RONALD W. CASPERS
WILDERNESS PARK
GENERAL DEVELOPMENT PLAN PHASE III
HABITAT CONSERVATION PROGRAM

Submitted to:

HARBORS, BEACHES AND PARKS DISTRICT
ENVIRONMENTAL MANAGEMENT AGENCY
COUNTY OF ORANGE
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1.0 INTRODUCTION

A General Development Plan for the Phase III area of R.W. Caspers Wilderness Park was approved by the Board of Supervisors November 5, 1985. The Final Negative Declaration for the Phase III Plan dated August 19, 1985 requires the preparation of a Habitat Conservation Program prior to Board approval of any plans or specifications for Phase III improvements. As required by the Negative Declaration, the Habitat Conservation Program (HCP) shall be developed and distributed to all interested parties for review and comment. Following the review period, the HCP shall be submitted to the Manager, Environmental and Special Projects Division of the Environmental Management Agency for approval.

The purpose of the Habitat Conservation Program as stated in the Negative Declaration is that the HCP shall function as an operational program to ensure protection of existing biological communities and sensitive plant and animal species. The stated objectives of the HCP state that the HCP will implement, at the minimum:

- An ongoing review of critical habitat areas
- A conservation plan, which identifies site specific operational directives for the protection of habitats which provides a mechanism for review and adjustment of directives in light of new information.

On February 24, 1987, the Board entered into an Agreement with Bruce H. Lewis, A.S.L.A. to prepare a Habitat Conservation Program for Ronald W. Caspers Wilderness Park Phase III.

The submitted plan was prepared in collaboration with the following consultants: Karlin G. Marsh, Botany; Steven A. Loe, Wildlife Biology; Peter H. Bloom, Avian Biology; and Ted L. Hanes, Ph.D, Chaparral Ecology.

2.0 ENVIRONMENTAL SETTING AND IDENTIFICATION OF SENSITIVE HABITAT AREAS

2.1 LOCATION

The 2,125 acre Caspers Park East is located in southeastern Orange County approximately 9 miles northeast of San Juan Capistrano. The property is bounded by Ortega Highway (State Route 74) to the west, existing Caspers Wilderness Park to the north, Ortega Rock Mine to the northeast, Cleveland National Forest to the east and Rancho Missio Viejo to the south. Nichols Institute is a partial inholding on the northwest.

Caspers Park East is located in Township 7 South, Range 6 West, in portions of Sections 7, 8, 16, 17, 18, 19 and 20, as depicted on the Canada Gobernadora, CA USGS Quadrangle Map. The site is in the foothills of the Santa Ana Mountains.

2.2 PHYSICAL SETTING

2.2.1 Topography

The property is topographically divided by Lucas Canyon and a smaller parallel canyon to the south. Both canyons discharge southwesterly through culverts beneath Ortega Highway to confluences with San Juan Creek, the flood plain of which comprises the western topographic boundary of the site. Discharge from both drainages is generated primarily onsite with the canyon bottoms providing ready access into the property. These canyons divide the westerly two-thirds of the proprty into three principal ridges, the summit gradients of which are rather gently inclined southwesterly and readily traversed on foot. On-site elevations range from 1,453 feet above sea level near the southeasterly corner of the property to 400 feet at the southwesterly corner.

Property is topographically divided into four principal terrain elements:

<u>River Terraces</u> located adjacent to the Ortega Highway which are composed of two elevation levels are further described as the southern, central and northern terraces;

<u>Broad Canyon Bottoms</u> which include Lucas Canyon and the unnamed canyon to the south and the easterly edge of the San Juan Creek floodplain;

<u>Gentle Ridge Crests</u> which include the principal ridge crests;

<u>Deeply Dissected Terrain</u> which includes all of the easterly half of the Lucas Canyon drainage and portions of the remainder of the site.

2.2.2 Summary of Geological Setting

Historically, the volcanic and other igneous rocks making up the core of the Peninsular Range Geomorphic Province within which the park property is located represent magmatic arc-trench terrain created east of a subduction zone which was active along the coast of North America in late Jurassic time (160 million years ago). The subduction zone formed as two tectonic plates collided, the western plate being forced beneath the eastern plate. When volcanism ceased in Early Cretaceous time, largely non-fossiliferous river sediments were deposited over the earlier volcanic rocks as a result of regional downwarping along the plate boundaries. Transgression of the sea in Late Cretaceous time (70 million years ago) allowed fossiliferous shallow marine sediments to be deposited over the river sediments. Local fluctuations of this ancient shoreline are recorded by shelly fossils within the property. The rock record for the area ends here, as no younger sediments were preserved due to nondeposition and erosion.

Much later, a Quaternary-age (125,000 years ago) river deposited materials along the San Juan Creek drainage. These materials are now at a higher elevation than the present river due to regional uplift and lowering of sea level in Recent time. Even more recently, landslides and residual soils developed.

2.2.3 Meteorology

Casper's Wilderness Park has a Mediterranean-type climate characterized by warm summers and mild winters. Rainfall in the park's vicinity averages 12 to 14 inches annually with most precipitation falling between November and April.

Mean temperatures vary from 54 degrees in the winter to 67 degrees in the summer. Prevailing wind velocities vary from two to 12 mph, with onshore breezes occurring during the day and offshore winds at night.

Strong warm, dry winds, known as Santa Anas, occasionally occur in spring and fall. During these times, the wind changes direction and the warm, dry desert air rushes toward the coast, sometimes with velocities as great as 60 mph. This desiccating air reduces humidity and represents a critical component in the fire weather responsible for wildfires."

Caspers Park East "represents a diversity of microclimate types as evidenced by the change in landform types and vegetative cover. North facing canyon slopes and the unnamed canyon which support groves of sycamore and oak trees represent the most favorable microclimate for recreation activities. The more exposed ridges and stream terraces offer limited shelter from wind and sun.

2.2.4 Summary of Biological Setting

Biotic Communities

The Park has seven biotic communities which have been categorized into canyon floor habitats and upland habitats. These communities occur primarily as a result of diversity of topography and relationship to soil moisture. The canyon floor habitats consist of alluvial scrub, riparian woodland and southern oak woodland. The upland habitats contain coastal sage scrub, chaparral, native and adventive grassland, and xeric ridgetops and rock outcroppings.

Acreages for each community are given in Table 1 . Overview descriptions follow.

1. Alluvial Scrub

Alluvial scrub is the characteristic plant community of dry rocky or gravelly floodplains away from moist stream banks. Though near water, its species for most part do not depend on stream underflow. Characteristic flora of this "floodplain desert" are scale broom (*Lepidospartum squamatum*), several kinds of cacti (*Opuntia*), California brickellbush (*Brickellia californica*), a variety of cudweeds (*Gnaphalium*), sandwash groundsel (*Senecio douglasii*) and several kinds of coastal sage scrub and chaparral plants. Coulter's matilija poppy (*Romneya coulteri*) is a special status species of the association.

Fauna of alluvial scrub can include the rare southwestern toad (*Bufo microscaphus*), orange-throated whiptail (*Cnemido-phorus hyperythrus*), San Diego horned lizard (*Phrynosoma coronatum blainvillei*) and Pacific pocket mouse (*Perognathus longimembris pacificus*). A variety of more common fauna also occurs here.

Alluvial scrub is well developed on the Lucas Canyon floodplain.

2. Riparian Woodland

On higher stream benches, not subject to regular abrasion, open woodland habitats develop. These are characterized by scattered clusters of California sycamore (*Platanus racemosa*) trees with an herbland-grassland understory. Because these areas have been subject to cattle impact, many contain undesirable weedy components, especially milk thistle (*Silybum marianum*), which forms dense stands within the dripline of many sycamores.

Shrub components of the riparian woodland include Mexican elderberry (*Sambucus mexicana*) and mulefat, as well as the ubiquitous laurel sumac (*Malosma laurina*). Thickets of

California wild rose (Rosa californica), giant rye (Elymus condensatus), poison oak (Toxicodendron diversilobum) or branching phacelia (Phacelia ramosissima) are common on the floors of tribuary canyons between the sycamore clusters.

Sycamore woodlands in the Park are not usually distinct from southern oak woodlands, but instead form a blend. Generally, the sycamore component of mosaic riparian-oak woodlands will occur closer to the edge of the lower alluvial floodplain than the oak component, which is concentrated at the back edge of the stream terrace and up the lower slope of the flanking canyonside's north-facing slope. In the smaller canyons, such as the unnamed canyon north of Rancho Carrillo Road, sycamores line the weakly defined drainage channel.

The oak and sycamore woodlands function as an ecological unit where they occur on the property. However, sycamore trees within that unit are significant habitat resources for cavity nesting birds.

Among raptors the red-bellied red-shouldered hawk (Buteo lineatus elegans) is a common inhabitant of the riparian woodlands in San Juan Canyon. Tree hole nesting and other songbird species constitute a significant proportion of its dietary intake. The American kestrel (Falco sparverius), screech owl (Otus kennicottii) and barn owl (Tyto alba), also occur here (adapted from Marsh and Roberts, 1984).

3. Southern Oak Woodland

The dominant and indicator species of this community is coast live oak (Quercus agrifolia), an evergreen species with glossy green, cupped leaves and blackish heavy bark. Occasionally occurring is a second oak which is a hybrid between Engelmann (Q. engelmannii) and scrub (Q. dumosa). These white oak hybrids are small trees with gray scaly bark and variously formed spiny leaves which are semi-deciduous. A single pure Engelmann oak grows in Lucas Canyon.

Oak trees occasionally occur in dense "closed canopy" stands with heavily shaded understories barren of vegetation. In areas where some light penetrates to the woodland floor, a variety of mesic (moisture-dependent) herbs are found. These include common chickweed (Stellaria media), miner's lettuce (Claytonia perfoliata), western lady's mantle (Alchemilla occidentalis), California hedge parsley (Caucalis microcarpa), Pacific sanicle (Sanicula crassicaulis) and Carolina geranium (Geranium carolinianum). In areas of grassy understory, ripgut brome (Bromus diandrus) is usually abundant.

On sheltered, moist banks shaded by oaks or by large chaparral shrub species associated with oaks, other, more

delicate herbs, along with several kinds of ferns are found.

The woodland community possesses in its understory or about its margin a shrub understory of fuchsia-flowering gooseberry (Ribes speciosum), toyon (Heteromeles arbutifolia), holly-leaved redberry (Rhamnus ilicifolia) and poison oak (adapted from Marsh and Roberts, op.cit.).

Oak woodland fauna include several kinds of salamanders, lizards and snakes, bats, rodents such as dusky-footed woodrat (Neotoma fuscipes) and California mouse (Peromyscus californicus), mule deer (Odocoileus hemionus), a rich variety of songbirds and the sensitive black-shouldered kite (Elanus caeruleus).

Oak and riparian woodlands are found on the north-facing slope of San Juan Canyon at the north edge of Caspers Park East, in the North Cove, in Lucas Canyon, in the cove between the north and south segments of the Central Terrace Group Camp and in the unnamed canyon. Individual oak trees are scattered along the west edge of the property adjacent to Ortega Highway, and a few trees and clusters are located within the terrace group camps.

4. Coastal Sage Scrub

Coastal sage scrub is the most widespread biotic community on site. It is found primarily on south-facing slopes and also on many of the ridge tops. Coastal sage scrub vegetation is composed primarily of waist to chest high suffrutescent (woody at the base) shrubs which are drought dormant and fairly shallow-rooted. The community typically occurs on "poor" stony soils, in contrast to grassland which best persists on deep soils with incorporated clay or clay loam.

Common suffrutescent shrubs of the community are California sagebrush (Artemisia californica), black sage (Salvia mellifera), California buckwheat (Eriogonum fasciculatum), and white sage (S. apiana). Black sage often forms pure stands which may be related to exposure or to differing substrate.

Laurel sumac is a woody evergreen-leaved shrub which is an integral part of this community on site. Many young sumacs are present on the scrubland slopes of San Juan Canyon. Bush mallow (Malacothamnus fasciculatus) is a second woody shrub occasionally encountered.

Western prickly pear (Opuntia occidentalis) is quite abundant in the community, especially on ridge tops.

Coastal sage scrub and chaparral share many vertebrate fauna species, though types like certain lizards and avian

and mammalian cactus dwellers are more prone to be found in the more arid habitat of the former community. Chaparral, on the other hand, shares many kinds of fauna with oak woodland; these generally do not occupy coastal sage scrub habitats.

Reptiles of the coastal sage scrub include many also found in alluvial scrub; side-blotched lizards (Uta stansburiana), western fence lizards (Sceloporus occidentalis), and rattlesnakes (Crotalus spp.) are common.

Birds frequently observed in the community include bushtits (Psaltriparus minimus), cactus wrens (Campylorhynchus brunneicapillus), brown towhees (Pipilo fuscus), and California quail (Callipepla californica).

Coastal sage scrub mammals may include desert packrats (Neotoma lepida), deer mice (Peromyscus maniculatis), cactus mice (P. eremicus), Pacific kangaroo rats (Dipodomys agilis), brush rabbits (Sylvilagus bachmani), coyotes (Canis latrans), and bobcats (Lynx rufus) (adapted from Marsh and Roberts, op.cit.).

5. Chaparral

Chaparral is composed principally of evergreen-leaved large woody shrub species with deep tap roots.

Water requirements for this community are somewhat greater than for coastal sage scrub, since it is not drought dormant. On the project site, old growth chaparral is found on the north-facing slope of Lucas Canyon. There is some difference in community composition on site which appears to be related to elevation and proximity to montane floristic influence. At lower elevations, as near canyon mouths, the community is a melange of lemonadeberry (Rhus integrifolia, here nearing its inland outpost in south Orange County), holly-leaved redberry, toyon, laurel sumac, some scrub oak (Quercus dumosa) and a substantial admixture of black sage from the coastal sage scrub community. As higher elevations are reached, scrub oak becomes dominant. Toyon and some redberry are still present and new species are encountered. The showiest of these in spring are California lilacs (Ceanothus spp.), which become dominant along tributary drainages which drop steeply down the upper Lucas Canyonside.

Although chaparral presents a dense and generally impenetrable aspect, small mesic openings are found on slopeland. These contain grasses and herbs.

As noted above, chaparral shares many fauna species with coastal sage scrub and also with southern oak woodland (adapted from Marsh and Roberts, op.cit.). Of particular management significance are late successional stage chaparral bird group members. These are fairly sedentary species

which depend on old growth habitat. Some examples are wrentit (Chamaea fasciata), California thrasher (Toxostoma redivivum) and black-headed grosbeak (Pheucticus melanocephalus). Many kinds of smaller fauna depend on old growth stands for cover and protection from predators, which have difficulty penetrating the intertwined brush.

6. Grassland

Marsh and Roberts, 1984 reported that most of the site's grasslands were dominated by Eurasian annual species, though some native purple needlegrass (Stipa pulchra) plants were dispersed through the stands. Within the subsequent three years, following removal of cattle from the Park, the recovery of native perennial grassland on the uplifted terraces here has been dramatic. Because of this recovery, campsites on the Central and Northern Terrace which were not in critical habitat when the plan was developed are in critical habitat today. The only areas where recovery is slow are sites where climax Eurasian grassland species (wild oats, Avena spp., ripgut brome, Bromus diandrus) have a firm foothold or where cattle disturbance was very substantial (as just south of the Rancho Carrillo Road underpass).

The grassland on the mountaintop bald north of Lucas Canyon is still dominated by adventive elements. Cardoon (Cynara cardunculus) is still present there, but the percentage of cover of the noxious thistle is down to around 50% in the bulk of the stand.

Common native grassland elements on site are purple needlegrass, foothill needlegrass (S. lepida) in south-facing slope coastal sage scrub-grass mosaic, Cleveland shooting stars (Dodecatheon clevelandii), blue-eyed grass (Sisyrinchium bellum) and wild hyacinth (Dichelostemma pulchella).

Common adventive grass elements are oats, bromes (Bromus spp.), foxtail barley (Hordeum leporinum), filarees (Erodium spp.), smooth cat's-ear (Hypochoeris glabra), mustards (Brassica spp.) and several late summer forbs such as tarweed (Hemizonia spp.) and doveweed (Eremocarpus setigerus).

The site's grasslands are found on fairly deep moisture-retentive terrace and slope soils containing clay, clay loam and cobble. A subsurface hardpan hindering downward water percolation may also help to keep these environments moist into middle spring on the terraces.

