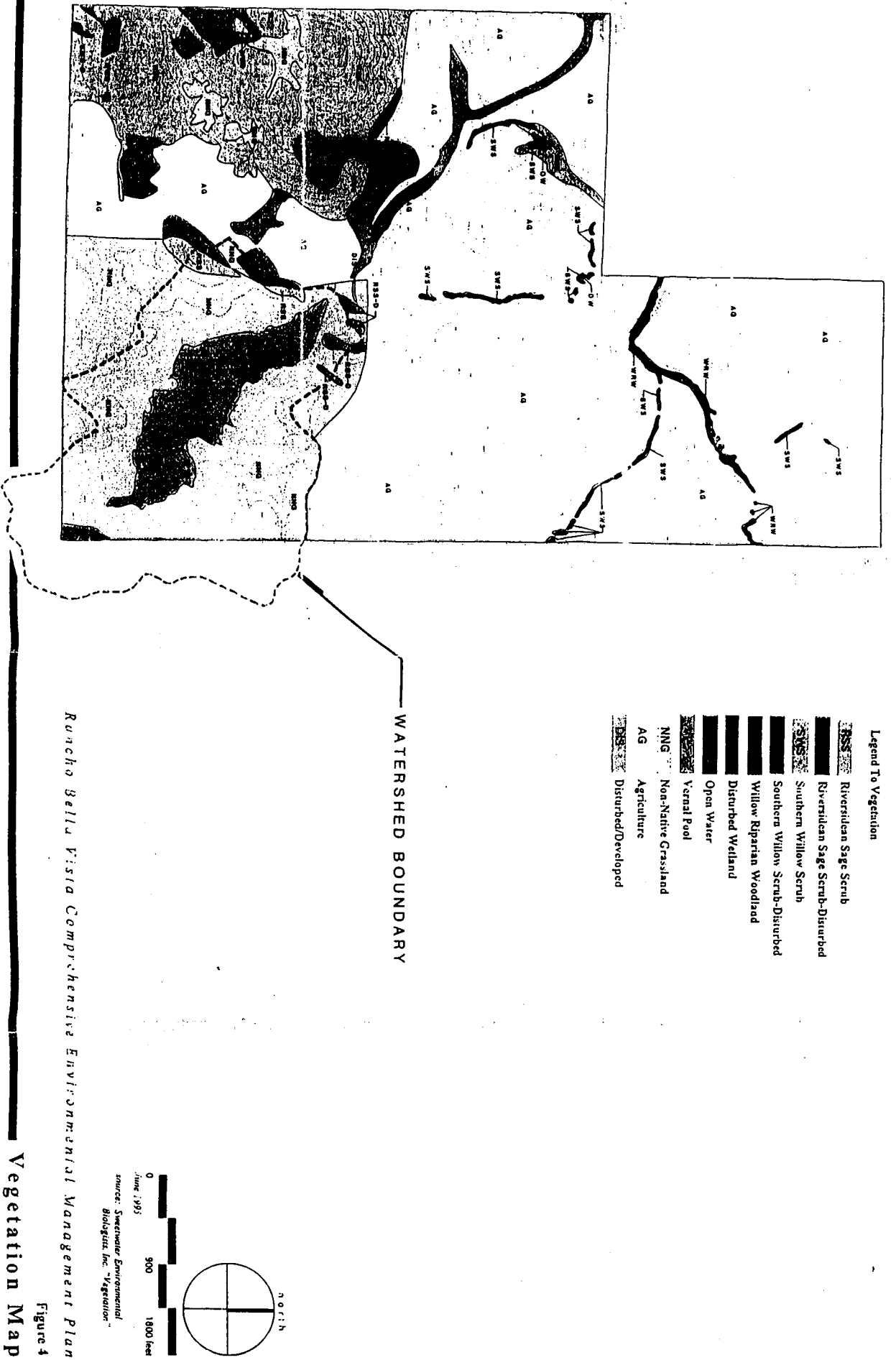
The currently functioning watershed of the Skunk Hollow vernal pool covers most of the southeastern corner of the Rancho Bella Vista project area (Figure 4) and encompasses approximately 140 ac (56.7 ha) on-site. This represents approximately 90 percent of the current watershed that covers 156 ac (63.1 ha).

5.2.5 Water supply

Formation of the vernal pool is dependent upon runoff and direct interception of rainfall. Past records indicate that during a 20-year period ending in 1989, inadequate precipitation prevented the formation or persistence of a pool during seven years, a small pool (10-50 percent of full size) formed in three of the years, and a large pool formed in the remaining 10 years (Riggin 1989). Hillside agriculture and nearby road construction have altered both runoff quality and quantity in recent years and any further reductions in the size of the watershed would likely result in contraction of the vernal pool system because of reduced flooding frequency (Zedler *et al.* 1990).

5.2.6 Water Quality

The aquatic invertebrates inhabiting the Skunk Hollow vernal pool are extremely sensitive to water quality. As a result, the increased potential for toxic spills and leakage from domestic sewers and street drains following development of Rancho Bella Vista, is a serious concern. The best protection against the introduction of toxic materials into the system is to maintain the maximum possible distance between the pool and the urbanized area and to ensure that all urban runoff is directed away from the preserve area.



Because Skunk Hollow is a closed basin of internal drainage, the problems of toxins, organic matter, nutrients, and salts are more serious than they would be in a free-flowing stream or body of water with regular inflow and outflow. Years of heavy rain that allow the pool to overflow may be important in removing dissolved salts. Reducing the frequency of overflow conditions by reductions in watershed area could cause increases in the salinity and alkalinity of the pool and may significantly alter the ion balance and nutrient content to the possible detriment of the animal component. The vascular plants that are rooted in better-buffered substrate would likely be less sensitive but could ultimately be affected as well.

5.2.7 Climatic conditions

Skunk Hollow is typified by a Mediterranean climate with cool, wet winters and hot, dry summers. Annual rainfall is highly variable but averages approximately 11.6 in (29.5 cm). The variation in rainfall and temperature is a significant factor in determining the biota of the pool.

5.3 Biological Characteristics

The Barry Jones Wetland Mitigation Bank and its surrounding environs support a unique assemblage of flora and fauna. Information presented below was gleaned from the following sources: *Formation of the Skunk Hollow Vernal Pool, Riverside County, California* (Riggan 1989); *Ecological Studies and Management Recommendations for the Skunk Hollow Vernal Pool, Riverside County, California* (Zedler, et al. 1990); *Preliminary Studies on the Anostracans of Skunk Hollow* (Zedler 1990); *Biological Resources Assessment for the Skunk Hollow Site Riverside County, California* (MBA 1993); an ongoing assessment of the site by Sweetwater Environmental Biologists, Inc., and the *Rancho Bella Vista Comprehensive Environmental Management Plan* (McCollum Associates et al. 1995).

5.3.1 Natural communities

The Barry Jones Wetland Mitigation Bank is comprised of a native vernal pool community surrounded by a largely non-native grassland community that has been routinely cultivated for grain crops.

The remaining area within the Rancho Bella Vista property and adjacent to Skunk Hollow contains Riversidean sage scrub, disturbed Riversidean sage scrub, non-native grassland/existing agriculture, willow riparian woodland, southern willow scrub, disturbed southern willow scrub, open water, and disturbed wetland (Figure 4). All eight of the native communities within the area are considered to be sensitive because they are rare within the region, are classified as sensitive by the California Department of Fish and Game (CDFG)

(Holland 1986), are considered jurisdictional by the U.S. Army Corps of Engineers (COE), or support special-status plants or animals.

Vernal Pool: Skunk Hollow is one of the largest vernal pools in southern California, and is considered unique because of its size and depth. As previously described, the pool covers approximately 33 ac (13.4 ha) based on topography of the basin, but its size can vary tremendously depending on annual rainfall. The watershed of the pool encompasses approximately 156 ac (63.1 ha).

Vernal pools are highly specialized aquatic habitats that support unique flora and fauna. They are generally characterized by two important physical conditions: a subsurface hardpan or claypan that inhibits the downward percolation of water and topography represented by a series of low hummocks called mima mounds and low depressions that collect runoff. Water collected in these pools during the rainy season gradually recedes over the course of the dry season giving rise to a temporal succession of plant species in concentric rings around the perimeter of the pool. Sensitive species observed within Skunk Hollow include two federally listed endangered species, the California orcutt grass (*Orcuttia californica*) and the Riverside fairy shrimp (*Streptocephalus wootoni*), and one species listed as threatened, the vernal pool fairy shrimp (*Branchinecta lynchi*).

Non-native Grassland/Existing Agriculture: The mitigation bank area contains approximately 107 ac (43.3 ha) of non-native grassland/existing agriculture. This community occurs predominantly on the lower, flatter portions of the area. Many of these areas are currently being dry-farmed for grain crops. Non-native grasses (*Bromus* spp.), oats (*Avena* sp.), and forbs, especially mustard (*Brassica* sp.) dominate this community where active farming is not occurring.

5.3.2 General Flora

Zedler *et al.* (1990) described the general vegetation around Skunk Hollow as dryland agricultural fields, chaparral, and coastal sage scrub. Much of the vegetation nearest the vernal pool was open, exhibiting signs of continuing disturbance by grazing animals and vehicles. Historically, the vegetation around the pool was probably evergreen chaparral on the steeper land to the west, coastal sage scrub on the rolling topography to the east and south, and open shrubland or perennial grassland on the intermittently flooded margins of the pool. The lowest part of the basin is presumed to have been at least as barren in dry years as it is today and possibly even more open because the most abundant species there now in dry years are introduced (e.g., *Bromus diandrus*, *Bromus rubens*, *Bromus mollis*, *Vulpia myuros*).

Field observations and germination trials conducted in 1990 resulted in the identification of 83 species of vascular plants in the Skunk Hollow flora (Zedler *et al.* 1990). Of this total, 35 percent were introduced species and another 36 percent are considered weedy or cultivated. These numbers are representative of communities that have experienced widespread disturbance (e.g., agricultural plowing at Skunk Hollow) and are also not unusual for communities exposed to a variable regime of flooding and drying. Periodic flooding prevents the intrusion of native shrub species, while favoring the expansion of weedy annuals and to a lesser extent perennial herbs when the basin is dry (Zedler *et al.* 1990).

5.3.3 Sensitive and Special-Status Flora

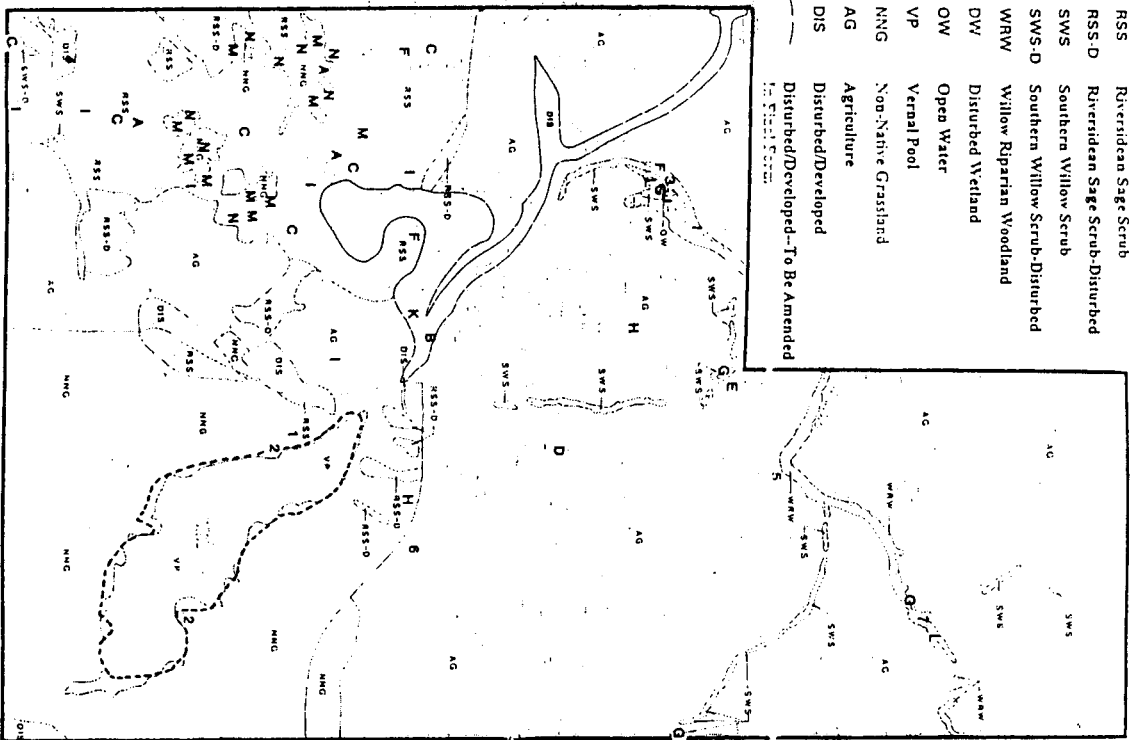
At least eight sensitive plant species have either been observed at Skunk Hollow and adjacent habitats or have the potential to occur based on habitat suitability and known distributions (Appendix B).