Pacific rattlesnakes (Crotalus viridis), gopher snakes (Pituophis melanoleucus) and western skinks (Eumeces skiltonianus) are among grassland reptiles present. Characteristic birds are foraging raptors and ground-

dwelling species such as water pipit (Anthus spinoletta), western meadowlark (Sturnella neglecta), horned lark (Eremophila alpestris) and several sparrows, including the Blue-listed grasshopper sparrow (Ammodramus savannarum). Badger (Taxidea taxus) is a sensitive grasslands mammal tentatively placed on site. Large numbers of several small rodents occur; the most obvious, Botta pocket gopher (Thomomys bottae). Audubon cottontails (Sylvilagus audubonii) are also present. Coyotes and other large mammals are seen in the grasslands.

7. Xeric Ridgetops and Rock Outcrops

These unusual habitats are found in several areas of Caspers Park East. They harbor outpost populations of desert and interior cismontane plants, one endangered succulent and typical montane and cismontane xeric habitat species.

Some typical components of xeric ridgetop habitats are Parish's three-awn grass (Aristida parishii), an interior cismontane and desert plant, odora (Porophyllum gracile), a pungent-smelling gray-green low growing suffrutescent shrub which is also typically a desert species, and fringed spineflower (Chorizanthe fimbriata), an herb with delicately fimbriate dusty rose sepals.

Other xeric ridgetop species include a variety of unique grasses, herbs, suffrutescent shrubs and other forms. Characteristic grasses, in addition to Parish's three-awn are beard grass (Bothriochloa barbinoides), annual muhlenbergia (M. microsperma), crested stipa (Stipa coronata) and foothill needlegrass (adapted from Marsh and Roberts, op.cit.). Whipple yucca (Yucca whipplei), cacti, and a number of spring-flowering herbs and subshrubs are also found in the xeric association. Several succulent dudleyas are present; one, many-stemmed dudleya (Dudleya multicaulis) is listed rare and endangered by CA Native Plant Society. A non-flowering plant, Bigelow spike moss (Selaginella bigelovii) is common in rock outcrop habitats.

Pacific pocket mouse and San Diego horned lizard are two sensitive vertebrate species known from xeric habitats in Caspers Park West. Both may occur here. The ridge crest barrens are natural dispersion corridors for many kinds of mammals, including large predators.

Cliffside outcrop habitats are favored by bats which may include two state species of special concern, and by owls, swifts and swallows, and ravens (Corvus corax).

As well as the major community and association types on site, there are areas of post-burn and post-disturbance seres. In addition are small areas of wetland hydrophytes, a rather extensive area of scrub-shrub wetland (mulefat,

Baccharis glutinosa) and a small willow (*Salix*) grove, all occurring in response to well, water tank or cattle water trough leakage. An area of natural wetland is found immediately north east of the Park in upper Lucas Canyon, within the Ortega Rock leasehold.

TABLE 1

BIOTIC COMMUNITIES

Map Symbol	Plant Community	Acres	Site Percen
AS	Alluvial Scrub	51.39	3.03
RIP or RW	Riparian Woodland	7.32	.43
O	Southern Oak Woodland	38.59	2.38
CSS	Coastal Sage Scrub	484.00	28.58
CH	Chaparral	555.42	32.80
G	Grasslands	397.14	23.45
B	Barrens & Rock Outcrops	87.05	5.14
RIP/Brush	Riparian Brush	6.43	.38
CH/O	Chaparral/Oak Woodland	6.27	.37
CSS/G	Coastal Sage Scrub/Grassland	40.83	2.41
	Roads & Unclassified Areas	18.92	1.03
	Total:	1,693.36	100.00

2.3 SENSITIVE HABITAT AREAS

Sensitive habitats within Caspers Park East are those sites which contain:

- Biotic communities and associations whose extent are limited in the project region or throughout their ranges.
- Highly vulnerable resources.
- Rare, endangered, limited distribution or locally significant biota.
- Resource areas of high value to wildlife.

As well as sensitive habitats of known occurrence, there may be yet-undiscovered sensitive habitats revealed through further monitoring of the park.

Sensitive habitats known within Caspers Park East and habitats of potential occurrence are summarized below.

1. Sensitive habitats may contain biotic communities and associations whose extent are limited in the region or throughout the range of these habitat types. Examples of limited distribution communities and associations in Caspers Park East are:

   a. Cismontane Native Perennial Grasslands

      Native perennial grasslands are estimated to occupy less than 1% of their former Valley Grassland Community range, in the Great Central Valley and cismontane southern California (Glen Holstein, CA Natural Diversity Data Base, Letter to HCP author Marsh, Oct. 29, 1980). Introduction of Eurasian grasses, overgrazing and agriculture have all contributed to the near demise of the native community.

   b. Southern Oak Woodland

      In 1971 southern oak woodland in Orange County was estimated to occupy only about 1% of its land surface or 5107 acres (Allday, 1971). Development since that date has contributed to some further loss, though oak woodlands are safeguarded as much as possible by development permit conditions of approval.

These valuable habitats are not common in most of the County because of low rainfall. The extent of oak woodlands was greater in the past than now because the County received more rainfall then. After European settlement, the ongoing natural decline was exacerbated by wood cutting for fuel.

On site, these woodlands are vulnerable to understory soil compaction and tree root injury, and undergrowth vegetation loss from trampling.

c. Riparian Woodlands and Wetlands

Allday cites a Department of Fish and Game estimate that in 1963, less than 0.7% of the County's land surface, 3,673 acres contained these valuable habitat types. As well as declining rainfall, a number of man-caused actions have contributed to the near demise of riparian woodlands and wetlands. These include:

- Uptake of groundwater for irrigation in the County's hydrogeologic basins. Groundwater once occurred at such shallow depth that it supported extensive stands of sycamore trees in the basin areas.

- Swamp Draining

  The coastal plain lands in the central and north County contained extensive freshwater marshes and sloughs when the County was first settled. These were drained to provide rich fields for agricultural foodstuffs production (celery, corn, lima beans, etc.).

- Stream Channelization

  In order to maximize the amount of developable land near the County's rivers and streams, many have been straightened and channelized with pipe and wire revetment, riprap, or box culvert and L trapezoidal concrete. The latter methods eliminate subsurface underflow which could otherwise nourish bankside riparian woodlands. These habitats were eliminated along reengineered channels. Flood control practices in Orange County dictate the herbicide spraying of in-channel hydrophyte vegetation on an annual basis.

- Development of Coastal Terraces

  Coastal terrace development has totally eliminated an unusual type of wetland habitat from the County, vernal pools. Many pools formerly existed on the mesas within the Newport Beach area, and some on mesas in Dana Point. Vernal pools contained many

examples of unique flora and fauna. (Some apparent vernal pool remnants occur on terraceland in Caspers Park East.)

d. Xeric "Barrens"; Alluvial Scrub

Xeric barrens are found on some well-drained ridgetops in sandy or cobbly soil, and on marine terrace exposures. These unusual, hostile habitats contain plant and animal species which are unique to them and may harbor outpost populations of desert plants. Certain now rare and endangered flora (such as many-stemmed dudleya and Orange County Turkish rugging) and limited distribution species of concern fauna (such as Pacific pocket mouse, San Diego horned lizard, Phobetus rain beetle) are restricted or near-restricted to these habitats.

Alluvial scrub is a floodplain xeric habitat found in sand, gravel and cobble alluvium with little incorporated humus. Certain fauna species of special concern are found primarily in alluvial scrub and several are found either in alluvial scrub or on ridgetop xeric barrens. These include southwestern toad, spadefoot toad, orange-throated whiptail, as well as San Diego horned lizard and Pacific pocket mouse. Certain now endangered plants are also restricted to the community. One restricted-distribution species occurring in the Park, Coulter's matilija poppy is also a component of the association.

Xeric barrens are naturally restricted habitats whose distribution in the County has been futher reduced by ridgetop firebreak grading in the Cleveland National Forest and elsewhere, and coastal marine terrace development.

Alluvial scrub has suffered the same fate from flood control and urban encroachment as wetland and riparian habitats. In addition, the community occurs atop commercially valuable aggregate deposits and is being removed from many portions of the County's rural area during sand and gravel mining operations. Restoration after these deposits are excavated is not possible, because base levels are reduced to a point near the water table (encouraging riparian mulefat brush growth) and the gravel/cobble substrate required by the association has been removed.

2. Sensitive habitats may contain examples of highly vulnerable resources or rare, endangered, limited distribution or locally significant biota. Some examples of these habitat types in Caspers Park East are:

a. Vulnerable Associations

- Perennial Flower Fields Within Native Perennial Grasslands

  These highly aesthetic areas are vulnerable to trampling (pedestrian, equestrian) and flower picking.

- Oak Woodland Margin Mesic Herb Association

  On site, this sensitive habitat contains an herb species, western Lady's mantle, known within Orange County only from the Park East and from Trampas Canyon several miles southwest (Fred Roberts, Jr., pers. comm.). Miner's lettuce, Carolina geranium and other delicate plants are also components. The woodland edge mesic herb association is vulnerable to trampling, especially in late winter and spring.

b. Habitats of Rare, Limited Distribution or Locally Significant Plants

- Many-stemmed Dudleya

  This species is listed as rare and endangered by the California Native Plant Society (CNPS) and is a Category 2 candidate for Federal listing.

- Coulter's Matilija Poppy

  This showy-flowered shrub is limited-distribution listed by CNPS.

- Engelmann Oak

  Very few examples still exist of genetically near-pure Engelmann oaks in Orange County, though at one time, the species apparently occurred in viable populations in the San Joaquin Hills and the south County Santa Ana Mountains foothills. Generally drying conditions in the County are responsible for its decline here.

- Venegasia

  Only two or three populations of this wild sunflower-like herb are known to exist in Orange County (Roberts).

- Alaska Rein Orchid

  Only a small number of Alaska rein orchid populations are known from mesic woodlands and spring-laced grasslands in the County (Roberts).

c. Foraging and Nesting Habitats of Rare, Limited Distribution or Locally Significant and/or Declining Fauna

- Raptors

  These large birds of prey are declining in numbers in the County because of loss of foraging habitat due to urban development and, to a lesser extent, agricultural type conversion of preexisting rangeland and wildlands. Several are either Blue Listed by National Audubon Society or Fully Protected by the State. The most critical species of concern on Caspers Park East is the black-shouldered kite, reduced from about four pairs in recent years to one pair which failed to breed in 1987. Several others have large nest critical zones and are displaced by proximity of human activity. The most notable of these is the red-tailed hawk.

- Grasshopper Sparrow

  This Blue-listed songbird is rare in the County today because of the rarity of its preferred native perennial grassland habitat.

- Coastal Race of Cactus Wren

  This race is of State special concern (John Gustafson, pers. comm.) and is restricted to coastal southwestern California.

3. Sensitive habitats include resource areas of high value for wildlife, including mammalian predators, omnivores and herbivores, cavity-nesting avifauna group and late successional chaparral avifauna group. Examples of these types of sensitive habitats are:

   a. Woodlands and woodland-savannah in canyons and coves.

   b. Ridgetop dispersion corridors.

   c. Wetlands and artificial water sources (cattle troughs) on and proximal to Caspers Park East.

   d. Old farm roads and existing cattle trails used for dispersion.

   e. Early post-burn chaparral, late successional state chaparral, chaparral openings and chaparral-grass mosaic habitats.

2.4 POTENTIALLY OCCURRING SENSITIVE HABITAT AREAS

As well as known sensitive habitats, others may occur but are yet undiscovered. Some of these are habitats of fauna species of special concern, including several candidates for Federal listing. Potentially occurring sensitive fauna are:

a. Southwestern toad

b. Red-legged frog

c. Pacific pond turtle

d. San Diego horned lizard

e. Orange-throated whiptail

f. San Diego mountain kingsnake

g. Two-striped gartersnake

h. Pacific pocket mouse

i. Bat species

j. Badger

3.0 HABITAT CONSERVATION PLAN RECOMMENDATIONS

1. Monitoring Techniques

A variety of monitoring techniques are recommended to maintain an updated assessment of biological conditions within Caspers Park East. Many of these are qualitative, requiring only knowledge of the species to be tracked. Others are quantitative, requiring some pre-training of those conducting the assessments. Among the purposes of monitoring are evaluation of the success of rehabilitation work, evaluation of the effect of recreational use within or near identified critical habitats, and analysis of successional changes in rangeland vegetation composition in the absence of management, after removal of cattle from Caspers Park East. A change in operations management or rehabilitation method may be predicated on the results of these monitoring studies. Another type of monitoring focuses on expansion of the resource data base for the site. This includes focused searches for sensitive biota not undertaken during the GDP III or HCP field assessments because of time and budgetary constraints. This type of monitoring is now being conducted in Caspers Park West by volunteer Helen Camp. The HCP suggests standardized data collection utilizing CFG Natural Heritage Program Field Survey Forms, and periodic updates to the critical habitats map set as the data base is expanded. Similar map updating of the rare plant habitats map originally prepared by Earl Lathrop for the Trabuco Ranger District was conducted by HCP author Marsh and other biologists working on the Forest. As ecologist W. Walton Wright aptly states, the "rarity" of a particular species is often in inverse ratio to the number of biologists out looking for it.

It is envisioned that most monitoring will be conducted by Park employees, volunteers and consultants. Pre and post monitoring associated with a contracted rehabilitation project should be conducted by the contractor or consultant. It is recommened that a series of workshops be conducted to assist Park personnel and volunteers in the techniques of monitoring. An individual, either employed by Parks and Recreation or contracted on a consultant basis should oversee and supervise both monitoring programs and resource management efforts which are not part of normal Park operations. Unless there is unified direction and supervision, it is expected that the proposals set forth in this habitat conservation program will be implemented only sporadically, counter to the specifications of the mitigated negative declaration for the Phase III GDP.

Some of the types of monitoring techniques recommended in the body of the HCP following, are discussed below. Specific methods employed in the more complicated techniques are discussed in appropriate HCP sections.

a. Qualitative and "Hybrid" Monitoring Techniques

These may employ specimen counts and measurement of habitat size, or only a checklist of flora and fauna, to assess relative diversity over time. They are not as scientifically rigorous as the quantitative techniques discussed below, but are adequate to achieve the particular monitoring goals for which they were designed.

- Focused Searches for Sensitive Biota

  These are intensive field surveys in appropriate habitats at the correct time of year to discover sensitive resources of suspected occurrence or additional localities of sensitive resources known from the Park. A plant or animal field survey form is completed for each locality discovered, and the site is added to the critical habitats map. Plant and animal field survey forms are reproduced in the body of the HCP, following.

- Monitoring of Previously Identified Sensitive Biota Localities

  HCP-mapped critical habitats containing sensitive or rare flora and fauna as well as those localities added later should be monitored annually, unless the species in question is likely to abandon the habitat because of monitoring disturbance. In the case of flora, a plant count and habitat measurement should be conducted. Small fauna may be live-trapped; baited Sherman alumium box traps are used for small mammals and pit traps for lizards. Fauna trapping is a project suitable for a supervised college field biology class. Trapping must be conducted in such a way that the trapped animal is not subject to inhumane treatment, such as being left in the trap too long after capture or being subject to excessive heat or chill.

  Field survey forms should be completed for each monitoring site where sensitive species were found or previously found, even if absent on subsequent surveys. As discussed later, a copy of the field survey form is retained at the Park and should be utilized there for adjustments in management practices, if required. If the taxon scrutinized is included in the California Natural Diversity Data Base Element List, a copy of the field survey form should be sent to the Data Base (address on form).

Copies should also be forwarded to University of California Irvine Museum of Systematic Biology and/or Dr. Peter Bowler, Department of Ecology and Evolutionary Biology, U.C.I.

Among the resources subject to focused searches and followup monitoring are rare plants, regionally sensitive plants, rare or regionally sensitive amphibians, reptiles and songbirds, all raptors (nest sites) and one rare small mammal (Pacific pocket mouse). Raptors should be monitored by a contracted raptor specialist for at least 3 years after facilities are open.

- Mountain Lion Monitoring

  Caspers Park East shall be included in the Park's ongoing monitoring of this animal. This monitoring includes recording and mapping of sightings, tracks and scat.

- Wildlife Critical Habitat and Dispersion Corridor Monitoring

  Weekly spotlight counts of mammals should be conducted by Park personnel during regular night-time patrols of roaded portions of Caspers Park East. The results of these surveys, keyed to specific locations within the Park such as the unnamed canyon and the terrace farm road will provide data on seasonal fluctuations in habitat/dispersion corridor use and the effects of recreational utilization on numbers of fauna continuing to occupy or move through these areas. Species should be identified where possible.

- Checklist Monitoring of Sensitive Habitats

  Specific sensitive habitats near or within recreation areas should be monitored annually. These include xeric flora association sites and cove oak/sycamore woodlands. A checklist of plants and animals within each locality should be prepared prior to opening the camping areas and hiking trail within Caspers Park East. Followup monitoring would include a search for previously identified species, and add new ones found. Presence of new species which are disturbance-indicators as well as disappearance of previously identified climax species would indicate a need for habitat management adjustments.

b. Quantitative Monitoring

This method is to be utilized in areas to be managed (grasslands, chaparral, woodland savannah) as by

burning, mowing, outplanting of appropriate flora, weed eradication and habitat creation (wetlands, vernal pools). Pre and post management monitoring should be conducted by the contracting rehabilitation specialist assisted by Park personnel or volunteers. Monitoring should be continued indefinitely in recreation sites within critical habitats such as native perennial grassland.

The line intercept transect is the monitoring method of choice for most habitat types. This technique yields measurements of percentage of cover and frequency of occurrence of various floristic habitat components. Analysis methods and computation techniques are detailed in Appendix C - pp. C-2. The methods employed should be taught to Park personnel and volunteers which will be conducting the surveys after completion of rehabilitation contracts. The methods should be clearly described and standardized.

In addition to line intercept transects, the quadrat is a useful monitoring tool to assess limited-size areas such as vernal pools, rare plant habitats, xeric barrens flora areas, and oak woodland edge mesic herb bands. Percentage of cover of component species is estimated within a meter square quadrat divided into gridded sections.

In addition to floristic analysis, the fauna of rehabilitation sites should be monitored. Small mammals and some reptiles can be live-trapped. Statistical monitoring of these is probably not necessary; if desired, this involves using a large number of traps (e.g., 300) over a series of nights. Captured animals are marked (toe clipped, ear clipped or marked with indelible pen). Trapping continues until all marked animals are recaptured. Avian counts are conducted on a transect, with the observer halting at predetermined intervals and counting all individuals of each species within his view. Probably adequate for the Park's purposes is the utilization of a species checklist described above, with additional qualitative assessment of relative numbers (uncommon, occasional, common, abundant).

2. Management Strategies

a. Introduction

A variety of management strategies are recommended within the HCP. These include avoidance of critical habitats through facilities design modification and season of use, physical barriers to prevent ingress into sensitive areas, signing of sensitive habitats, environmental interpretation to enlist visitor cooperation, and de-facto avoidance of resources within GDP III-proposed wilderness areas and other locales not served by trails. Also included are a variety of resource enhancement proposals to offset unavoidable impacts within areas served by facilities. These incorporate grassland biotic community restoration, creation of new wetland sites, habitat and foraging ground improvement through noxious species eradication or controlled burning, and enhancement of wildlife carrying capacity by developing more watering sites, revegetating woodland understories, planting more sycamores and oaks, erecting nest boxes and establishing a remote area clean feeding station for turkey vultures.

A mechanism for adjustments of the HCP management recommendations is based on future changes in surrounding land use and Park visitor load, and monitoring results and new research findings which predicate modification.

b. Summary of Management Strategies

- Facilities Design Modification; Landscaping; Use Scheduling

  The HCP does not revise the design of the GDP III, but modifies and refines it as needed, to accomplish habitat and dispersion corridor preservation objectives.

- Southern Terrace Group Camp

  (1) Concentrate use in central open area; plant shade/screening vegetation away from and not linked to the peripheral shrub area; trails from camp to other areas should pass through open areas, not brush. (Mountain lion predation amelioration.)

  (2) Consider shade structures in lieu of or in addition to shade tree plantings. (Unsuitable soil for most trees and shrubs.)

  (3) Consider facility expansion, to include north portion of terrace near Rancho Carrillo Road; securely fence road edge to prevent trespass onto road. (Native grassland protection; delete sites in more sensitive areas.)

  (4) Schedule groups desiring large active recreation area to Southern Group Terrace. (Native grasslands protection in Central and Northern Terrace.)

- Unnamed Canyon Group Camp

  (1) Bring all sites closer to farm road which goes up canyon, and bring all sites closer together; leave open area near underpass and water trough, with a 200-300' setback from these facilities. Delete site near the water trough. (Protect wildlife dispersion corridor and watering site; red-tailed hawk nest sites, freshwater marsh.)

  Locate all sites north of road; move roadway north where feasible. Maintain recommended water trough, underpass setbacks, and site deletion.

  (2a) Campsites should not be under old sycamore trees. (Public safety; preservation of snag habitats, preservation of cavity-nesting avifauna habitat.)

  (2c) No use of unnamed canyon campground during raptor nesting season. (Raptor protection.)

An arborist shall inspect all trees in the proposed camping area and recommend corrective maintenance. Selected trees and clusters shall be maintained as is for snag preservation, raptor nest sites and cavity nesting species habitat. These shall rtain understory habitat and be located away from campsites. The unnamed canyon drive-in campground shall be used only when raptors and cavity nesting avifauna are not breeding. Acceptable use time will be from June 30 to January 15.

- Unnamed Canyon Hike-in Sites and Trail

(1a) Use of hike-in campsites and hiking trail, above the sites shall be permitted only from January 15 to June 1. (Raptor nest site protection.)

(1b) Hike-in campsite use shall be permitted from beginning of rainy season (December 15) to April 1 only. (Preservation of wildlife habitat and dispersion corridors.)

(1c) Sites in the "Dead Cow" lateral and elsewhere near oak trees shall be used only from May 15 to December 15. (Preservation of woodland edge sensitive flora; reduction of soil compaction which would occur around oaks in the rainy season.)

(1d) Move sites in "Dead Cow" lateral 200 feet up into lateral. (Summertime wildlife dispersion corridor preservation.)

Conflict not fully resolvable. Consider deletion of walk-in sites; no canyon bottom trail use between January 15 and June 1. (Ridge trail could still be used.) Alternatively, permit campsite use from December 1 - January 15; in "Dead Cow" lateral and near oaks in main canyon, fence oak woodland margin 10 feet out from tree-shrub edge to restrict vegetation and compaction impacts. Do not change site location in "Dead Cow" lateral, but consider deleting the sites (in lieu of protective fence or up-cove setback).

- Hiking Trail

(1a) Move rim trailhead overlooking unnamed canyon red-tailed hawk nest tree north +/- 50 yards. (This will require the bisection of a group site on the southerly segment of the Central Terrace.) (Raptor nest site protection.)

(1b) Consider deletion of or redesign of group site east of farm road in southerly segment of Central Terrace. (See Central Terrace Group Camp.) (Native grassland protection; vernal pool establishment.)

Move rim trailhead as recommended; redesign or delete group site east of farm road.

(2) Keep trail narrow in ridgetop xeric habitats; prohibit equestrian access to southerly terrace branch of hiking trail. (Protection of xeric flora; public safety.)

(3) Advise Park visitors that hiking trail not suitable for equestrian use; post steep drop off areas with warning signs. (Public safety.)

(4) Fence south edge of north terrace branch of trail as it passes near many-stemmed dudleya habitat. (Rare plant protection.)

(5) Zig-zag trail to maintain gentle gradient between ridge and upper unnamed canyon. (Public safety.)

(6) Prohibit use of unnamed canyon segment from January 15 - June 1. (Raptor nesting territory protection.)

(7) Establish walk-in spurs to flower field areas. (Restrict damage to flower fields by focusing impact.)

- Central Terrace Group Camp, Southerly Segment

(1a) Delete. (Raptor breeding and foraging territory protection.)

(1b) Set back sites 100 feet or more from margin of unnamed canyon; plant south edge of terrace with screening vegetation. (Wildlife dispersion corridor in unnamed canyon.)

(1c) Delete northernmost site west of farm road. (Native grasslands protection, setback from cove raptor nest site.)

(1d) Consider deletion of site east of farm road, redesign, or use only in summer. (Public comfort [wet area], wetlands rehabilitation site, native grassland protection, reconfiguration of trailhead.)

(1e) Extend road along south edge of terrace to west edge, and put additional sites there, unless area contains significant quality native perennial grassland.

(1f) Do not mow grasslands except in campsites or for adventive grass control in early spring. (Native grasslands protection.)

Adopt recommendations 1b, 1c, 1d, 1e and 1f.

- Central Terrace Group Camp, Northerly Segment

(1a) Eliminate lower half. (Public safety, preservation of red-shouldered hawk nest territory and sensitive woodland habitat in cove, south.)

(1b) No use of lower half from January 15 - May 15. (Red-shouldered hawks.)

(1c) Reduce number of sites in lower half; locate all brush-grass mosaic sites "on the ground". (Native grassland and flower field protection.)

(1d) Increase sites in open grassland. (Public safety.)

(1e) Do not increase sites in open grassland. (Native grasslands protection.)

Adopt 1b, 1c. Restrict use of brush-grass mosaic sites to adults, until mountain lion predation risk reduced to insignificance. Adopt 1e. Do not mow, except in campsites.

- Northern Terrace Group Camp

(1a) Delete. (Protection of black-shouldered kite and grasshopper sparrow critical habitat, native perennial grassland, spillover impact into Lucas Canyon and cove lateral, potential trespass on Ortega Rock Haul Road.)

(1b) Use group camp only from June 15 to January 15. (Protection of black-shouldered kites during actual breeding; minimization of springtime impact on native grassland.)

(1c) Use group camp only from July 15 to March 15. (Protection of grasshopper sparrow habitat during breeding season.)

(1d) Do not use group camp during rainy season. (Native grassland; oak woodland soil impact.)

(1e) Fence drip zones of oaks, mulch within fence. (Oak protection.)

Alternatively, adopt 1a; <u>or</u> use site only from July 15 to beginning of rainy season, <u>and</u> gate and post emergency access road to Lucas Canyon Haul Road beyond Juaneno Trail junction, <u>and</u> adopt 1e.

- Habitat Enhancement

A variety of habitat enhancement strategies are recommended in the HCP. A cost analysis of enhancement actions was not conducted. Following is a listing of proposed enhancements, recommendations of personnel categories to implement these

- Terrace

Native grassland rehabilitation: prescribed burns, mowing, outplanting of nursery propagated material, indigenous wildflower seeding. Implemented by professional grasslands rehabilitation consultant assisted by Park staff and Orange County Fire Department.

- Terrace Vernal Pool Establishment

Implemented by vernal pool rehabilitation consultant assisted by Park staff.

- Unnamed Canyon

Woodland-savannah enhancement:

(1) Tree planting, understory shrubbery planting.

(2) Milk thistle eradication (mechanical or herbicide).

(3) Sycamore understory native perennial grass planting.

Implementation:

(1) Implemented by Park staff, volunteers.

(2) Implemented by Park staff (mechanical) or Public Facilities Operations "weedbuster" team (herbicide).

(3) Implemented by professional rehabilitation consultant.

- North Cove Understory Rehabilitation and Wetland Enhancement

(1) Eradication of noxious weeds.
Mechanical
Herbicide

(2) Wetland enhancement.
Repair well and windmill
Excavate depressions in southerly area
mulefat scrub for ponds
Vegetate site with willows, hydrophytes

Implementation

(1) Implemented by Park staff (mechanical) or Public Facilities Operations "weedbuster" team herbicides).

(2) Implemented by landscape contractor, wetlands rehabilitation specialist and water well repair company.

Offsite compensation funds for wetland creation as specified in Clean Water Act Section 404 permit, from private developer or public Agency.

- Ridgetop Bald North of Lucas Canyon: Raptor Enhancement

(1) Cardoon eradication in grassland.

(2) Turkey vulture clean feeding station.

Implementation

(1) Public Facilities Operation "weedbuster" team.

(2) Park staff.

- Lucas Canyon Chaparral Management: Mosaic Prescribed Burns

  Implementation by Orange County Fire Department.

- Lucas Canyon Wash Channel Stabilization

  Implementation by landscape architect assisted by Park staff.

- Endangered Species Site Revegetation (Many-stemmed dudleya)

  Implemented by botanical consultant assisted by Park staff.

- Erection of Bird Houses to Expand Habitat of Cavity Nesting Avifauna, Including Small Raptors

  Implemented by Caspers Volunteer Group assisted by Park staff.

- Creation of Additional Watering Sites for Wildlife

  Implemented by landscape contractor assisted by wildlife biologist, or by Park staff so assisted.

- Propagation and Outplanting of Landscaping Stock From Site or Area-Indigenous Engelmann Oak

  Implemented by native plant nursery, Park staff.

- Interpretation as a Management Strategy

The purposes of environmental interpretation are education about the Parks resources, stimulation of aesthetic awareness and ultimately, the transmittal of a sense of resource stewardship. The latter has a positive effect on the way people behave in the natural environment and treat it. Thus, environmental interpretation can be a powerful management tool as well as an amenity.

Some appropriate subjects for environmental interpretation in Caspers Park East are:

- The hiking trail (a site description which can be used as the basis for an interpretive guidebook is included in the Appendix).
- Fossil study
- Wetlands biota and ecology
- Native grasslands history and ecology
- Chaparral ecology and management
- Wildlife of the Park
- Living with nature: appropriate behavior in sensitive habitats, avoidance of safety hazards.

Mechanisms for interpretation useful here include but are not limited to the following:

- Signs, posters, and displays
- Trail guidebooks
- Conducted hikes
- Labelled self-guiding trails
- Campfire programs
- "Hands-on" activities programs for youth groups.
- Orange County Outdoor School Programs
- College field trips and "outdoor classroom" research activities such as the UC Irvine supercourse
- Supervised student intern volunteer work (monitoring, habitat management).

The less technical interpretive programs can be conducted by Park staff. The latter activities enumerated would be conducted by educational institution-

employed staff. The final activity comes full circle, with educational institution staff "handing off" to Park ranger staff and consultants.

A unique opportunity for public-private cooperation exists for Caspers Regional Park and Nichols Institute. The exceptional and sensitive landscape plan developed for the Nichols site promises to be a native plant xeriscape interpretive resource, when developed. Three potential interpretive resources could be on County land near Nichols Institute: the suggested North Cove wetland, the existing Ladd Formation fossil site and the suggested turkey vulture clean feeding station. Nichols Institute could potentially function as the nucleus of a day-long school group outdoor education and science program (administered by Orange County Outdoor School) which could also include information about what is done at the research facility. Continuing the present good-neighbor relationship with Nichols Institute could result in development of an exciting educational resource opportunity.

- Miscellaneous Operations Management Recommendations

Certain aspects of operations management are included in foregoing sections. In addition, these measures are recommended.

- Establish good-neighbor relationship with Ortega Rock Co. and reach water-sharing agreement with them. Fence south side of their haul road to prevent trespass by Park visitors.

- Repair and maintain pipeline and existing water troughs. Determine whether overflow of unnamed canyon trough is damaging nearby sycamore, and correct if needed.

- Establish interagency communication mechanism with O.C. Fire Dept. and Rancho Carrillo Homeowners Association regarding protection of critical habitats on park land along Rancho Carrillo Road.

- Mow adventive grass habitat in unnamed canyon (around campsites only) in May to ensure viable seed dispersion for next winter and spring grass cover.

- Mow campsites in native grass-dominated areas in early spring when adventive grasses are beginning to come into flower but before they set seed. A second mowing may be required later, if additional vegetative growth occurs. Mow as high as feasible so that native grasses are not unduly impacted. Rest a rotation of sites in native grassland over a growing season's time.

- Do not enter the Northern Terrace Group Camp until the nearby pair of black-shouldered kites finishes nesting and fledging their young. Avoid using the north end of the farm road during the breeding season.

- Delay youth camping in Caspers Park East until evidence indicates that mountain lions are becoming less of a threat to children.

- Harass bold mountain lions which frequent developed portions of Caspers Park East, to engender a fear of man.

- Manage woodland resources for tree health and in facilities sites, public safety. Mulch within drip zones; renovate soil if compacted. Prune out hazardous dead limbs overhanging campsites. Call out a consultant plant pathologist to examine trees which are declining.

- Conduct focused patrol surveillances in vulnerable resource sites. Watch for visitor behaviors which endanger sensitive resources (impacting open space grasslands unduly, picking flowers, chopping down trees or limbs, collecting horned lizards or other sensitive fauna).

- Participate in regional wildlife studies, lending Park facilities and personnel to these larger efforts. Keep good records so they will be of regional usefulness (see monitoring).

- Attempt to control sources of visitor hazard. Brush back poison oak along trails and within campsites. Remove honeybee hives in/near campsites or trails. Eradicate yellow-jacket ground nests in campsites. Provide baited insecticide dust boxes for rodents harboring dangerous or disease-carrying ectoparasites. Cooperate with O.C. Vector Control monitoring programs. Post rattlesnake warning signs in unmowed perennial grasslands.