California Orcutt Grass: *Orcuttia californica*, a state and federally listed endangered species, was found growing in large numbers along the margin of Skunk Hollow during field surveys conducted in 1993 and 1995 (Figure 5), and was found in rehydrated soil samples by Zedler *et al.* in 1990. This species is known from less than 20 vernal pool sites in western Riverside, San Diego, and Ventura counties; and Baja California, Mexico.

San Diego Ragweed: *Ambrosia pumila*, a former candidate for federal listing and currently on the California Native Plant Society (CNPS) List 1B, is the only other sensitive plant actually observed within the Barry Jones Wetland Mitigation Bank property (Figure 5). The San Diego ragweed has apparently been extirpated from many locations in San Diego County but several hundred individuals were observed during 1993 field surveys at the northern end of Skunk Hollow. The species typically occurs in chaparral, coastal sage scrub, valley and foothill grasslands, vernal pools, and often in disturbed portions of these habitats.

Munz's onion: Munz's Onion, *Allium munzii*, is known to occur within the Rancho Bella Vista property but outside of the Barry Jones Wetland Mitigation Bank. The species is a state listed as threatened and currently proposed for listing under the federal endangered Species Act. It is limited to western Riverside County and is known from fewer than 10 locations. However, a population of approximately 250 individuals was observed in the southwest portion of Rancho Bella Vista near the western border of the Barry Jones Wetland Mitigation Bank (Figure 5). *Allium munzii* occurs on clay soils in chaparral, cismontane woodland, sage scrub, pinion-juniper woodland and native grasslands.

- RSS Riverside Sage Scrub
 RSS-D Riverside Sage Scrub-Disturbed
 SWS Southern Willow Scrub
 SWS-D Southern Willow Scrub-Disturbed
 WAW Willow Riparian Woodland
 DW Disturbed Wetland
 OW Open Water
 VP Vernal Pool
 NNG Non-Native Grassland
 AG Agriculture
 DIS Disturbed/Developed
 DIS-D Disturbed/Developed-To Be Amended To Final Form



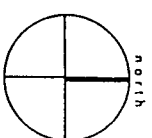
Legend To Sensitive Resources

- A Bell's Sage Sparrow
(Amphispiza belli belli)
 B California Horned Lark
(Eremophila alpestris actia)
 C Coastal California Gnatcatcher
(Polioptila californica californica)
 D Golden Eagle
(Aquila chrysaetos)
 E Loggerhead Shrike
(Lanius ludovicianus)
 F Northern Harrier
(Circus cyaneus)
 G Raptor Nest
 H San Diego Black-Tailed Jackrabbit
(Lepus californicus benningi)
 I Southern California Rufous-Crowned Sparrow
(Aimophila ruficeps canescens)
 J Southwestern Pond Turtle
(Clemmys marmorata pallide)
 K Western Spadefoot
(Spea hammondi)
 L White-Tailed Kite
(Elanus leucurus)
 M Palmer's Grapplinghook
(Harpegonella palmeri)
 N Muoz's Onion
(Allium muozii)
 Riverside Fairy Shrimp*
(Streptocephalus woottoni)

*Observed by Eng et al. 1990.

Legend To Sensitive Resources Map By MDA (1993) But Not Confirmed in 1995

- California Orcutt Grass
(Orcuttia californica)
 1 San Diego Ragweed
(Ambrosia pumila)
 2 Tricolored Blackbird
(Agelaius tricolor)
 3 Yellow Warbler
(Dendroica petricola)
 4 Orange-breast Whiptail
(Cnemidophorus hyperythrus beddingi)
 5 Coastal Whiptail
(Cnemidophorus tigris multicinctus)
 6 San Diego Horned Lizard
(Phrynosoma coronatum blainvilliei)
 7 Two-Striped Garter Snake
(Thamnophis hammondi)



Source: Sweetwater Environmental
 Biologist, Inc. "Vegetation"

Rancho Bella Vista Comprehensive Environmental Management Plan

Figure 5 Sensitive Resources

Palmer's grapplinghook: *Harpagonella palmeri*, is a former candidate for federal listing and currently on the CNPS List 2. It is the sole member of the genus *Harpagonella*. A large population of this species, over 10,000 individuals, was observed in the southwest portion of Rancho Bella Vista just west of the mitigation bank property (Figure 5). The historic range of this species included Los Angeles, Orange, Riverside, and San Diego counties; San Clemente and Santa Catalina islands; portions of Arizona; and in Baja California and Sonora, Mexico. In Riverside County it is currently known from the Gavilan Hills, Lake Skinner, Vail Lake, Murrieta, Miller Mountain, and Lake Mathews. It has apparently been extirpated from Los Angeles County. *Harpagonella palmeri* occurs on clay soils in annual grasslands and sage scrub below 3,000 ft in elevation. In grasslands, this species is more prevalent after fires, as this creates additional openings in the habitat. Grazing, agricultural conversion, and urbanization have all contributed to its decline. The plant blooms from March to April, and is believed to be self-pollinated.

Other sensitive plants: Four other sensitive plant species limited to vernal pools have the potential to occur at Skunk Hollow but have not been observed during field surveys to date (Appendix B). These species, Orcutt's brodiaea (*Brodiaea orcuttii*), prostrate navarretia (*Navarretia fossalis*), little mousetail (*Myosurus minimus* ssp. *apus*), and thread-leaved brodiaea (*Brodiaea filifolia*), may have been missed during earlier surveys because of inappropriate timing or location. Thread-leaved brodiaea is a state listed endangered species while the other three species lack state or federal listing status.