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APPENDIX A

Flora Species List

Legend

Community or Association (Symbol to right of scientific name)

RIP-1	- Stream edge, freshwater marsh and other moist places (San Juan Creek, upper Lucas Creek)
RIP-2	- Riparian woodland and brushland
AS	- Alluvial scrub of riparian floodplains
OW	- Southern oak woodland
CH	- Chaparral
CSS	- Coastal sage scrub
X	- Xeric barrens and desert-like habitats on ridge tops
NG	- Native perennial grassland
AG	- Adventive annual grassland
W	- Ruderal (weed) of disturbed places
B	- Recently burned areas (post fire flora)
H	- Horticultural introduction

Frequency of Occurrence within Community or Association (Symbol to right of Community symbol)

A - Abundant
C - Common
O - Occasional
U - Uncommon

Status (Symbol to left of scientific name)

no stars - native species with no special status
one star - introduced species
two stars - rare or endangered species

LYCOPODIAE

SELAGINELLACEAE - CLUB-MOSS FAMILY

Selaginella bigelovii little club-moss, Bigelow spike moss	X - O

EQUISETAE

EQUISETACEAE - HORSETAIL FAMILY

Equisetum arvense common horsetail	RIP-1 - O

FILICAE

ASPIDIACEAE - FERN FAMILY

Dryopteris arguta wood fern	OW, CH - O

POLYPODIACEAE - FERN FAMILY

Polypodium californicum California polypody	OW, CH - O

PTERIDACEAE - FERN FAMILY

Adiantum jordani maidenhair fern	OW, CH - O
Pellaea andromedaefolia coffee fern	OW, CH - O
Pellaea mucronata bird's foot fern	CH, CSS - U
Pityrogramma triangularis goldenback fern	OW, CH - O

DICOTYLEDONAE

ANACARDIACEAE - SUMAC FAMILY

Malosma laurina laurel sumac	CH, CSS - A at lower elevations
Rhus integrifolia lemonadeberry	CH - C

ANACARDIACEAE - SUMAC FAMILY (cont.)

Rhus ovata sugar bush	CH - U
Rhus trilobata squaw bush	RIP-2 - U
Toxicodendron radicans diversilobum poison oak	OW,CH - C

APIACEAE - CARROT FAMILY

Bowlesia incana bowlesia	CH, OW - U
Caucalis microcarpa California hedge parsley	OW, RIP-2 - C
*Conium maculatum poison-hemlock	RIP-2 - O
Daucus pusillus rattlesnake weed	CSS - O
*Foeniculum vulgare sweet fennel	AS - U
Lomatium dasycarpum woolly-fruited lomatium	X - O
Sanicula arguta sharp-toothed snakeroot, purple sanicle	NG - C
Sanicula crassicaulis Pacific sanicle	OW, CH - C

ASTERACEAE - SUNFLOWER FAMILY

Achillea millefolium yarrow	CH - O
Ambrosia psilostachya western ragweed	AG, RIP-2 - O
*Anthemis cotula mayweed	W - U
Artemisia californica coastal sagebrush	CSS - A
Artemisia douglasiana California mugwort	RIP-2 - O
Baccharis glutinosa mulefat	AS, RIP-2 - C

ASTERACEAE - SUNFLOWER FAMILY (cont.)

Baccharis pilularis coyote brush	RIP-2, CSS - U
Bebbia juncea sweet bush	X - U
Brickellia californica California brickellbush	X, AS - O
*Centaurea melitensis tocalote	AG - O
Chaenactis artemisiaefolia artemisia-leaved chaenactis or white pincushion flower	X - U
Chaenactis glabriuscula yellow chaenactis or yellow pincushion flower	B - O
Cirsium californicum Bigelow thistle	CSS, RIP-2 - O
*Cirsium vulgare bull thistle	RIP-2 - O
*Conyza canadensis horseweed	W - O
Corethrogyne filaginifolia common corethrogyne	CSS - O
*Cotula coronopifolia common brass-buttons	RIP-1 - U
*Cynara cardunculus cardoon	AG - A
Erigeron foliosus leafy daisy	OW - O
Eriophyllum confertiflorum golden yarrow	CSS, AS - O
Filago californica California fluffweed	B (AG) - O
*Filago gallica narrow-leaved fluffweed	AG, X - O
Gnaphalium beneolens fragrant everlasting	AS - O

ASTERACEAE - SUNFLOWER FAMILY (cont.)

Gnaphalium bicolor bicolored-leaf cudweed	AS, X, CSS - O
Gnaphalium californicum California everlasting	CSS, CH - O
*Gnaphalium luteo-album weedy cudweed	RIP-2, AS - C
Gnaphalium microcephalum white everlasting	AS, X, CSS - O
Gutierrezia bracteata San Joaquin matchweed	CSS, X - O
Haplopappus palmeri Palmer's goldenbush	CSS - U
Haplopappus squarrosus saw-toothed goldenbush	CH - O
Haplopappus venetus coastal goldenbush	CSS, RIP-2 - O
Helianthus gracilentus slender sunflower	CSS, AS - U
Hemizonia ramosissima slender tarweed	AG - O
Heterotheca grandiflora telegraph weed	W - O
*Hypochoeris glabra smooth cat's ear	AG - O
*Hypochoeris radicata hairy cat's ear	AG - U
*Lactuca serriola prickly lettuce	W - O
Lasthenia chrysostoma goldfields	NG, AG - U (expected to be more abundant in wet years)
Lepidospartum squamatum scale-broom	AS - A
Matricaria matricarioides pineapple weed	W - O
Microseris douglasii Douglas' microseris	NG - U

ASTERACEAE - SUNFLOWER FAMILY (cont.)

Microseris heterocarpa derived microseris	NG - U
*Osteospermum fruticosum trailing African daisy	H - U
Perezia microcephala sacapellote	CH, CW, CSS - O
*Picris echioides bristly ox tongue	W - O
Porophyllum gracile odora	X - C
Senecio douglasii sandwash groundsel	AS - O
Senecio vulgaris common groundsel	W - U
*Silybum marianum milk thistle	RIP-2 - A
Solidago californica California goldenrod	RIP-2, CW - O at higher elevations (upper Lucas Canyon)
*Sonchus asper prickly sow thistle	W - O
*Sonchus oleraceus common sow thistle	W - O
Stephanomeria virgata tall stephanomeria	W - O
Venegasia carpesioides venegasia	CW, RIP-2 - U (upper Lucas Canyon)
*Xanthium strumarium cocklebur	RIP-1 - C

BETULACEAE - BIRCH FAMILY

Alnus rhombifolia white alder	RIP-1 - O

BORAGINACEAE - BORAGE FAMILY

Amsinckia intermedia common fiddleneck	AG - O
Cryptantha intermedia white forget-me-not	B, AG - O
Cryptantha muricata prickly cryptantha	B - O
Pectocarya linearis slender pectocarya	B, X - O
Plagiobothrys nothofulvus popcorn flower	NG , AG - O

BRASSICACEAE - MUSTARD FAMILY

*Brassica geniculata summer mustard	AG - O
*Brassica nigra black mustard	AG on clay - C
Cardamine californica milkmaids	OW - U
Lepidium lasiocarpum hairy pepper-grass	B, X - O
*Raphanus sativus wild radish	AG - U
Rorippa nasturtium-aquaticum water-cress	RIP-1 - C
*Sisymbrium sp. tumbling mustard	W - U
*Sisymbrium officinale hedge mustard	OW - C

CACTACEAE - CACTUS FAMILY

*Opuntia ficus-indica Indian fig	CSS, AS - U
*Opuntia "occidentalis" western prickly pear	CSS - A ; AS - C
Opuntia littoralis coastal prickly pear	AS - C

CACTACEAE - CACTUS FAMILY (cont.)

Opuntia parryi coast cholla	AS, RIP-2 - U

CAPRIFOLIACEAE - HONEYSUCKLE FAMILY

Lonicera subspicata southern honeysuckle	CH - O
Sambucus mexicana Mexican elderberry	RIP-2 - C

CARYOPHYLLACEAE - PINK FAMILY

*Cerastium glomeratum mouse-ear chickweed	OW - O
*Silene gallica windmill pink	AG - O
*Spergularia villosa villous sand-spurrey	W - U
*Stellaria media common chickweed	OW - A

CERATOPHYLLACEAE - HORNWORT FAMILY

Ceratophyllum demersum hornwort	RIP-1 - O

CHENOPODIACEAE - GOOSEFOOT FAMILY

*Chenopodium album lamb's quarters	W - O
Chenopodium californicum California goosefoot	RIP-2, OW - O
*Salsola iberica Russian thistle	W - U

CONVOLVULACEAE - MORNING-GLORY FAMILY

Calystegia macrostegia western bindweed	B - C ; CH, CSS - O
Cuscuta ceanothi canyon dodder	CH, CSS - O

CRASSULACEAE - STONECROP FAMILY

Crassula erecta dwarf stonecrop	X - O

CRASSULACEAE - STONECROP FAMILY (cont.)

Dudleya lanceolata lance-leaved dudleya	X - O
**Dudleya multicaulis many-stemmed dudleya	X - O
Dudleya pulverulenta chalk lettuce	X - O

CUCURBITACEAE - GROUD FAMILY

Marah macrocarpus wild cucumber	CH, OW - O

DATISCACEAE - DATISCA FAMILY

Datisca glomerata durango root	RIP-1 - U

EUPHORBIACEAE - SPURGE FAMILY

Eremocarpus setigerus dove weed	AG - C
*Euphorbia peplus petty spurge	OW - O
Euphorbia polycarpa golondrina	X - O
*Ricinus communis castor bean	RIP-2 - O in San Juan Canyon

FABACEAE - PEA FAMILY

*Cassia tomentosa senna	H - U
Lathyrus laetiflorus wild sweet-pea	OW, CH - O
Lotus hamatus San Diego hosackia	B - O
Lotus heermannii woolly hosackia	RIP-1, AS - O
Lotus purshianus Spanish clover	B, AG - O
Lotus strigosus strigose lotus	B - U

FABACEAE - PEA FAMILY (cont.)

Lotus scoparius deerweed	CSS, B - O
Lupinus bicolor Lindley's annual lupine	B, AG - O
Lupinus longifolius Watson's bush lupine	RIP-2, CSS - U
Lupinus sparsiflorus loosely flowered annual lupine	B - U
Lupinus succulentus succulent annual lupine	B - U
Lupinus truncatus Nuttall's annual lupine	B - O
*Medicago lupulina black medick	AG - U
*Medicago polymorpha bur-clover	AG, W - C
*Medicago sativa alfalfa	W - U
Psoralea macrostachya leather root	RIP-1 - U

FAGACEAE - BEECH FAMILY

Quercus agrifolia coast live oak	OW - A
Quercus dumosa scrub oak	CH - A
Quercus dumosa x q. engelmannii scrub-Engelmann oak hybrid	CH - U

GERANIACEAE - GERANIUM FAMILY

*Erodium botrys broad-lobed filaree	AG - C
*Erodium cicutarium red-stemmed filaree	AG - O
*Erodium moschatum white-stemmed filaree	AG - O
Geranium carolinianum Carolina geranium	RIP-2, OW - O

HYDROPHYLLACEAE - WATERLEAF FAMILY

Eucrypta chrysanthemifolia common eucrypta	B, CH - O
Phacelia parryi Parry's phacelia	B - C
Phacelia ramosissima branching phacelia	RIP-2 - O
Pholistoma auritum blue fiesta flower	B, OW - U

LAMIACEAE - MINT FAMILY

*Marrubium vulgare horehound	AG, disturbed CSS - O
Mentha arvensis common mint	RIP-1 - C
Salvia apiana white sage	CSS - O
Salvia apiana x mellifera white and black sage hybrids	CSS - U
Salvia columbariae chia	X - U
Salvia mellifera black sage	CSS - A
Stachys rigida rigida rigid hedge-nettle	RIP-1 - O
Stachys rigida quercetorum (no common name)	NG - U
Trichostema lanceolatum vinegar weed	AG - U

MALVACEAE - MALLOW FAMILY

Malacothamnus fasciculatus mesa bushmallow	CSS -U ; B - O
*Malva parviflora cheeseweed	W - O
Sidalcea malvaeflora checker bloom	NG - O

NYCTAGINACEAE - FOUR-O'CLOCK FAMILY

Mirabilis californica wishbone bush	X - O

ONAGRACEAE - EVENING-PRIMROSE FAMILY

Camissonia bistorta southern sun-cup	disturbed AS - O
Camissonia micrantha small primrose	B - U
Epilobium adenocaulon California cottonweed	RIP-1 - O
Oenothera hookeri Hooker's evening primrose	RIP-2 - U (San Juan Canyon)
Zauschneria californica California fuchsia	B, CSS - U

OXALIDACEAE - WOOD-SORREL FAMILY

Oxalis albicans California wood's-sorrel	CSS, X - O
*Oxalis pes-caprae Bermuda buttercup	OW, RIP-2 - U

PAEONIACEAE - PEONY FAMILY

Paeonia californica California peony	CH, OW - U

PAPAVERACEAE - POPPY FAMILY

Eschscholzia californica California poppy	B - U
**Romneya coulteri Coulter's Matilija poppy	RIP-2 - O (eastern cove only)

PLANTAGINACEAE - PLANTAIN FAMILY

Plantago erecta California plantain	X - C
Plantago lanceolata English plantain	W - U
*Plantago major common plantain	RIP-1 - U

PLATANACEAE - SYCAMORE FAMILY

Platanus racemosa California sycamore	RIP-2 - A

POLEMONIACEAE - PHLOX FAMILY

Eriastrum sapphirinum sapphire eriastrum	X - O
Leptodactylon californicum prickly phlox	CH - U
Linanthus dianthiflorus ground-pink	NG - U (expected in more abundance in wet years)
Navarretia atractyloides holly-leaved navarretia	AS - U

POLYGONACEAE - BUCKWHEAT FAMILY

Chorizanthe fimbriata fimbriate spine-flower	X - O
Eriogonum elongatum long-stemmed eriogonum	NG, CSS - U
Eriogonum fasciculatum California buckwheat	CSS - A
Eriogonum fasciculatum cf. foliolosum woolly California buckwheat	X - O
Polygonum aviculare common knotweed	W - U
Polygonum lapathifolium willow-weed	RIP-1 - O
Pterostegia drymarioides pterostegia	X, CH, CSS - U
*Rumex crispus curly dock	RIP-1, AG - O
Rumex salicifolius willow dock	RIP-1, RIP-2 - O

PORTULACACEAE - PURSLANE FAMILY

Calandrinia ciliata redmaids	AG - U
Calyptridium monandrum common calyptridium	B - O

PORTULACACEAE - PURSLANE FAMILY (cont.)

Claytonia perfoliata miner's lettuce	CW - C

PRIMULACEAE - PRIMROSE FAMILY

*Anagallis arvensis scarlet pimpernel	B, W - O
Dodecatheon clevelandii shooting star	NG - A on slopes and in sheltered areas

RANUNCULACEAE - CROWFOOT FAMILY

Clematis lasiantha chaparral clematis	RIP-2 - U
Delphinium parryi Parry's larkspur	NG, RIP-2 - U
Ranunculus hebecarpus downy-fruited buttercup	CW - O
Thalictrum polycarpum many-fruited meadow-rue	RIP-2 - O

RHAMNACEAE - BUCKTHORN FAMILY

Ceanothus spinosus green-barked ceanothus	CH - C in upper Lucas Canyon
Ceanothus sorediatus jim-brush	CH - U in upper Lucas Canyon
Rhamnus californica coffeeberry	CW (San Juan Creek only) - U
Rhamnus ilicifolia holly-leaved redberry	CH - C

ROSACEAE - ROSE FAMILY

Alchemilla occidentalis western lady's mantle	CW - O
Adenostoma fasciculatum chamise	CH, upper Lucas Canyon - O
Cercocarpus betuloides mountain mahogany	CH, upper Lucas Canyon - O
Heteromeles arbutifolia toyon	CH - C

ROSACEAE - ROSE FAMILY (cont.)

Potentilla glandulosa sticky cinquefoil	OW, CH - U
Prunus ilicifolia holly-leaved cherry	AS (CH washdown from higher elevation in Lucas Canyon) - U
Rosa californica wild rose	RIP-2 - C
Rubus ursinus California blackberry	RIP-2 - C in San Juan Canyon only

RUBIACEAE - MADDER FAMILY

Galium angustifolium chaparral or narrow-leaved bedstraw	CH, CSS - O
*Galium aparine goose grass	OW - O
Galium nuttallii Nuttall's bedstraw	CSS, CH - O

SALICACEAE - WILLOW FAMILY

Salix lasiolepis arroyo willow	RIP-1,-2 - O

SAXIFRAGACEAE - SAXIFRAGE FAMILY

Jepsonia parryi mesa saxifrage	NG, CH (shaded banks) - O
Ribes indecorum chaparral currant	OW - U
Ribes speciosum fuchsia-flowered gooseberry	CH, OW - C

SCROPHULARIACEAE - FIGWORT FAMILY

Antirrhinum nuttallianum Nuttall's snapdragon	AS - U
Castilleja affinis coast Indian paint-brush	CSS - O
Castilleja foliolosa woolly Indian paint-brush	CSS - O
Cordylanthus filifolius dark-tipped bird's beak	openings in OW, CH - U

SCROPHULARIACEAE - FIGWORT FAMILY (cont.)