5.3.4 General Fauna

Surveys performed over the entire Rancho Bella Vista property in 1993 and 1995 verified the presence of all the major vertebrate wildlife groups. The species assemblage included two amphibian species, 7 reptile species, 54 bird species, and 9 mammal species. The property also supports a diverse invertebrate species assemblage, although no focused surveys were conducted for this taxon during those years. However, surveys focused on the Skunk Hollow vernal pool in 1990 identified at least two, and possibly three species of anostracans (fairy shrimp) from the pool (Eng *et al.* 1990). Among the most conspicuous species observed during the 1993 and 1995 surveys were Pacific chorus frog (*Pseudacris regilla*), side-blotched lizard (*Uta stansburiana*), western meadowlark (*Sturnella neglecta*), rufous-sided towhee (*Pipilo erythrophthalmus*) red-tailed hawk (*Buteo jamaicensis*), desert cottontail (*Sylvilagus audubonii*), and coyote (*Canis latrans*). Skunk Hollow also appears to support a high number of migrating and wintering water birds.

5.3.5 Sensitive and Special-status Fauna

At least 21 sensitive animal species have been observed within or immediately adjacent to the Rancho Bella Vista project area during surveys conducted in 1990, 1993, and 1995 (Appendix C). Although only three of these species were actually confirmed to occur within the boundary of the Skunk Hollow Mitigation Bank, each of these 21 species have the potential to occur within the bank due to their mobility and the presence of suitable habitat. The three species observed, Riverside fairy shrimp, vernal pool fairy shrimp, and Stephens' kangaroo rat, are state and/or federally listed as threatened or endangered. The coastal California gnatcatcher was observed adjacent to the property and is highly mobile; based on its status as a threatened species the gnatcatcher is addressed in more detail below. McCollum Associates *et al.* (1995) listed at least 23 additional sensitive species that were not observed during surveys of the site but have some potential to occur based on the area being within the known range of the species and by the presence of potential habitat on-site (Appendix B).

Riverside Fairy Shrimp: The Riverside fairy shrimp (*Streptocephalus wootoni*) is listed as endangered under the federal Endangered Species Act and is known from only a few vernal pools in Riverside County; Miramar Naval Air Station and Otay Mesa in San Diego County; and one location in Orange County. The Skunk Hollow vernal pool represents the largest known population of this species within its range. Characteristic habitat for the Riverside fairy shrimp includes deep vernal pools and seasonal wetlands at least 2.5 ft (0.8 m) deep with minimal vegetation (Simovich and Fugate 1990). At appropriate depths, the temperature of the water in the pool is a critical factor in hatching and development of this species, with a preferred range of 59 to 68 degrees Fahrenheit. Based on this scenario, it is likely that the successful completion of this species' life cycle is dependent upon the deep filling of the pool for at least two months after water temperatures have climbed above 59 degrees Fahrenheit (Simovich and Fugate 1990).

Vernal Pool Fairy Shrimp: The vernal pool fairy shrimp (*Branchinecta lynchi*) was federally listed as threatened on September 19, 1994 (FWS 1994). It is endemic to vernal pools in the Central Valley, coast ranges, and a limited number of sites in the Transverse Range and Santa Rosa Plateau of California. Although this species has a relatively wide range, it has a sporadic distribution within vernal pool complexes, wherein the majority of pools within a given complex typically are not inhabited by the species. It is typically found at low population densities in pools where it does occur. It only rarely co-occurs with other fairy shrimp species, but where it does, it is never the numerically dominant species (Eng *et al.* 1990).

Vernal pool fairy shrimp were not observed in live samples taken from Skunk Hollow by Eng *et al.* (1990), but were hatched at the laboratory from soil samples collected at the site. Live individuals have been collected from the nearby Santa Rosa Plateau (Simovich and Fugate 1990). The species typically occupies vernal pools with clear to tea-colored water, most commonly in grass or mud bottomed swales, or basalt flow depression pools in unplowed grasslands. However, at least one population occurs in sandstone rock outcrops and another population in alkaline vernal pools. It has been collected from early December to early May. The water in pools inhabited by this species has low total dissolved solids, conductivity, alkalinity, and chloride. It generally occurs in pools when water temperatures are between about 43 and 68 degrees Fahrenheit, and thus is considered a winter to early spring hatcher.

Stephens' Kangaroo Rat: The Stephens' kangaroo rat is listed as endangered under the federal Endangered Species Act, and as threatened under the California Endangered Species Act. This species was known to occur within the Ranch Bella Vista property prior to habitat modifications authorized by the County of Riverside's Section 10(a) Permit. Although not observed during recent surveys, this species may still be present in the habitat adjacent to Skunk Hollow. The Ranch Bella Vista project has participated in the County of Riverside's Habitat Acquisition Program, funding \$1,247,000.

The Stephens' kangaroo rat is restricted to southwestern San Bernardino, western Riverside, and northern San Diego Counties of southern California. It is generally found at below about 1,970 ft (600 m) elevation on relatively level or gentle slopes with well-drained gravelly soils; they generally avoid areas high in clay content.. The species prefers abundant patches of bare ground and few shrubs, presumably because this facilitates bipedal locomotion and affords an unobstructed view while foraging. They are highly sedentary animals, with adults moving an average of only about 100 ft (30 m) during their lifetime, and even juvenile dispersal is generally restricted to a maximum of 164 ft (50 m) from their natal burrow. Home range size varies with sex and by season, varying from estimates of about 0.1 to 0.2 ac (0.04 to 0.16 ha) per individual.

The main past and present threat to Stephens' kangaroo rat has been rapid urbanization, resulting in loss and fragmentation of habitat. Additionally, populations near human dwellings may be vulnerable to predation by feral cats and competition from rats (*Rattus* spp.) and house mice (*Mus musculus*). Other disturbances such as off-road vehicles and increased nighttime illumination may negatively impact populations. For long-term preservation of the species, preserves of large size (i.e., ~ 3,212 ac [1,300 ha]) are probably needed. A

minimum viable population size of about 13,200 individuals has been estimated as necessary to perpetuate the species.

Coastal California Gnatcatcher: Coastal California gnatcatchers, a federally threatened species, were observed in the Riversidean sage scrub on the hill west of Skunk Hollow in the southwestern corner of the Ranch Bella Vista property. Four to five pairs have been observed consistently within the property in recent years, and several additional pairs have been seen just outside the property along the proposed Murrieta Hot Springs Road alignment. Additional pairs are known from Tualota Creek to the west of the property. This represents a significant population within southwestern Riverside County.

The subspecies has a very restricted distribution: it inhabits coastal areas from Ventura County to north-central Baja California and west of the Transverse and Peninsular Ranges. Once common, its numbers have dropped precipitously during the past 50 years. This non-migratory passerine is found exclusively within moderately dense stands of coastal sage scrub habitat occurring below 2034 ft (620 m). They demonstrate a strong preference for California sagebrush or black and/or white sage, vegetation not commonly found in chaparral.

Coastal California gnatcatchers are extremely territorial, especially in the proximity of the nest. Data obtained by FWS suggest that average territory size is about 32 ac (13 ha). Breeding occurs from March to June, and there may be two broods. It is also thought these gnatcatchers, like other gnatcatcher species, mate for life. Most commonly, nest placement is within several meters of the ground in thick sagebrush or sage. Three to five eggs are laid, and both sexes participate in incubation, which takes about 14 days. The young, altricial at birth, are ready to fledge in about nine to 15 days. Both parents tend and feed the young, which can continue for as long as three weeks postfledging. The coastal California gnatcatcher is insectivorous, and also eats spiders, and on rare occasions, seeds.

5.4 Historical and ongoing research

No rigorous scientific studies specific to Skunk Hollow were performed prior to the late-1980s when P. J. Riggan examined the formation of the pool using aerial photographs and Landsat Thematic Mapper images from previous years that were obtained from the NASA Ames Research Center (Riggan 1989). P.H. Zedler directed additional research during the late 1980s on the ecology of Skunk Hollow (Zedler *et al.* 1990). Detailed studies were also performed in 1990 on the status of the fairy shrimp occupying Skunk Hollow (Eng *et al.* 1990, Simovich and Fugate 1990). Finally, MBA (1993) reported the results of their general biological resources assessment of the area,

and Sweetwater Environmental Biologists, Inc. have conducted an ongoing study of the biology of the site since 1993.

5.5 Ecological Processes

Vernal pool/grassland ecosystems are adapted to periodic fire and grazing by native ungulates. Complicating this situation is the fact that California grasslands, like those at Skunk Hollow, have been transformed over the past 200 to 300 years as exotic and invasive annual grasses have been introduced from the Mediterranean region. Areas that once were primarily native perennial grasslands often are now naturalized annual grasslands that have been grazed by livestock since European immigration to California's interior.

Vernal pool/grassland ecosystems continue to need the disturbances of fire and grazing, or surrogate processes, in order to thrive. In their pristine state, vernal pool grasslands were affected by these disturbances in patches (perhaps up to several hundred ac in size) that resulted in a mosaic of different habitat conditions, each benefitting different components of the community.

Zedler *et al.* (1990) noted that the vernal pool ecosystem fluctuates within and between years in response to the changes in rainfall, temperature, and complex species interactions. Total seasonal rainfall contributes largely to the amount of variation in the pool and the individual populations of species that occupying it. However, the biota of a pool is also strongly influenced by the interactions between other physical features and among the plants and animals themselves.

5.6 Physical improvements, Previous Enhancement, and Management History

An above ground water reservoir is located at the base of a large knoll west of Skunk Hollow and several dirt roads cross the Rancho Bella Vista property. No other physical improvements or enhancements exist on the site. Much of the non-native grassland areas surrounding Skunk Hollow have been, or are currently dry-farmed for grain crops. Evidence exists that the vernal pool basin has also been tilled in the past, generally during prolonged drought periods. No other active management of the property has occurred to date. Areas surrounding the Rancho Bella Vista property consist of low density residential housing and several ranches to the north, east, and south of the project area.

5.7 Current Issues

The potential adverse effects of development surrounding the Skunk Hollow Mitigation Bank property on the Riverside fairy shrimp, and to a lesser extent the vernal pool fairy shrimp, are primary concerns. Specifically, a reduction in the size of the watershed could result in a corresponding reduction in the pool's inundation period (Zedler *et al.* 1990). This could mean that the pool would not persist long enough in some years to

allow completion of the Riverside fairy shrimp's life cycle (estimated at 20+ days under field conditions). Simovich and Fugate (1990) concluded that a minimum inundation of 60 days after temperatures reach about 59 degrees Fahrenheit is needed for the species to be successful. The Rancho Bella Vista project under the revised conceptual land use plan is expected to result in the loss of about 7.0 ac (2.8 ha) of vernal pool watershed. An additional 11.8 ac (4.8 ha) will be impacted off-site on the Johnson and Roripaugh ranches combined. The Rancho Bella Vista project effects amount to approximately 3.8 percent of the entire watershed for Skunk Hollow. Cumulative impacts from the project and the activities at the Johnson and Roripaugh ranches total approximately 10.1 percent. Based on a study of the pools hydrology performed by Riggan (1989) it appears that the loss of 10 percent of the pool's watershed will have negligible impacts on pool size and, as a result, will likely have little if any direct impact on the fairy shrimp populations (McCollum Associates *et al.* 1995).

Management strategies at Skunk Hollow could also have a profound influence on the local populations of *Orcuttia californica*. Protection of the habitat, removal of disturbance from plowing, and possibly control of the introduced grass *Crypsis niliaca* may actually permit a large increase in the population. However, the species peaks in abundance at higher elevations of the pool, and could be adversely affected by any reductions in inundation frequency and depth that might result from a reduced watershed.

Development of the area surrounding Skunk Hollow could result in a number of indirect impacts to Skunk Hollow. These impacts could include degradation of the habitat during active construction because of increased noise and dust, night lighting, polluted runoff, human intrusion, and the related issues such as trash and the introduction of non-native weedy species. These same impacts are possible when residences become occupied after construction, along with the introduction of predatory domestic animals and the alteration of the habitat through a change in the frequency of fire.

5.8 Constraints to Management

5.8.1 Legal Constraints

The federal and California Endangered Species Acts and the California Native Plant Protection Act provide protection to a variety of species at Skunk Hollow. Listed species that could be affected by local development include *Allium munzii*, *Orcuttia californica*, Riverside fairy shrimp, vernal pool fairy shrimp, coastal California gnatcatcher, and the Stephens' kangaroo rat. Impacts to these species require permits from the FWS and CDFG. Other sensitive, but currently unlisted, species could be listed before the project is complete, resulting in the need for additional permits. Impacts to drainage areas and vernal pools require approval from the COE and the CDFG under

Section 404 of the federal Clean Water Act and Section 1600 of the California Fish and Game Code. Agreements or permits issued by both agencies under provisions of SP 184 have subsequently expired. Finally, the Rancho Bella Vista project is subject to analysis and approval through the California Environmental Quality Act (CEQA) environmental impact report process.