Keckiella cordifolia climbing penstemon	CH, OW - O
Linaria canadensis smaller blue toad-flax	AG - U
Mimulus aurantiacus orange bush monkeyflower	CSS - O
Mimulus aurantiacus x puniceus orange and red bush monkeyflower	CSS - O
Mimulus cardinalis scarlet monkeyflower	RIP-1 - O
Mimulus floribundus floriferous monkeyflower	RIP-1 - O
Mimulus guttatus yellow monkeyflower	RIP-1 - O
Mimulus puniceus red bush monkeyflower	X - O
Scrophularia californica coast figwort	AS, CH, OW - O

SOLANACEAE - NIGHTSHADE FAMILY

*Nicotiana glauca tree tobacco	RIP-2 - O
Solanum douglasii Douglas' nightshade	RIP-2, OW, CH - O
Solanum umbelliferum blue witch	AS, RIP-2 - O

VERBENACEAE - VERVAIN FAMILY

Verbena lasiostachys (includes V. robusta) western verbena	RIP-2 - O

VISCACEAE - MISTLETOE FAMILY

Phoradendron tomentosum greenleaf mistletoe	RIP-2 - O (parasite on sycamore)

MONOCOTYLEDONAE

AGAVACEAE - AGAVE FAMILY

Yucca whipplei Whipple yucca	CH, X, AS - O

AMARYLLIDACEAE - AMARYLLIS FAMILY

Allium haematochiton red-skinned onion (white flowered form)	NG - O (Lucas Canyon only)
Bloomeria crocea golden stars	NG - U
Dichelostemma pulchella wild hyacinth	NG - C

COMMELINACEAE - SPIDERWORT FAMILY

*Tradescantia virginiana Virginia spiderwort	H - O (along Ortega Highway)

CYPERACEAE - SEDGE FAMILY

Carex spissa San Diego sedge	RIP-1 - U
*Cyperus alternifolius umbrella plant	RIP-1 - C
Eleocharis macrostachya pale spike-rush	RIP-1 - O

IRIDACEAE - IRIS FAMILY

Sisyrinchium bellum blue-eyed grass	NG - C

JUNCACEAE - RUSH FAMILY

Juncus macrophyllus long-leaved rush	RIP-1 - O
Juncus mexicanus Mexican rush	RIP-1 - O
Juncus rugulosus wrinkled rush	RIP-1 - O

LILIACEAE - LILY FAMILY

**Calochortus catalinae Catalina mariposa	NG, offsite near NE corner of property - O

LILIACEAE - LILY FAMILY (cont.)

Calochortus splendens lilac mariposa	CSS, X - O
Chlorogalum parviflorum small-flowered amole	X, NG - U
Chlorogalum pomeridianum soap plant	CSS, CH, OW - O

ORCHIDACEAE - ORCHID FAMILY

Habenaria unalascensis Alaska rein orchid	NG, CH shaded banks - U

POACEAE - GRASS FAMILY

Agrostis diegoensis leafy bentgrass	CSS, CH, NG - O
Aristida adscensionis annual three-awn	X (disturbed) - C
Aristida parishii Parish's three-awn	X - O
*Arundo donax giant reed	RIP-2 (San Juan Creek) - U
*Avena barbata slender wild oat	AG - A
*Avena fatua common wild oat	AG - C
Bothriochloa barbinodis beard-grass	X - C
*Bromus diandrus ripgutgrass	AG - expected O in shaded areas (no inflorescences present during study)
*Bromus mollis soft chess	AG - O
*Bromus rubens red brome	AG - C
*Cortaderia atacamensis pampas grass	RIP-2 (San Juan Creek) - U
*Cynodon dactylon bermuda grass	W - U

POACEAE - GRASS FAMILY (cont.)

Elymus condensatus giant wild rye	OW, RIP-2 - O
Festuca megalura foxtail fescue	AG - A ; MG - C
*Gastridium ventricosum nitgrass	X - U
*Hordeum leporinum foxtail barley	AG, shaded areas under trees - C
*Lamarckia aurea goldentop	X - O
Melica imperfecta small-flowered melica	CH - U
Muhlenbergia microsperma annual muhlenbergia	X - C
Muhlenbergia rigens deer grass	RIP-2 - U (San Juan Canyon)
Oryzopsis miliacea Indian rice grass	RIP-2, AS - U
*Pennisetum setaceum fountain grass	W - U
*Poa annua wintergrass	AG, moist places - U
*Polypogon monspeliensis rabbit's-foot grass	RIP-1 - O
*Schismus barbatus schismus grass	W - A
*Sorghum halepense Johnson grass	W - U
Stipa coronata crested stipa or needlegrass	X - O
Stipa lepida small-flowered needlegrass	NG, CSS, X - O
Stipa pulchra purple needlegrass	NG - A

TYPHACEAE - CAT-TAIL FAMILY

Typha latifolia RIP-1 - C
broad-leaved cat-tail

Fauna Species List

Legend

Occurrence[1] (Symbol to right of scientific name)

SITE - Observed[2] in Caspers Park East by the authors during the field survey.
CP-R - Observed by Fred Roberts (junior author) in Caspers Park original parcel during field surveys from 1974-1978.
CP-M - Observed by Karlin Marsh (senior author) in Caspers Park original parcel during present field survey period.
CP-Mc & Z - Observed by Ian McKinnie and Richard Zembel in Caspers Park original parcel in 1976.
SR-F - Observed at Starr Ranch Audubon Sanctuary by miscellaneous researchers, cited by Froke, 1983.
SR-B - Observed at Starr Ranch Audubon Sanctuary by David Bontrager, cited by McKinnie and Zembel, 1976.
SAM-P - Observed in the Santa Ana Mountains by Willis Pequegnat from 1937 to 1951, and reasonably expected to occur on the Caspers Park recent acquisition parcel.
CG,AT-M - Observed by Karlin Marsh in Canada Gobernadora or Arroyo Trabuco area.
POSS - Not documented, but of potential occurrence.

Habitat (Symbol to right of occurrence symbol)

A - Aquatic or moist areas.
W - Woodlands, oak or sycamore
B - Brushland (chaparral, coastal sage scrub)
X - Xeric habitats (barrens, alluvial scrub, cliffs)
G - Grassland

Status (Symbol to left of scientific name)

no stars - native species with no special status.
two stars - regionally sensitive, rare or endangered species (including accidentals and vagrant bird species).

1. Several reporters may cite a species. Only one citation is included, usually that closest to the site.
2. Observation of the animal, or its call, track, scat, burrow, or remains of its kill, if diagnostic.

AMPHIBIANS

CAUDATA - NEWTS AND SALAMANDERS

Taricha torosa California newt	SAM-P - A
Ensatina eschscholtzi Eschscholtz's salamander	SAM-P - A
Batrachoseps nigriventris black-bellied slender salamander	CP-R - A, W
Aneides lugubris arboreal salamander	SAM-P - W

SALIENTIA - FROGS AND TOADS

Scaphiopus hammondi western spadefoot	SAM-P - A, X (temporary pools in alluvial floodplain)
Bufo boreas western toad	CP-R - A
Bufo microscaphus southwestern toad	CP-R - A
Hyla regilla Pacific treefrog	SITE - A, W
Hyla californiae California treefrog	SITE - A (San Juan Creek)
**Rana aurora red-legged frog	POSS - A
Rana catesbeiana bullfrog	SITE - A (San Juan Creek)

REPTILES

CHELONIA - TORTOISES AND TURTLES

**Clemmys marmorata western pond turtle	SAM-P - A

SQUAMATA - LIZARDS AND SNAKES

Sceloporus occidentalis western fence lizard	SITE - B, X
Uta stansburiana side-blotched lizard	SITE - B, X

SQUAMATA - LIZARDS AND SNAKES (cont.)

**Phrynosoma coronatum blainvillei CP-R - X
San Diego horned lizard

Eumeces skiltonianus SAM-P - B, W Site-G
western skink

**Cnemidophorus hyperythrus CP-R - X (alluvial scrub)
orange-throated whiptail

Cnemidophorus tigris CP-R - B
western whiptail

Gerrhonotus multicarinatus CP-R - W
southern alligator lizard

Lichanura trivirgata SAM-P - B
rosy boa

Diadophis punctatus SAM-P - B, W
ringneck snake

Coluber constrictor mormon POSS - G
yellow-bellied racer

Masticophis flagellum piceus SAM-P - B, X
red racer

Masticophis lateralis CP-R - B
striped racer

Salvadora hexalepis SAM-P - B
western patch-nosed snake

Arizona elegans CP-R - X (alluvial scrub)
glossy snake

Pituophis melanoleucus SITE - G
gopher snake

Lampropeltis getulus SAM-P - A, B, W
common kingsnake

**Lampropeltus zonata pulchra SAM-P - W
San Diego Mountain kingsnake

Rhinocheilus lecontei SAM-P - B
long-nosed snake

**Thamnophis couchi hammondi SAM-P - A
two-striped garter snake

Tantilla planiceps SAM-P - G (beneath rocks and in soil fissures
western black-headed snake in clay substrate)

SQUAMATA - LIZARDS AND SNAKES (cont.)

Hypsiglena torquata klauberi San Diego night snake	CP-R and recent collection - X (alluvial scrub)
**Trimorphodon vandenburghi lyre snake	SAM-P - B, X
Crotalus ruber red diamond rattlesnake	CP-R - B, W
Crotalus viridis helleri southern Pacific rattlesnake	SITE - G, B
Crotalus mitchelli speckled rattlesnake	SAM-P - X, B

BIRDS

ANSERIFORMES - WATERFOWL

Anas platyrhynchos mallard	SITE - A

FALCONIFORMES - VULTURES, HAWKS, OSPREYS AND FALCONS

Cathartes aura turkey vulture	SITE - all habitats
**Elanus leucurus black-shouldered kite	SITE - W, G
Accipiter striatus sharp-shinned hawk	SITE - W, B
Accipiter cooperii Cooper's hawk	SITE - W
Buteo jamaicensis red-tailed hawk	SITE - B
**Buteo lineatus elegans red-bellied red-shouldered hawk	SITE - W
**Aquila chrysaetos golden eagle	CP - Mc & Z
**Circus cyaneus northern harrier	SITE - G
**Falco mexicanus prairie falcon	CG, AT-M - G

FALCONIFORMES - VULTURES, HAWKS, OSPREYS AND FALCONS (cont.)

Falco sparverius American kestrel	SITE - G
**Falco columbarius pigeon hawk	SITE - G (burn area)

GALLIFORMES - GALLINACEOUS BIRDS

Lophortyx californicus California quail	SITE - B

CHARADRIIFORMES - SHOREBIRDS, GULLS AND ALCIDS

Charadrius vociferus killdeer	CP-M - X (alluvial scrub)

COLUMBIFORMES - PIGEONS AND DOVES

Columba fasciata band-tailed pigeon	SR-F - W
Columba livia rock dove	CP-Mc & Z - near habitation
Zenaida macroura mourning dove	SITE - G, B

CUCULIFORMES - CUCKOOS AND ROADRUNNERS

Geococcyx californianus roadrunner	SITE - G, X, B

STRIGIFORMES - OWLS

Tyto alba barn owl	SR-F - W, X (caves)
**Otus asio screech owl	SR-F - W
Bubo virginianus great horned owl	CP-M - W
**Speotyto cunicularia burrowing owl	CP-Mc & Z - G
**Asio otus long-eared owl	CP-Mc & Z - G

CAPRIMULGIFORMES - GOATSUCKERS

Phalaenoptilus nuttallii poor-will	SR-F - B
Chordeiles acutipennis lesser nighthawk	CP-Mc & Z - X (alluvial scrub)

APODIFORMES - SWIFTS AND HUMMINGBIRDS

Chaetura vauxi Vaux's swift	CP-Mc & Z - X (cliffs)
Aeronautes saxatalis white-throated swift	CP-Mc & Z - X (cliffs)
**Stellula calliope calliope hummingbird	CP-Mc & Z - B (around flowers)
Archilochus alexandri black-chinned hummingbird	CP-Mc & Z - B (around flowers)
Calypte costae Costa's hummingbird	SR-F - B, X (around flowers)
Calypte anna Anna's hummingbird	SITE - B (around flowers)
Selasphorus rufus rufous hummingbird	CP-Mc & Z - B (around flowers)
Selasphorus sasin Allen's hummingbird	CP-Mc & Z - B (around flowers)

CORACIIFORMES - KINGFISHERS AND ALLIES

Megaceryle alcyon belted kingfisher	SITE - A

PICIFORMES - WOODPECKERS AND ALLIES

Colaptes auratus common flicker	SITE - W
**Dryocopus pileatus pileated woodpecker	CP south of Hot Springs, W along San Juan Creek. Observed by Gordon Marsh in 1977.
Melanerpes formicivorus acorn woodpecker	SITE - W
**Asyndesmus lewis Lewis' woodpecker	CP-Mc & Z - W

PICIFORMES - WOODPECKERS AND ALLIES (cont.)

Sphyrapicus varius yellow-bellied sapsucker (red-breasted race)	CP-Mc & Z - W, B
Dendrocopos nuttallii Nuttall's woodpecker	SITE - W, B

PASSERIFORMES - PERCHING BIRDS

Tyrannus verticalis western kingbird	SITE - G
Tyrannus vociferans Cassin's kingbird	CP-Mc & Z - B
Myiarchus cinerascens ash-throated flycatcher	SR-F - W
Sayornis nigricans black phoebe	SITE - A
Sayornis saya Say's phoebe	SITE - G
**Empidonax traillii willow flycatcher	POSS - A, W (willow)
Empidonax difficilis western flycatcher	SR-F - W
Contopus sordidulus western wood pewee	SR-F - W
Tachycinetta thalassina violet-green swallow	CP-Mc & Z - X (cliffs)
Iridoprocne bicolor tree swallow	CP-Mc & Z - W
Hirundo rustica barn swallow	CP-Mc & Z - about structures
Petrochelidon pyrrhonota cliff swallow	CP-Mc & Z - X (cliffs)
Aphelocoma coerulescens scrub jay	SITE - W, B
Corvus corax common raven	SITE - B
Corvus brachyrhynchos common crow	SITE - G

PASSERIFORMES - PERCHING BIRDS (cont.)

Parus inornatus plain titmouse	SITE - W
Psaltriparus minimus bushtit	SITE - B
Sitta carolinensis white-breasted nuthatch	SR-F - W
Certhia familiaris brown creeper	CP-Mc & Z - W
Chamaea fasciata wrentit	SITE - B
Troglodytes aedon house wren	SITE - W
Thryomanes bewickii Bewick's wren	SITE - B
**Campylorhynchus brunneicapillus (coastal race) coastal cactus wren	SITE - B (cactus)
Salpinctes obsoletus rock wren	CP-Mc & Z - X
Catherpes mexicanus canyon wren	CP-M - X (in canyons)
Mimus polyglottos mockingbird	SITE -W & B near habitation
**Toxostoma rufum brown thrasher	SR (personal communication-Ruth Loveless) - B,
Toxostoma redivivum California thrasher	SITE - B
Turdus migratorius American robin	SITE - W, B (about toyons)
**Ixoreus naevius varied thrush	CP-Mc & Z (also obs. by K. Marsh in Hot Springs Canyon, 1975) - W
Catharus guttatus hermit thrush	SITE - W
Catharus ustulatus Swainson's thrush	CP-Mc & Z - W, A

PASSERIFORMES - PERCHING BIRDS (cont.)

Sialia mexicana western bluebird	SITE - W, G
Polioptila caerulea blue-gray gnatcatcher	SITE - B
**Polioptila melanura californica California black-tailed gnatcatcher	POSS - B (coastal sage scrub)
Regulus calendula ruby-crowned kinglet	SITE - W
Anthus spinoletta water pipit	CP-Mc & Z - G
Bombycilla cedrorum cedar waxwing	CP-Mc & Z - B, W (about toyons)
Phainopepla nitens phainopepla	CP-Mc & Z - W (about sycamores with mistletoe)
Lanius ludovicianus loggerhead shrike	CP-Mc & Z - G
Sturnus vulgaris starling	SITE - W (sycamores)
Vireo huttoni Hutton's vireo	SR-F - W
Vireo solitarius solitary vireo	CP-Mc & Z - W
Vermivora celata orange-crowned warbler	SR-F - W
Vermivora ruficapilla Nashville warbler	CP-Mc & Z - W
**Dendroica petechia yellow warbler	SR-F - W, A
Dendroica nigrescens black-throated gray warbler	CP-Mc & Z - W
Dendroica coronata yellow-rumped warbler	SITE - B
Dendroica townsendi Townsend's warbler	CP-Mc & Z - W
Dendroica occidentalis hermit warbler	CP-Mc & Z - W

PASSERIFORMES - PERCHING BIRDS (cont.)