5.8.2 Financial Constraints

A key element in the success of any large scale conservation program, such as the Skunk Hollow Mitigation Bank, is the identification of adequate funding for the creation and maintenance of the preserve in perpetuity. The costs of a regional program of this scale cannot be borne solely by the property owner. Rather, funding should be provided by a combination of private and public funds. Funding for the Skunk Hollow Mitigation Bank is derived from a number of sources including the sale of mitigation credits, and other development related financial incentives.

The sale of mitigation credits serves as the primary source of funding for Skunk Hollow, assuming the acceptance by FWS and CDFG of these credits as mitigation for off-site development impacts. However, additional funding through innovative development incentives is needed to ensure the success of the program. Such incentives include the transfer and sale of development densities, offset of fees, and the timely issuance of environmental permits for the project. The Rancho Bella Vista project will incur significant development and impact fees. To the extent that these fees can be waived, refunded, or credited by the preserve program, additional funding will be realized.

The PAR (Appendix A) for this program calculates requirements for average annual ongoing expenses, and this level of funding is considered to be the minimum required for revenue to adequately maintain the preserve in perpetuity. The average annual expense allows for savings to cover large costs that occur cyclically, such as fence replacement.

5.8.3 Environmental Constraints

Skunk Hollow is a relatively small preserve that will be nearly surrounded by future development. As a result, the feasibility of implementing a grazing or prescribed program for management/control of invasive exotic plants is in question. Management activities may have to be restricted to manual techniques for vegetation control. However, some very limited grazing or small burns may be possible under the right conditions. Additional consideration will be given to the use of grazing and fire should vegetation monitoring studies indicate an unacceptable rate of invasion by exotic plant species that adversely

affects the native flora and fauna, especially populations of threatened and endangered species.

5.8.4 Social Constraints

The long-term viability of Skunk Hollow will depend on the support of the people who reside near it. If the area is perceived as an unsightly annoyance by these individuals, they may fail to support efforts to improve or maintain it because they are indifferent or antagonistic toward it. Therefore, it is desirable to create a positive feedback situation where the citizens are genuinely interested in preserving the property. To achieve this state, the importance of scale and visual aesthetics must be considered. A small area of vernal pool and annual grassland surrounded by a fence may look like a vacant lot to some people, no matter what the biological significance of the resource within it. Protection of the majority of the watershed should be large enough to convey some sense of the area's relation to the original landscape and allow it to be viewed as a resource worth protecting.

6. Future Potential Growth of the Skunk Hollow Preserve

There are no plans for future expansion of the Skunk Hollow preserve. Growth of the preserve is limited by pending urban development that will essentially surround the property. Opportunities may exist for expansion of other preserves/conservation areas that will be linked with Skunk Hollow.

7. Management Goals and Objectives

7.1 Ecological Objectives

The following ecological objectives are intended to guide the long-term management of the Skunk Hollow Mitigation Bank:

- ▶ Maintain the overall diversity and abundance of the native flora and fauna within the Skunk Hollow preserve. (A certain amount of fluctuation in these parameters from year to year is normal; however, trends may indicate potential future problems, which can be monitored more closely to ascertain whether action is needed.) This objective can be measured by conducting annual monitoring of the flora and fauna, photo monitoring, percent cover estimates, etc., within the vernal pool and adjacent habitat. Special attention will be given to monitoring the status of *Orcuttia californica*, Riverside fairy shrimp, and coastal California gnatcatcher.
- ▶ To the extent necessary, institute management practices that mimic disturbance processes to which the vernal pool/grassland ecosystem is adapted (i.e., grazing and fire). A primary goal will be to control the establishment and spread of invasive exotic plant species.

- ▶ Protect and monitor the integrity of the vernal pool by monitoring the pool's watershed and the water quality of runoff entering the pool.
- ▶ Promote the long-term viability of the vernal pool/grassland ecosystem, including the entire component of native species of flora and fauna.

7.2 Programmatic Objectives

The following programmatic objectives are designed to guide the management of the Skunk Hollow Mitigation Bank in perpetuity:

- ▶ Increase awareness and build a supportive constituency for the Skunk Hollow preserve within the planned communities adjacent to the property.
- ▶ Develop a public access/interpretive program for the preserve that will discourage vandalism and trespass into the vernal pool area, aid in ensuring that uses of the site are appropriate, and integrate preserve management with the needs of the local community.
- ▶ Promote the use of Skunk Hollow as a "laboratory" for testing and assessing management techniques and practices that will benefit *Orcuttia californica*, Riverside fairy shrimp, vernal pool fairy shrimp, and other sensitive species within the area.

7.3 Facilities Maintenance Objectives

All proposed fences, trails, signs, and interpretive infrastructure will be maintained in perpetuity to ensure protection of the property and its resources, and to carry out the educational objectives of the project.

8. Management Strategies

Management strategies constitute the heart of the land management program by detailing the actions that can and should be implemented to achieve the overall goals and objectives for management of Skunk Hollow. In certain cases, management strategies will consist primarily of obtaining sufficient information (through research, surveys, or monitoring) to determine the appropriate action. In other cases, when complex or detailed management programs are proposed, the strategy will be to develop a plan specific to that activity, such as a grazing or prescribed burn plan. Each management strategy is likely to achieve more than one management objective and each objective will require several strategies to succeed.