Oporornis tolmiei MacGillivray's warbler	CP-Mc & Z - W
Geothlypis trichas common yellowthroat	CG, AT-M - A
Wilsonia pusilla Wilson's warbler	SAM-P - A
**Ictera virens yellow-breasted chat	CP-Mc & Z - B,A
Sturnella neglecta western meadowlark	SITE - G
Agelaius phoeniceus red-winged blackbird	CP-Mc & Z - A
**Agelaius tricolor tricolored blackbird	POSS - A
**Icterus parisorum Scott's oriole	CP-Mc & Z - W, X
Icterus cucullatus hooded oriole	SR-F - W
Icterus galbula northern oriole	SR-F - W
Euphagus cyanocephalus Brewer's blackbird	CP-Mc & Z - A, G
Molothrus ater brown-headed cowbird	SR-F - W
Piranga ludoviciana western tanager	CP-Mc & Z - B, W
**Piranga flava hepatic tanager	CP-Mc & Z - W
Pheucticus melanocephalus black-headed grosbeak	SR-F - W, B
Passerina amoena Lazuli bunting	CP-Mc & Z - B, G
Carpodacus mexicanus house finch	SITE - W near habitation
Spinus tristis American goldfinch	CP-Mc & Z - G, B

PASSERIFORMES - PERCHING BIRDS (cont.)

Spinus psaltria lesser goldfinch	SITE - G, B, A
Spinus lawrencei Lawrence's goldfinch	SR-F - B, W
Pipilo erythrophthalmus roufous-sided towhee	SITE - W
Pipilo fuscus brown towhee	SITE - B
Chondestes grammacus lark sparrow	SR-F - G
Passerculus sandwichensis savannah sparrow	SITE - G
**Ammodramus savannarum grasshopper sparrow	SR-F - G
Pooecetes gramineus vesper sparrow	CP-Mc & Z - G
Aimophila ruficeps rufous-crowned sparrow	SITE - B
**Amphispiza bilineata black-throated sparrow	CP-Mc & Z - X
Amphispiza belli sage sparrow	SR-F - B, X (alluvial scrub)
Junco hyemalis dark-eyed junco	SITE - W
Spizella passerina chipping sparrow	SR-F - G
**Spizella atrogularis black-chinned sparrow	SR-F - B
Zonotrichia atricapilla golden-crowned sparrow	SITE - W, B
Zonotrichia leucophrys white-crowned sparrow	SITE - W, B
**Zonotrichia albicollis white-throated sparrow	CP-Mc & Z - B
Passerella iliaca fox sparrow	CP-Mc & Z - W

PASSERIFORMES - PERCHING BIRDS (cont.)

Melospiza melodia song sparrow	SITE - W, B, A

MAMMALS

MARSUPIALIA - POUCHED MAMMALS

Didelphis virginiana Virginia opossum	SITE - W, B, A

INSECTIVORA - INSECT EATERS

Sorex ornatus ornate shrew	SAM-P - A
Notiosorex crawfordi desert shrew	SR-B - B
Scapanus latimanus broad-footed mole	SR-B - G, W

CHIROPTERA - BATS

**Myotis yumanensis Yuma myotis	SR-B - X
Myotis californicus California myotis	SR-B - W, B, X
Eptesicus fuscus big brown bat	SR-B - W, B
Antrozous pallidus pallid bat	SR-B - B
Pipistrellus hesperus western pipistrel	CP-Mc & Z (listed as "possible" species) - A, X (caves)

CARNIVORA - FLESH-EATERS

Procyon lotor raccoon	SITE - A
Mustela frenata long-tailed weasel, masked variant	SR-B - A, G, B
Taxidea taxus badger	SITE ?, SR-B - G
Spilogale gracilis spotted skunk	CP-Mc & Z (listed as "possible" species) - G, B, W

CARNIVORA - FLESH-EATERS (cont.)

Mephitis mephitis striped skunk	SR-B - W, A, B, G
Canis latrans coyote	SITE - ALL
Urocyon cinereoargenteus gray fox	SR-B - B
**Felis concolor moutain lion	SITE ?[1], SR-B - ALL
Lynx rufus bobcat	SR-B - B

RODENTIA - GNAWING MAMMALS

Citellus beecheyi Beechey ground squirrel	SITE - G
Sciurus griseus western gray squirrel	SR-B - W (periodically migrates from higher elevations into oak woodlands along the mountain margin)
Thomomys bottae Botta pocket gopher	SITE - G, W
**Perognathus longimembris pacificus little pocket mouse	SR-B - X, B
Perognathus fallax San Diego pocket mouse	SR-B - X (alluvial scrub)
Perognathus californicus California pocket mouse	SR-B - W, B
Dipodomys agilis simulans Pacific kangaroo rat	SITE ?, SR-B - X
Reithrodontomys megalotis western harvest mouse	SR-B - G, A
Peromyscus eremicus cactus mouse	SR-B - B, X (cactus patches)
Peromyscus californicus California mouse	SR-B - B, W

1. Possible mountain lion kill observed on site.

RODENTIA - GRAWING MAMMALS (cont.)

Peromyscus maniculatus deer mouse	SR-B - ALL
Peromyscus boylii brush mouse	SR-B - B
Neotoma lepida desert woodrat	SITE - B, X
Neotoma fuscipes dusky-footed woodrat	SITE - W
Microtus californicus California vole	SITE - G
Mus musculus house mouse	SR-B - G about habitation

LAGOMORPHA - HARES AND RABBITS

Lepus californicus black-tailed hare	POSS - G
Sylvilagus audubonii desert cottontail	SITE - B/G ecotone
Sylvilagus bachmani brush rabbit	SR-B - B

ARTIODACTYLA - EVEN-TOED HOOFED MAMMALS

Odocoileus hemionus mule deer	SITE - ALL

APPENDIX C

Botanical Sensitive Habitats

1. Native Perennial Grasslands

a. Location and General Description

Native perennial grassland habitat areas occur on heavy, moisture retentive soils of clay loam and clay loam cobble, with or without subsurface caliche hardpans. The principal sites of native perennial grasslands within the HCP area are on the Pleistocene stream benches of San Juan Creek. As described in the Phase III GDP and its Biological Resources Inventory appendix, there are two terrace levels. The lower, near the present floodplain of San Juan Creek but elevationally separated from it by about 50 feet, varies in width from 400 to 900 feet. The upper terrace is elevationally separated from the lower approximately 60 feet. The width of this bench varies from 600 to 1600 feet. Within Caspers Wilderness Park East, these ancient stream benches extend from Lucas Canyon south to Verdugo Canyon, a distance of about 1 3/4 miles. The terraces are dissected by the unnamed canyon and a series of smaller drainage gullies. At the mouthes of these runs are small coves, extensions of the present-day higher floodplain of San Juan Creek.

In addition to the upper and lower elevated stream benches of San Juan Creek, other areas of significant native grassland development within the addition parcel are on the slopes of the unnamed canyon and to a lesser extent, the north-facing slope of Lucas Canyon. On the hillsides flanking the unnamed canyon, grasslands range in size from 2 1/2 to 4 acres, and exist as "potreros" within the dominant coastal sage scrub (or sometimes laurel sumac [*Malosma laurina*] chaparral) cover. The small grasslands on the westerly portion of the north-facing slope of Lucas Canyon are 1/4 to 1 acre patches within coastal sage scrub or mixed chaparral.

Lucas north-facing canyonside grasslands were not surveyed on foot and are rather inaccessible. They appear via binocular inspection to be composed of *Stipa* bunchgrasses. The much larger grassland on the higher south-facing slope of Lucas, extending across the ridge divide between that canyon and upper San Juan Creek show substantial past cattle impact. While *Stipa* is present in certain portions of this mountaintop grass bald, dominant vegetation consists of wild oats (*Avena* spp.) and in much of the area, cardoon or wild artichoke (*Cynara cardunculus*).

Disturbance-response vegetation is also present on ridgetop grassland between the unnamed canyon and the higher stream terrace north. Here, heavy growths of

black mustard (Brassica nigra) and wild oats were noted, coupled with absence of Stipa.

On the north-facing slope of the unnamed canyon, the dominant grass is purple needlegrass (Stipa pulchra) the "typical" native perennial grassland species of southern and central valley California. North-facing slope grasslands are flower-rich. Masses of blue eyed grass (Sisyrinchium bellum, Iris family) were in bloom when the grasslands were surveyed in early April, 1987. The large saddle grassland at the head of the canyon contains the regionally rare Alaska rein orchid (Habenaria unalascensis). Grasslands examined on the south-facing slope of the unnamed canyon contain foothill needlegrass (Stipa lepida), a chaparral/coastal sage scrub opening infill species which is more drought tolerant than purple needlegrass.

b. Survey Methods

As discussed before, habitats occur in Caspers Park East in inaccessible areas where human impact is not predicted, in areas near trails and facilities where some impact may occur and within proposed intensive recreation development sites where a great deal of impact can be predicted. This scenario is particularly true of the native perennial grasslands. The major field survey effort for the HCP was expended in potential impact locales. However, in some wilderness area sites, intervention to improve degraded habitats could result in the expansion of native grassland (or good quality adventive grassland). This would be beneficial to wildlife species dependent on grassland, such as foraging raptors. These areas requiring management intervention regardless of location were also included in the field survey effort.

The HCP scope of work includes the development of a monitoring plan which can be replicated in the future, to assess the existing condition of critical habitats now and after implementation of the GDP improvements and subsequent human use of the parkland. The monitoring plan for the sites' grasslands consists of the use of line intercept vegetation transects to quantify percentage of cover of component species, and frequency of occurrence of single species-dominated areas. The latter measurement can provide evidence of disturbance, where there is a high frequency of seral elements. It can also provide evidence of evolving perennial grassland recovery, in instances of high frequency of native climax vegetation species, such as numbers of small tufts of needlegrass. In fully evolved climax native grassland on central flats away from slopes or transition edge habitats, needlegrass frequency will decrease as its percentage of cover increases. This

reflects a condition of continuous cover, with no breaks occupied by other plants. On north-facing slopes and along protected edges at the grass-brush contact zone, frequency should remain high. Here openings between needlegrass clumps will be vegetated by herbaceous elements of the native flower field association such as Cleveland shooting star (Dodecatheon clevelandii), or, in more disturbed locales, Eurasian grasses and forbs such as soft chess (Bromus mollis), filarees (Erodium) and smooth cat's-ear (Hypochoeris glabra).

Line intercept transects utilize a long tape measure. A plastic coated cloth metric tape of about 5000 cm (50 meters) was used for the initial survey. Each transect was run by a two-person team consisting of a measurer and a recorder. The measurer first inventoried all vegetation species along the transect tape, as well as other transect elements such as dead grass mulch, leaf litter, bare ground and miscellaneous debris. These were listed on a notepad by the recorder, who left room to add measurement intervals. The measurer and recorder then walked to opposite ends of the tape and moved it slightly, to get it away from the area previously trampled by the measurer. The measurer then walked along the side of the tape, being careful not to trample more vegetation, and called out to the recorder, the linear area of cover in centimeters occupied by each species or other transect element, beneath the transect line which lay lightly on the top of the vegetation. In instances where overstory and understory occurred within a single transect interval (such as grasses shading ground-hugging filaree or cat's-ear), 1/2 of the overstory and 1/2 of the understory was recorded. Thus, the total of all measurements recorded equalled the transect length.

A typical field record form prepared during the HCP study is reproduced on the next page for reference. Vegetation species and other transect elements are recorded along the left margin. Transect interval measurements are then recorded to the right, using several lines if necessary. A dot is placed between each recorded interval to keep the numbers separated. The interval numbers are later added up for each species. Then the number of times the species was encountered is counted. These figures are located right of the field-recorded intervals. Then, all the interval measurements of cover are added together. This is the transect length, the raw figure for total cover. The numbers of intervals recorded are also added together, giving the raw figure for total frequency.

1st South Mesa past underpass.
From road to oak tree
TRANSECT # 7

SLENDER OAT - 10 · 10 · 10 · 30/3 .6/1

B.L. FILAREE 40 · 40 · 15 · 15 · 15, 5 · 5 · 25 · 160/8 3/3

RED BROME - 2 · 10 · 12/2 .2/.7

SOFT CHESS 15 · 30 · 60 · 30 · 15 · 10 · 40 · 10 · 20 · 15 · 30 · 10 · 30 · 10 · 30 · 10 · 10 · 20 · 10 · 10 · 5 · 15 · 5 · 5 · 10 · 5 · 20 · 10 · 10 · 5 · 50 · 10, 10 · 10 · 10 · 15 · 10 · 10 · 5 · 5 · 5 · 5 656/42 14/15

NEEDLEGRASS 20 · 15 · 40 · 60 · 65 · 40 · 60 · 30 · 5 · 70 · 15 · 40 · 10 · 20 · 30 · 55 · 30 · 45 · 20 · 110 · 70 · 1 · 20 · 20 · 25 · 60 · 10, 30 · 15 · 5 · 5 · 15 · 25 · 10 · 10 · 15 · 25 1141/37 24/13

CATSEAR 15 · 10 · 20 · 25 · 10 · 10 · 10 · 10 · 10 · 5 · 15 · 20 · 10 · 10 · 10 · 10 · 10 · 15 · 30 · 5 · 30 · 15 · 40 · 15 · 20 · 10 · 10, 15 · 30 · 5 · 5 · 10 · 465/32 10/11

FOXTAIL BARLEY 5 · 20 · 25 · 20 · 20 · 15 · 35 · 15 · 30 · 35 · 10 · 15 · 30 · 50 · 15 · 10, 20 · 10 · 20 · 5 · 5 · 10 · 20 · 20 · 10 · 20 · 40 · 5 · 20 · 10 · 15 · 25 · 15 · 20 · 20 · 20 · 20 · 30 · 20 · 10 · 10 · 5 · 10 · 30 · 810/44 17/16

RIDGUT BROME 5 · 5 · 5 · 5 · 20 · 10 · 10 · 15 · 10 · 30 · 20 · 135/11 3/4

SUMMER MUSTARD 5 · 10 · 20 · 35/3 .7/.1

FOXTAIL FESCUE 10 · 30 · 10 · 10 · 5 · 10 · 75 · 10 · 5 · 25 · 10 · 40 · 10 · 20 · 5 · 10 · 15 · 10, 30 · 25 · 15 · 5 · 5 · 10 · 10 · 5 · 10 · 425/27 9/16

DEAD 20 · 20 · 30 · 10 · 10 · 35 · 10 · 15 · 5 · 10 · 5 · 5 · 10 · 15 · 40 · 10 · 10 · 10 · 10 · 5 · 15 · 5 · 15 · 10 · 10 · 10 · 10 · 30 · 5 · 30 · 5 · 10 · 15 · 10 · 10 · 5 · 15 · 15 · 20 · 10 · 15 · 10 · 10 · 20 · 20 · 10 · 25 · 10 · 880/65 18/23

DEAD 10 · 15 · 10 · 30 · 20 · 10 · 10 · 10 · 5 · 10 · 10 · 10 · 10 · 10 · 10 · 20 · 20

SPANISH CLOVER ~~[illegible]~~ - 10 · 5 · 5 · 5 · 35/4 .7/.1

BARE 5 · 5/1 .1/.4

WILD LETTUCE 10 · 10/1 .2/.4

BEER BOTTLE .7 · 7/1 .1/.4

CHICKWEED 5 · 5 · 10/2 .2/.7

To determine percentage of cover per species or other element, the individual cover total is divided by transect length. The product is always less than 1 unless there is a monoculture of one species within a transect. 1 would equal 100% cover. .1 would equal 10% of cover. .01 would equal 1% of cover.

To determine frequency for each transect element, the number of times it was recorded in the transect is divided by the total number of transect intervals for all elements. Again, the product should be less than 1, and is translated from decimal fractions to percentage as described above.

In the sample transect shown, for line 1, the figures depicted are the following:

Slender Oats (Species)	10.10.10 (Centimeter intervals where species was dominant)	30 (Total cover [cm])	/ 3 (Total intervals)	.6 (.6% of cover in transect)	/ 1 (1% frequency in transect)

The total length of this transect was 4810 cm. $\frac{30}{4810}$ = 0.006237

This was rounded off to 0.006, or 0.6%. The total number of transect intervals was 282 . $\frac{3}{282}$ = 0.0106382. This was rounded off to 0.01, or 1%. Rounding off will result in a series of percentage figures which may be slightly less or more than 100% when added together. As the reader will recall from his school days, a figure of .125 would be rounded off as 13% while one of .124 would equal 12%; (decimal fractions were not calculated unless the cover or frequency equalled less than 1%). Rounding off is justified because the entire measuring process is not precise enough to lend significance to decimal fractions. The field surveyor may err in direct measurement if standing at a slight angle from rather than directly over the transect line. Where a mix of species occurs in a transect interval without clear dominance of one, the measurer must arbitrarily allocate the percentage of the interval (in centimeters) to be assigned to each. His assessment will probably not be precise. The location of the transect selected may or may not be truly representative of the area studied, though every effort should be made (and was made during the initial monitoring) to measure a site which is not atypically pristine or degraded, but just average for the setting.

It is also recognized that exact transect replication is probably not possible. Transect locations are shown

on the Habitats Exhibit Map which accompanies the HCP. However, it was not considered feasible to establish permanent marker points for the transects, as these almost always are vandalized through the years.

The purpose of transect replication in the future is to assess negative or positive habitat changes. Negative changes would signal that adjustments in management and recreational use should be made. Positive changes would indicte that management practices and use levels are appropriate, that habitat manipulative intervention strategies are successful and can be implemented in additional areas requiring rehabilitation, or that areas are continuing to recover in the absence of management intervention. Negative changes in the grassland environment will be reflected by a greater percentage of cover and frequency of ruderal (primary sere) elements, and secondary sere and climax grass and forb species which are non-native. Positive changes will be reflected by a greater percentage of cover of purple needlegrass, and an increase of cover and frequency of native perennial and annual flower field elements.

The transect studies were conducted by author Marsh and Caspers Regional Park groundskeeper personnel Randy Dimeo, Dona Krucki and Scott Smith. Dimeo and Smith acted as recorders and Krucki, who has a good knowledge of the plant species at Caspers Park, as both recorder and measurer. It is important that replicated studies in future years be conducted by individuals who are familiar with the Park flora and transect measuring and computation techniques. The latter can be learned by a few hours of work in the field with an experienced analyst; Krucki became quickly adept at the measuring task though this was the first time she had been involved in such a study. Future facilities or unmanaged open space monitoring is envisioned to be conducted by Park personnel and members of the volunteer group after preliminary training by a consultant or staff ecologist. Monitoring in vegetation rehabilitation areas would be done by the consultant directing the restoration program, or under his/her supervision.

c. Description of Transect Study Areas; Transect Results

- Terrace Group Camping Areas North of Unnamed Canyon

  The following pages describe and quantify resources of three group camping areas depicted by the approved GDP Phase III on the lower terrace north of the unnamed canyon and Rancho Carrillo Road.

  - Northern Terrace Group Camp

The northernmost camp is on the terrace just south of the Lucas Canyon floodplain. There are four (or five) group campsites and a restroom at this location. These are arranged along a planned loop turnaround at the existing farm road.

The central portion of the Northern Terrace Group Camp contains a predominance of native grassland with interstitial infill of adventive soft chess between purple needlegrass clumps. Some adventive ripgut brome is also present, along with lesser amounts of other adventive and native grasses and forbs. Around the margins of the terrace is a mosaic of native grassland and screening brush and tree vegetation of laurel sumac (Malosma laurina) and some coast live oak (Quercus agrifolia). Transition habitat between the dispersed brush/tree line and the central grassland contains scattered large clumps of California sagebrush (Artemisia californica) and California buckwheat (Eriogonum fasciculatum). There are some mesic depressions in the grassland especially near the base of the slope of the upper terrace but beyond the laurel sumac edge. These contain western ragweed (Ambrosia psilostachya), an indicator of intermittent moisture accumulation. These depressions, and others seen along the terrace inner margin south might be infilled vernal pools.

Transect #1 was run from southeast to northwest near the center of the grassland in Northern Terrace Group Camp. The transect started and ended at oak trees, spanning about 150 feet (4540 cm) and passed through portions of the west central and east central camp sites, crossing the loop turnaround in between. It should be noted that in addition to sensitive grassland resources potentially impacted here, each of these sites contains one or more oaks, which could be harmed by excessive trampling within their drip zones.

The results of Transect 1 are on the following page.

- Central Terrace Group Camp, North Segment

This terrace area is separated from the North Terrace Group Camp by a laurel sumac-vegetated canyon which contains a few oaks below. This canyon also bisects the upper terraceland.

As in the preceding, the central portion of this group camp area contains grassland, with dominance of native purple needlegrass. Around the margins, occupying at least half of the flat area of the

Transect 1
Northern Terrace Group Camp

Transect Length 4540 cm
Transect Occurrence Intervals 169

Category	Species	% Cover	% Frequency
3N	Stipa pulchra (purple needlegrass)	43	22
2N	Bromus mollis (soft chess, = B. hordaceua	20	24
3A	Bromus diandrus (ripgut brome)	12	9
-	bare ground	6	9
2A	Bromus rubens (red brome)	4	9
2A	Erodium botrys (broad-lobed filaree)	4	8
2A	Hypochoeris glabra (smooth cat's-ear)	4	7
2N	Vulpia myuros hirsuta (foxtail/	2	3
	fescue, = Festuca megalura)	2	.5
1	Hordeum leporinum (foxtail barley)	2	2
-	Quercus agrifolia leaf litter (coast live oak)	1.3	.6
2N	Galium aparine (goosegrass)	.9	1
3N	Sildacea malvaeflora (checker bloom)	.7	.6
3A	Avena barbata (slender wild oats)	.7	1
2A, 2N (moisture indicator)	Rumex crispus (curly dock)	.4	.6
3N	Dichelostemma pulchella (wild hyacinth)	.2	2
2A	Centaurea melitensis (star thistle)	.07	.6
2A, 2N	Silene gallica (windmill pink)	.02	.6
		101%	100%

terrace is the same mosaic of laurel sumac and native grassland seen on the north terrace. The slope toward Ortega Highway contains dense laurel sumac cover, as it does along the slope flanking the north terrace. The slope up to the broader high bench contains brush/grass mosaic, similar to the slope above the north terrace. There are four clumps of oak trees, each containing one to a number of individual trees. The clumps are concentrated at the south end of the pure stand grassland and immediately west at the head of a localized drainage which dissects the west terrace margin. South of the terrace is a well developed drainage arroyo which eminates from the edge of the higher central terrace bench. The lower portion of this arroyo is filled with oak trees, replaced on the cove floor below, (facing Ortega Highway) by sycamore (Platanus racemosa) woodland-savannah. The cove was inhabited by a black-shouldered kite and red-shouldered hawk during the previous survey. The latter species still nests here. It is considered a critical woodland habitat and is discussed within that report section. At the head of a shorter drainage which runs into the cove north of the principal arroyo, headwall back cutting threatens to bisect the farm road.

This segment is planned for intensive group camp use. A total of eighteen campsites served by four loop roads, four parking bays and one restroom are depicted for the segment. The majority of the campsites are located in native grass/laurel sumac brush mosaic habitat. As discussed before, this type of setting is typically more floristically diverse than open grassland areas. However, the degree of floristic diversity was not quantified in the HCP study. The area was not a mapped flower field (Cleveland shooting star) habitat in the 1984 GDP III biological study ("Dc habitat" on Vegetation Resources Map). However, during the spring 1987 site reconnaissance, some good populations of shooting star and additional native wildflowers such as purple sanicle (Sanicula arguta), checker bloom (Sildacea malvaeflora) and mariposa lily (Calochortus sp. not yet in flower) were found within and at the margin of the grass-brush mosaic zone. Scott Smith reported that there was substantial mule deer utilization of the mosaic habitat.

The visual setting within the mosaic habitat is of enclosed "rooms" of needlegrass clumps or adventive bromes with interstices infilled with smooth cat's-ear and broad-lobed filaree, or native

perennial wildflowers. These "rooms" are surrounded by laurel sumacs and a little lemonadeberry (Rhus integrifolia), and edged by buckwheat (Eriogonum fasciculatum), sagebrush (Artemisia californica) and some black sage (Salvia mellifera). The coastal sage scrub is occasionally quite extensive and dense. This element creates a fire hazard risk during the drought season.

Around the oak clumps west of the farm road, purple needlegrass occurs sparingly, probably because these areas were resting sites for cattle in the past. There is some infestation of Italian thistle (Carduus) within the drip zones of these oaks, a further indication of past cattle impact.

On the east side of the farm road, the two-tree oak clump is flanked on the south by good quality native grassland. However, beneath and in between the oaks are a melange of primary succession foxtail barley (Hordeum leporinum) and milk thistle (Silybum marianum), again indicating past cattle impact.

Overall grassland quality is not significantly different from that of the Northern Terrace Group Camp. Like the former site, this area contains a predominant cover of native perennial grassland, with interstitial infill between needlegrass clumps of adventive annual grasses and forbs, and some native perennial wildflower species.

However, there are elements of habitat value variation within this campground segment that are difficult to pinpoint on mapping or relate spatially to proposed campsite areas in the absence of site flagging.

As discussed within the management portion of the Native Perennial Grasslands Critical Habitats Section, on-the-ground adjustments of campsite boundaries by a biologist, perhaps omitting some sites and expanding others would be particularly useful here.

Two vegetation transects were run within grassland in this segment of the Central Terrace Group Camp. The northerly, Transect 2, was about 146 feet long and extended west from the farm road to the edge of the laurel sumac-grass mosaic within the northwest camping loop of the segment. The transect probably runs through the north campsite on the east side of the loop service road, though this is difficult to verify without site flagging.

The results of this transect vary only subtly from those of Transect 1. Native grassland quality is a little better, and there is only a minimal amount of the climax adventive grass, ripgut brome (Bromus diandrus). However, the importance of B. diandrus in Transect 1 may be related to the transect's proximity to oak-shaded habitat, which gives the adventive a competitive edge over Stipa. Dead grass mulch is present in Transect 2 and many others subsequently discussed. The species making up the mulch are assumed to be adventive annuals. The role of mulch is discussed in the management portion of this Critical Habitat section.

The results of Transect 2 follow.

Transect 2
North Central Terrace - North Node

Transect Length 4429 cm
Transect Occurrence Intervals 186

Category	Species	% Cover	% Frequency
3N	Stipa pulchra	48	25
2N	Bromus mollis	12	15
2A	Erodium botrys	9	13
2A	Bromus rubens	7	5
-	dead grass mulch	6	9
3A	Avena fatua (common wild oats)	5	5
-	bare ground	4	8
2A	Hypochoeris glabra	2	3
3N	Isocoma veneta (coastal golden-bush, = Haplopappus venetus)	2	.5
3N	Dichelostemma pulchella	1	9
3A	Avena barbata	1	3
2N	Vulpia myuros hirsuta	1	3
1	Medicago hispida (bur clover)	.6	1
3A	Bromus diandrus	.2	.5
1	Hordeum leporinum	.2	.5
2A, 2N	Cerastium glomeratum (mouse-eared chickweed)	.1	.5
		99	101

Transect 3 is located on the north side of the northerly oak cluster on the east side of the farm road, near the center of the north segment of the Central Terrace Group Camp. It extends through the northerly of three campsites east of the farm road. 11% of the cover of the transect consists of non-grassland elements (laurel sumac plus dead and down wood). Purple needlegrass is the most extensive species element within the transect.

The bulk of the infill between Stipa clumps (more widely spaced than out in the center of the grassland due to "edge effect" and shading) consists of forbs, rather than annual grasses. The forb cover is split fairly evenly between adventive and native species, with non-native broad-lobed filaree and native checker bloom predominant. This grasslands edge transect yielded the greatest diversity of native wildflower species of the 7 run, lending quantitative support to the observations of increased perennial flower field importance in sheltered areas along the edges of native bunchgrass stands.

The results of Transect 3 follow.

Transect 3
North Central Terrace
Central Loop East of Road
North Group Camping Site

Transect Length 3209 cm
Transect Occurrence Intervals 119

Category	Species	% Cover	% Frequency
3N	Stipa pulchra	34	24
2A	Erodium botrys	13	14
3N	Sildacea malvaeflora	12	10
-	Malosma laurina (laurel sumac)	10	2
2N	Bromus mollis	7	10
2A	Bromus rubens	5	4
-	dead grass mulch	4	7
3A	Avena barbata	4	3
3N	Dichelostemma pulchella	2	8
2A	Hypochoeris glabra	2	5
-	bare ground	2	5
3A	Bromus diandrus	2	3
-	log	1	.8
3N	Sanicula arguta (purple sanicle)	.8	3
		98.8	98.8

- Central Terrace Group Camp, South Segment

This terrace segment is rounded rather than oblong in configuration like the other terrace planning sites. Its boundaries are the wooded cove (discussed before) to the north, the slope to the higher terrace level, east, the lower reach of the

unnamed canyon, south and the San Juan Creek floodplain and Ortega Highway, west. The outer (west) margin overlooking the Ortega Highway and San Juan Creek Valley contains rather dense laurel sumac cover. There are additional clusters of laurel sumac dispersed through the westerly portion grasslands of the terrace top. The setting of the bulk of the terrace is visually dominated by grassland, and is open in aspect. At the base of the slope of the upper level terrace, east of the farm road is vernally marshy land with three developed swales variously containing curly dock, ragweed and mulefat (Baccharis glutinosa). Flower field elements (Cleveland shooting star) are found along the north and south margins of the terrace, which flank, respectively, the cove and unnamed canyon. A few oaks extend out of the cove onto the terrace edge, north.

The grassland on this terrace segment is predominantly of native perennial composition, with certain portions containing very dense needlegrass cover. However, some areas are moderately invaded by Eurasian annual elements. In particular, the terrace edge above the unnamed canyon contains a substantial amount of wild oats. There also appears to be a subtle difference between the loamy soil here (as exposed by gopher excavations) and the more clayey soils of the other terrace grassland locales examined north and east. This somewhat better-drained soil would be more suitable for screening shrubbery plantings than the tighter soils of the purple needlegrass-dominated sites.

An excellent viewpoint of the San Juan Creek Valley and the foothills to the west is available at the southwest corner of the terrace.

Six group camp sites are depicted within this segment. They are distributed along both sides of the farm road and southwest, along the terrace margin overlooking the unnamed canyon. A restroom and parking bays are other planned site improvements. Group sites are located within areas containing flower field habitat, vernal marshland and dense Stipa grassland. However, continuous grassland habitat in the central portion of the terrace is not intruded upon by proposed improvements, though it could be vulnerable to recreational use impact eminating from the group sites distributed along the margin.

One vegetation transect was run in this segment of the Central Terrace Group Camp. This transect

extended 162 feet from the farm road through the northerly group camp site to the west. Except for a band of disturbance-response foxtail barley along the graded edge of the farm road, the grassland in this transect was of exceptionally good quality, with a remarkable 71% of cover of purple needlegrass. This is the highest percentage of cover of the native perennial dominant found in any of the transects run. The only other significant component, soft chess is today a characteristic infill species in Orange County's native-dominated grasslands. As discussed previously, the two species coexist well, though the chess supplants flower field elements. This dense perennial grassland composition seems to be characteristic throughout the eastern portion of the terrace, probably because of soil moisture retentiveness and runoff-enhanced environment evidenced by the scattered vernal marsh swales here.

Results of Transect 4 follow.

Transect 4
Central Terrace, South Segment
North Group Camping Site West of Road

Transect Length 4917 cm
Transect Occurrence Intervals 96

Category	Species	% Cover	% Frequency
3N	*Stipa pulchra*	71	33
2N	*Bromus mollis*	14	33
1	*Hordeum leporinum*[1]	7	10
-	dead grass mulch	5	11
3A	*Avena barbata*	2	4
-	bare ground	.5	2
2N	*Vulpia myuros hirsuta*	.3	2
2A	*Erodium botrys*	.2	1
3N	*Dichelostemma pulchella*	.1	2
		100.1	98

1 Mostly in disturbance zone along road

- Upper Level Terraceland North of Unnamed Canyon

This broad terrace bench is one of the key habitat and visual features of Caspers Park East. Except

for two hiking trail pathways, no GDP III alterations are proposed within this expansive grassland setting. However, certain climax adventive grassland species such as wild oats and ripgut brome have not relinquished their foothold on the upper terrace, and probably will not do so in the future unless management intervention takes place. There is ample Stipa on the high terraceland, but these climax adventives, particularly Avena spp. have captured habitat and are described in the literature to be successful in holding it in perpetuity (Heady in Barbour and Majors, 1977, citing Burcham, 1956-57).