8.1 Recommendations on Species Requirements and Management

The following activities and studies will be conducted to monitor and protect the sensitive resources at Skunk Hollow, and to fulfill the management objectives of the project:

- ▶ Conduct botanical and invertebrate surveys to establish a baseline of preserve conditions at the outset of conservation management.
- ▶ Conduct annual monitoring of plant and invertebrate populations that will provide quantitative data on trends in species composition, diversity, and abundance. Use these trends to make adaptive management decisions and adjustments to management practices. For example, implement a program to eradicate exotic plants and animals (e.g., bullfrogs) when they are observed in the preserve.
- ▶ As necessary and appropriate based on monitoring results, mimic historic disturbance processes to which the vernal pool/grassland community is adapted. The goals will be to promote native species diversity and control invasive exotic plant species. The small size and proximity to development of the preserve will necessitate that any disturbance strategies be controlled imitations of natural processes, such as prescribed burns, livestock grazing, mowing, or a combination thereof. If absolutely necessary, and as a last resort in the event other tools are infeasible or ineffective, herbicides may be considered as an additional measure for control of exotics.
- ▶ Use “buffer management” to closely coordinate road maintenance and hydrological protection measures within neighboring communities.
- ▶ Develop a public access program in cooperation with the Mitigation Bank Review Team (MBRT) that will aid in the achievement of the preserve management objectives. Specifically, control access, and where necessary limit access of people, vehicles, and domestic pets to the vernal pool area. Zedler *et al.* (1990) proposed a series of barriers that would allow human access to the perimeter of the vernal pool but would preclude access to the pool itself. The concept is as follows:

“A narrow outer perimeter is considered to be sacrificed, that is, to receive frequent disturbance and therefore to require relatively intensive management. A fence at this outer perimeter that excludes cars is essential. Pedestrian traffic, however, would not be prevented, so that the natural area can be approached on foot. A second fence at the outer edge of the reserve would limit pedestrians to gated entry points and exclude other classes of vehicles, especially motorcycles. A third unobtrusive, inner barrier would serve to encourage pedestrians not to enter the immediate vicinity of the pool. The

general concept is based on a recognition that it is desirable to have controlled and sensitive use of the reserve but impossible to prevent some degree of disturbance, including occasional vandalism. The aim is to rely on distance to attenuate the frequency and intensity of disturbance so that it is reduced to an acceptable level in the vicinity of the pool."

- ▶ Develop public information materials and programs including: 1) a brochure that describes the natural resources, areas of special interest, and prohibited activities within conserved habitats; 2) a landscape and fuel break planning brochure for homeowners and homeowner associations adjacent to the conserved habitats, providing them with information about which plant species to use or avoid; 3) nature trails along or through Skunk Hollow; and 4) identification of study areas within the preserve to be used for public education purposes.
- ▶ Monitor the progress of developments bordering the preserve as they are planned and implemented.
- ▶ Identify opportunities for restoration and enhancement of the vernal pool/grassland community.
- ▶ Develop a fire management program in consultation with the County of Riverside Fire Marshall and appropriate wildlife agencies to: 1) avoid catastrophic fires within conserved habitats; 2) develop alternatives for reducing fuel loads; 3) minimize impacts to conserved habitats from fire management programs for adjacent land uses; and 4) if prescribed burns are implemented, develop "optimal" fire regimes for key sensitive species.

8.2 Adaptive Management

Adaptive management is a process whereby results of management actions are regularly assessed by monitoring certain aspects of the system and determining whether management objectives are being achieved. If they are failing to reach the intended goal, management practices are changed or modified as needed. Research may be appropriate in some cases when information gaps are severely limiting management effectiveness or options.

In the case of a newly established preserve, such as Skunk Hollow, one of the most important aspects of monitoring is gathering initial detailed baseline data. Establishing a baseline is essential in order to draw any future conclusions about the effects of management or changes noted in the system. Baseline information gathered may often be more detailed than the information gathered through long-term monitoring.

Baseline data provide information that is necessary to make future decisions concerning where, what type, and the frequency with which future monitoring activities will be conducted.

Inventory and monitoring are used to track the condition of targeted habitats and populations relative to the baseline condition and ecological goals that have been set for them. An inventory provides a list of species/community occurrences. Monitoring is broadly used to describe a host of field activities conducted for the purpose of collecting data on the status or results of various projects, activities, and habitats. Scientific research in natural areas are usually oriented toward answering specific management-related questions concerning the site, although some sites may provide opportunities for conducting basic research that contributes to an overall understanding of ecology.

8.2.1 Inventory

Several recent inventories provide adequate baseline information for the Skunk Hollow property (Riggan 1989, Zedler *et al.* 1990, Eng *et al.* 1990, Simovich and Fugate 1990, MBA 1993, McCollum Associates *et al.* 1995). Additional information will be acquired over time as part of the ongoing monitoring program.

8.2.2 Monitoring

The following monitoring program is recommended for the Skunk Hollow preserve in order to determine the future effects of management practices and surrounding land use activities on the biota of the preserve. Parameters to be examined include species richness and abundance, and the overall condition of the vernal pool within the preserve (i.e., pool surface area, water temperature, depth, pH, duration of ponding, and turbidity). The interagency MOA for the Skunk Hollow Mitigation Bank requires that monitoring and management will be conducted for a period of 30 years. The frequency of monitoring activities, however, is flexible.

Depending upon resources available, monitoring could be conducted in the range of every week to once annually to every two to five years. Variable weather patterns from year to year and lack of historical data on the extent of variance of parameters being monitored are factors which can make long-term data difficult to interpret, particularly as the frequency of monitoring decreases. All of these factors will be considered in setting up the monitoring protocol. Because vernal pool plant cover can vary dramatically depending on environmental conditions, we recommend annual monitoring of vegetation and wet sampling of invertebrates within the vernal pool.

Monitoring Objectives: The monitoring objectives are as follows.

- ▶ Provide feedback to management, in perpetuity, of the condition of the natural resources, as well as the effects of management actions on the system;
- ▶ Ascertain that any management practice implemented (e.g., grazing, mowing, prescribed burns) is achieving its stated goals of enhancing native plant and animal diversity while reducing invasive exotic species;
- ▶ Identify trends over time that would indicate negative changes in animal or plant community structure or abundance; and
- ▶ Identify changes in conditions of the vernal pool, including surface area, duration of ponding, pH, temperature, depth, and turbidity.
- ▶ Identify problems, such as new exotic species invasions, in the early stages in order to maximize the chances of successfully addressing the problem.

Proposed Monitoring Studies: The following monitoring studies are proposed for meeting the monitoring objectives for the property and are itemized in the PAR (Appendix A).

- ▶ Develop monitoring programs that generate data that are comparable to those presented by Zedler *et al.* (1990) for plant species and vernal pool physical characteristics, and Simovich and Fugate (1990) for invertebrates;
- ▶ Monitor populations of Riverside fairy shrimp and other vernal pool invertebrates through annual wet sampling. Sampling should be conducted at least every two weeks throughout the vernal pool season. (Dry sampling is not recommended for reasons of cost, as well as the current emphasis in using this technique for characterizing project/mitigation lands in one season);
- ▶ Concurrent with wet sampling for fairy shrimp, pools can be checked for the presence of larval stages of amphibians, particularly species of concern such as the western spadefoot toad (*Scaphiopus hammondi*) and the presence of exotic species such as bullfrog (*Rana catesbeiana*);

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- ▶ Design and implement a repeatable procedure for monitoring physical characteristics of the vernal pool including, surface area, duration of ponding, water depth, turbidity, pH, and temperature. For example, establish permanent stations to be sampled annually during the ponding season.
- ▶ Monitor overall site conditions using photo-documentation. The entire mitigation bank property should be photographed from permanently-established stations that are placed to ensure complete coverage of the property. Photographs should be taken from all stations twice during the vernal pool inundation season (i.e., during winter and spring);
- ▶ Monitor vegetation within the vernal pool/grassland community using either a frequency or estimated cover class method at randomly placed quadrats (see above reference to Zedler *et al.* 1990). Cover class estimates generally reflect real conditions more accurately than frequency data, although they can be less precise. Frequencies tend to be less accurate because they can vary dependent upon the size and shape of the quadrat used for sampling. Using nested frequencies (e.g., using a minimum of three different sized quadrats) can eliminate some of this bias, but not all. The use of nested frequencies is also more labor intensive than simple frequencies. Vegetation monitoring will require development of a detailed monitoring protocol in consultation with a botanist and statistician to ensure that the data are adequate for statistical analysis;
- ▶ Monitor distribution and abundance of *Orcuttia californica*, and additional occurrences of other rare plants, within the preserve including, but not limited to, presence/absence determination, counting of individual plants, and sampling quadrats;
- ▶ Record incidental observations of all additional species observed within the preserve during field studies, particularly bird species. Birds play a significant role in the maintenance of some vernal pool species, especially by acting as dispersal agents. The persistence of some organisms may depend on occasional re-introductions by transient birds, or on the introduction of specific alleles needed to adapt to climatic changes or introduction of novel disease organisms;
- ▶ Develop a record keeping system that will ensure consistent documentation of incidental observations, including time of year, habitat

use by species, significant behavior, name of observer, and other relevant factors;

- ▶ Record detailed weather data including annual precipitation levels, temperature, wind direction/velocity and precipitation amounts for days on which monitoring occurs. Catalog monitoring data and analyze annually to determine if changes from year to year represent long-term trends or potential concerns for management.

8.2.3 Research

No intensive research studies will be conducted other than those activities associated with the monitoring program described above.

8.2.4 Assessment

Monitoring results will be assessed annually and summarized in the annual report. CNLM will work cooperatively with the MBRT to refine and adapt management strategies and implement remedial actions as appropriate.

8.3 Restoration, Enhancement and Reintroduction

No restoration of habitats or reintroduction of any species are anticipated at this time. Enhancement efforts will likely be restricted to those measures that protect the preserve from adverse human impacts (e.g., barriers, fences, signs) and the control of invasive exotic plant and animal species as described below.

8.4 Invasive/Exotic Pest and Plant Species Control

Zedler *et al.* (1990) conducted field observations in 1990 of the vegetation at Skunk Hollow. They reported that 42 percent of the observed species were weedy or exotic. Four of the five most abundant species are introduced, and the area gives the appearance of being dominated by introduced annual grasses. However, germination experiments suggested that the weedy component was less than half (16-19 percent) of that observed in the field during the dry period when the field study was conducted. In the germination studies, the only non-native species among the top 10 most abundant species was the aquatic grass, *Crypsis niliaca*, which occasionally occurs along the margins of fluctuating lakes in California (Mason 1969, Munz 1974). Zedler *et al.* (1990) also speculated that eradication or reduction of *Crypsis niliaca* could permit a large increase in the population of *Orcuttia californica*. Furthermore, a reduction in disturbances such as plowing is expected to result in an increase of native species, especially along the margins of the pool.

A program will be designed and implemented for control of *Crypsis niliaca*, bullfrogs, and other invasive exotic plants and animals, as necessary to maintain populations of native flora and fauna, especially *Orcuttia californica*. Potential measures for control

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of exotic plants include a limited program of grazing, prescribed burns, mowing, and treatment with herbicides. Possible methods for removing bullfrogs, if and when they are discovered in the pool, include netting and gigging.

8.5 Guidelines for Sensitive Species/Sensitive Habitats

8.5.1 Vernal Pools

Vernal pools are shallow landscape depressions that fill with water during the winter and dry out during the spring, sometimes filling and emptying multiple times during the growing season. These ephemeral pools support one of the most unique and distinctly Californian plant communities with a biota adapted to the extremes of periodic inundation and absence of water. Vernal swales are distinguished from pools by an outlet that allows water to drain from the swale; They are typically larger depressions where characteristic vernal pool species are found and whose hydrology is characterized by relatively greater overland flow and greater watershed than that of most vernal pools.

A specially adapted flora of about 200 species, including some of the state's rarest and most unusual plants, have evolved within these habitats (Holland 1978, Jones & Stokes 1990). Approximately 91 percent of vernal pool species are considered native to California, and 55 percent are endemic to the state (Holland 1976). These habitats also support endemic species of crustaceans and bees (see Riverside Fairy Shrimp Guidelines below).

Vernal pools have been greatly reduced from their original extent in California through conversion to agriculture or development. It is estimated that today only 5-30 percent of the Central Valley's vernal pools remain (Holland 1978; Jones & Stokes 1990). Vernal pool habitat types are also found in Chile, South Africa, Australia and the Mediterranean Basin; however, the diversity of specialist vernal pool flora in these places cannot compare with the richness found in California's vernal pools.

Optimal Habitat Conditions: High quality vernal wetlands are notable for their relatively high composition of native species as compared to surrounding grassland communities on uplands or mounds where introduced species often comprise the majority of species present.

The ephemeral nature of vernal pools and swales excludes fishes; consequently, they are refugia for a variety of creatures that have never evolved mechanisms to cope with large predators. In addition, vernal pool fauna can be characterized as able to tolerate extremes of temperature, are resistant to desiccation, and are equipped with extraordinary dispersal mechanisms.