- Upper Level North Terrace

Reestablishment of native perennial grassland on this mesa segment has been particularly slow, relative to the recovery of the lower level terraces west following the removal of cattle from the Park three years ago. The sensitive flower field band of shooting stars is still present along the terrace margin but except adjacent to the wooded lateral of Lucas Canyon, north, the flower field band is no longer continuous. The cessation of grazing seems to have resulted in greater grass density along the margins, competing with native herbaceous grassland elements. In addition to shooting stars, some goldfields (Lasthenia chrysostoma), an annual flower field element was found in mosaic grass-brush habitat along the terrace edge.

The results of the transect run in the north segment bears out the qualitative impressions of habitat condition here. Stipa attains only 37% of cover. There is significant dead grass mulch buildup, which may in this case be advantageous for perpetuation of the Stipa clumps present. Ripgut brome and other adventive elements occupy a substantial proportion of the cover.

The transect, about 159 feet long, was run in the approximate center of the upper north terrace segment on relatively flat land. The habitat within the transect sampling area exhibits considerable species diversity. The flora inventoried included 2 native grasses, 1 native subshrub, 3 native herbs, 5 adventive grasses and 4 adventive herbs. This diversity probably reflects the very expansive area of grassland cover within the sampling area as well as its still only partially recovered condition following cessation of cattle grazing.

Results of Transect 5, run in the north segment of the upper level terraceland, follow.

Transect 5
Upper Level Northern Terrace
Center Area of Terrace

Transect Length 4824 cm
Transect Occurrence Intervals 335

Category	Species	% Cover	% Frequency
3N	Stipa pulchra	37	19
-	dead grass mulch	13	16
3A	Bromus diandrus	11	5
2N	Bromus mollis	8	10
2A	Erodium botrys	6	7
3A	Arena barbata	5	8
2N	Vulpia myuros hirsuta	4	6
3N	Dichelostemma pulchella	3	8
2A	Bromus rubens	3	5
3A	Avena fatua	3	2
2A	Hypochoeris glabra	2	4
3N	Isocoma veneta	2	3
-	bare ground	1	3
2A, 2N	Silene gallica	.4	.9
2N	Stellaria media (common chickweed)	.2	.9
3N	Trifolium sp. (clover)	.2	.3
3N	Lasthenia chrysostoma (goldfields)	.1	.3
		98.9	98.4

- Upper Level Central Terrace

This very broad terrace, covering about 40 acres is separated from the benchland north by a drainage arroyo, open or with dispersed elderberry bushes (Sambucus mexicana) in its upper reach, and vegetated by laurel sumac below. Xeric habitat with a many-stemmed dudleya (Dudleya multicaulis) population was observed in the mid portion of the gully as it crossed the terrace, during the 1984 site reconnaissance. As discussed subsequently, no many-stemmed dudleya plants were found during the 1987 survey.

This terrace segment, like the preceding contains a flower field band of shooting stars along its

north and west margins. This showy-blossomed species appeared to be less dense and continuous in its distribution than at the time of the previous survey, with more tall grass competition in the habitat. However, the survey time of season was somewhat later, and the spring of 1987 was unusual in that late rains stimulated the growth of grasses. The cessation of grazing may, however, play a role, as discussed above. Flower field settings were not subject to quantitative monitoring, however. A series of plot specific analyses over several years time are required to properly document the decline of flower field elements if, indeed, such a decline is taking place. The surveys should take place at identical points in the flowering phenology of the shooting star, dominant flower field species. This date, usually sometime in January to February, will differ from year to year and must be determined by onsite inspection. Fluctuation in flower field density, even of perennial elements like shooting star will result from short-term influences of cyclic drought or heavy rain, and the timing of rainfall. Monitoring therefore should be long term in order to discern what are truly successional trends, as differentiated from cyclic fluctuations.

The condition of the grassland is better here than in the north segment. Quantitative analyses proved especially useful. A long, dog-leg transect of 310 feet was run on flat ground near the center of the terrace. Its results differed somewhat from qualitative visual impressions, deceptive in such an expansive setting where the tall culms of annual Avena tended to disguise the importance of Stipa in the total cover. Nevertheless, there is enough inclusion of aggressive habitat-holding adventive species to warrant at least pilot project management intervention.

Diversity with this terrace segment, like the north is high. 2 native grasses, 1 native subshrub, 2 native herbs, 6 adventive grasses and 3 adventive herbs are present. Percentage of Stipa cover is a satisfactory 53%.

Results of Transect 6 in the upper level central terrace follow.

Transect 6
Upper Level Central Terrace

Transect Length 9384 cm (310')
Transect Occurrence Intervals 467

Category	Species	% Cover	% Frequency
3N	Stipa pulchra	53	28
-	dead grass mulch	12	19
2N	Bromus mollis	10	15
2A	Bromus rubens	6	8
3A	Avena barbata	5	9
3A	Bromus diandrus	5	3
3N	Dichelostemma pulchella	2	6
3A	Avena fatua	2	2
2A	Brassica geniculata dead (summer mustard)	2	2
2A	Brassica geniculata living	1	1
2N	Vulpia myuros hirsuta	.7	2
3N	Isocoma veneta	.7	.2
2A	Erodium botrys	.4	1
-	bare ground	.4	.9
3N	Sanicula arguta	.3	.6
2A	Hypochoeris glabra	.3	.6
1	Hordeum leporinum	.2	.4
		101	98.7

- South Terrace, Lower Level

The terraceland on the east side of San Juan Canyon is fully bisected by the unnamed canyon, which cut down through San Juan Creek's ancient floodplain levels as this larger watershed's base level itself was dropping relative to its surroundings. The relative descent in base level is suspected to be caused, at least in part, by late Pleistocene and Holocene tectonic uplift within the southern portion of Orange County (Rod Rashke, RMW Paleo Associates, personal communication).

On the south side of the unnamed canyon is Rancho Carrillo Road. An underpass culvert is located beneath the road, providing an access connection between the north and south portions of Caspers Park East.

The upper level terraceland and adjacent mountainside were burned prior to the 1985 site reconnaissance. At the time of the field survey, evidence of

vegetative cover was difficult to discern over much of the area because of subsequent cattle trampling and overgrazing. Those areas where vegetation was not obliterated exhibited "an almost total" (qualitative assessment) regrowth of Vulpia (foxtail fescue).

Cattle impact appeared to be most substantial on the northerly segment of the lower level terrace near the underpass, which was gated at that time. Large numbers of cattle were congregated here on a regular basis. The site still has not recovered from this intensive impact.

The northerly and southerly segment of the lower terrace were subject to quantitative vegetation monitoring during the current study. The upper level terrace was not assessed quantitatively, but was examined from a qualitative standpoint. The results of these surveys follow.

- Lower Level, North Segment

  This segment is bounded on the north and west by Rancho Carrillo Road, on the east by the slope of the upper level terrace and on the south by a drainage gully which eminates from the edge of the upper terrace. The slope east and gully south are vegetated by brush-grass mosaic. Both laurel sumac and coastal sage scrub elements are present there. In addition to a single oak tree, the flat contains disturbed adventive-dominated grassland with about 24% native Stipa within the cover. There is substantial cover of primary succession foxtail barley and mulch buildup of dead grass, presumably of annual species. Other weedy elements present are prickly lettuce (Lactuca serriola), Spanish clover (Lotus purshianus) and summer mustard (Brassica geniculata). The fairly diverse cover consists of 2 native grasses, 1 native herb which is a weed, 5 adventive grasses and 5 adventive forbs.

  Although this terrace segment is the least sensitive of all grassland sites surveyed, no facilities improvements are proposed for it at this time, because of its proximity to Rancho Carrillo Road. Despite its reduced floral sensitivity, it should be noted that this locale appears to be within a wildlife dispersion corridor between the unnamed canyon and Verdugo Canyon, utilizing the Rancho Carrillo Road underpass. During the ongoing field reconnaissance as discussed later, mountain lion scat was found in the vicinity of the underpass, and a brief glimpse was caught of

an animal which appeared to be a young lion moving rapidly out of the unnamed canyon toward the underpass. It is to be expected that wildlife also move between the unnamed canyon and Lucas Canyon via the existing farm road which would pass through future terrace camping areas on the lower level central and north terrace.

Results of the 159 foot long Transect 7, run from near the farm road west to the oak tree follow.

Transect 7
South Terrace, Lower Level
Northerly Portion Between Rancho Carrillo Road Underpass and First Drainage Gully

Farm Road West to Oak Tree

Transect Length 4810 cm
Transect Occurrence Intervals 282

Category	Species	% Cover	% Frequency
3N	*Stipa pulchra*	24	13
-	dead grass mulch	18	23
1	*Hordeum leporinum*	17	16
2N	*Bromus mollis*	14	15
2A	*Hypochoeris glabra*	10	11
2N	*Vulpia myuros hirsuta*	9	10
3A	*Bromus diandrus*	3	4
2A	*Erodium botrys*	3	3
1	*Lotus purshianus* (Spanish clover)	.7	.1
2A	*Brassica geniculata*	.7	.1
3A	*Avena barbata*	.6	.1
2A	*Bromus rubens*	.2	.7
2N	*Stellaria media*	.2	.7
1	*Lactuca serriola* (prickly lettuce)	.2	.4
-	beer bottle	.1	.4
-	bare ground	.1	.4
		85.5	97.9

- Southern Terrace Large Group Camp

Grassland condition here is better than in the terrace segment to the north. This setting contains about the same amount of open grassland as the preceding. The entire open area and the periphery of the brushland are proposed as a large group camp.

The central opening is partially encircled and semi-enclosed by dense laurel sumac chaparral which flanks it on the north, west and south. Slopeland chaparral of this species extends onto the margins of the flat. The hillside between the lower and upper terrace, east, contains an open mosaic of laurel sumac, coastal sage scrub and grasses. While the fringing brushland is an attractive frame enclosing the large group site, it also may provide cover for large predators. This is of concern especially if the site is ultimately intended for youth groups such as Boy Scouts, Indian Guides and the like.

The existing farm road will be jogged to the east so that it doesn't run through the middle of the group site. Some fill and culverting may be needed beneath the roadway as it crosses the drainage arroyo north of the large group site. Further north at the Rancho Carrillo Road underpass exit, severe erosion gullying will also require remedial action.

The results of Transect 8, a 163 foot long transect run east-west through the center of the large group camp shows that the area is a recovering native grassland. Stipa now occupies 30% of cover and Vulpia, the annual of post burn and post grazing areas within preexisting native grasslands, 15% of cover. Soft chess is the other important annual component, occupying 27% of cover. Stipa frequency is fairly good, at 23%. This indicates that there are a lot of fairly small and young clumps which would fill out and replace habitat occupied by annuals as they grew older. However, intensive use of the site will probably stop native grassland recovery here, resulting instead in a deterioration of cover and establishment of a variety of primary succession grasses and forbs.

This site is less floristically diverse at present than the preceding, probably because it lacks primary succession ruderals (except for some foxtail barley).

Results of Transect 8 follow.

- Upper Level of South Terrace

From Rancho Carrillo Road to the slope of Verdugo Canyon, this terrace encompasses about 50 acres. Burned in 1983, the terrace when surveyed about 9 months later was covered by Vulpia annual fescue. When resurveyed in late spring of 1987, the north

South Terrace, Lower Level
Large Group Camping Area: Transect 8

Transect Length 4933 cm
Transect Occurrence Intervals 185

Category	Species	% Cover	% Frequency
3N	Stipa pulchra	30	23
2N	Bromus mollis	27	23
2N	Vulpia myuros hirsuta	15	16
-	dead grass mulch	8	11
2A	Bromus rubens	8	9
1	Hordeum leporinum	4	5
3A	Avena barbata	3	6
2A	Erodium botrys	2	3
-	bare ground	.8	.5
3A	Avena fatua	.6	.5
3N	Isocoma veneta	.5	.5
3A	Bromus diandrus	.1	.5
3N	Dichelostemma pulchella	.06	2
		99.06	100

portion of the terrace contained very dense Stipa at the foot of the mountain slope, dispersed Stipa along the outer margin and dense ripgut brome within the central flat. There was also a lot of dead grass buildup. The south portion was not resurveyed. Stipa establishment near the base of the uplands is probably correlated with better water availability there from slope runoff. Ripgut brome successfully holds habitat in the center areas. Management intervention will be required to assist the reestablishment of Stipa there.

Rancho Missio Viejo once tried a pilot project of growing barley (Hordeum vulgare) on one of the terraces onsite. Ranch personnel today cannot recall the exact site of the pilot project, which failed. However, aerial photos of the upper level south terrace reveal 2 long paralleling diagonal scrapes from northwest to southeast. These may have been the pilot sites, or boundaries of a site. This would account in part for the lack of Stipa in the central part of the northerly portion of this terrace. As noted before, the setting was also substantially overgrazed and trampled by cattle.

This terrace was not subject to a quantitative analysis transect study. Such should be conducted

prior to and following a rehabilitation program to improve grassland quality.

d. Status of Component Species Inventoried in Grassland Transects

Species listed in the foregoing transects include members of primary and secondary seres and climax communities of California Valley grassland and Eurasian annual grassland. As discussed before, it must be recognized that the latter community is now established in climax condition within the state, supplanting both the perennial needlegrass-dominated phase of valley grassland and to an even greater extent, the light soil flower field phase.

Primary sere species are those which become established first after a period of heavy disturbance which may have resulted in denudation of the soil. These opportunists often rely on the surge of released soil nutrients associated with substrate disturbance. As the habitat stabilizes and nutrients become less easy to obtain, primary sere flora is gradually supplanted by secondary or intermediate-stage vegetation. This sere is ultimately replaced in fully stabilized habitats by components of a climax community.

While a group of species is listed as members of climax Eurasian annual grassland, it is the judgement of the HCP team that this community should not be considered a permanent feature of the study area terraces. Aggressive intervention may be required to reestablish native perennial grassland of relatively pristine condition, but the chances appear good that such effort would be successful here, because of the heavy and moisture-retentive characteristics of the substrate and the presence of Stipa even in areas of past heavy impact.

Following is a categorization of transect-inventoried species and some others which were inventoried in the grasslands outside of the transect reaches, annotated with symbol @.

1. Primary Succession

Hordeum leporinum (foxtail barley)

Medicago hispida (bur clover)

Lotus purshianus (Spanish clover)

Lactuca serriola (prickly lettuce)

Brassica nigra (black mustard)@

2. Secondary Succession

2A. Adventive (Eurasian) annual grassland

Erodium botrys (broad-lobed filaree)
Hypochoeris glabra (smooth cat's-ear)
Brassica geniculata (summer mustard)
Bromus rubens (red brome)
Centaurea melitensis (star thistle)
Silene gallica (windmill pink)
Cerastium glomeratum (mouse-eared chickweed)
Rumex crispus (curly dock)
Cynara cardunculus (cardoon)@
Eremocarpus setigerus (dove weed)@
Erodium cicutarium (red-stemmed filaree)@

2N. Native perennial grassla

Bromus mollis (soft ches
Vulpia myuros hirsuta (foxtail fescue)
Galium aparine (goose grass)
Stellaria media (common chickweed)
Silene gallica
Cerastium glomeratum
Rumex crispus

CLIMAX

3A. Adventive (Eurasian) Annual Grassland

Heavy Soil

Bromus diandrus (ripgut brome)
Avena barbata (slender wild oats)
Avena fatua (common wild oats)

Light Soil

Bromus rubens
Bromus mollis
Erodium botrys
Hypochoeris glabra
Silene gallica
Hemizonia ramasissima (slender tarweed)@

3N. California Valley Grassland

Heavy soil (native perennial grassland)

Stipa pulchra (purple needlegrass)
Dichelostemma pulchella (wild hyacenth)
Sildacea malvaeflora (checker-bloom)
Sanicula arguta (purple sanicle)
Isocoma veneta (coastal goldenbush)
Sisyrinchium bellum@ (blue-eyed grass)
Dodecatheon clevelandii (Cleveland shooting-star)@
Jepsonia parryi (mesa saxifrage)@
Bloomeria crocea (golden stars)@

Light Soil (flower field)

Lasthenia chrysostoma (goldfields)
Trifolium (clover)
Plagiogothrys nothofulvus (rusty popcorn flower)@
Cryptantha intermedia (white forgetmenot)@
Linanthus dianthiflorus (ground-pink)@
Eschscholzia californica (California poppy)@

Transect Elements which are not Grassland Components

Quercus agrifolia (coast live oak)
Malosma laurina (laurel sumac)
bare ground, dead grass, down wood, litter

e. Categorization by Component Status

- Introduction

The foregoing section lists transect inventory species according to seral stage and native/adventive community association. Those familiar with the species in question will observe that certain opportunistic natives are components of the predominantly adventive community, while several adventives are now found occurring in harmony with native dominants in fairly well evolved seres, at least in Orange County. The most notable of the latter is Bromus mollis which occupies a secondary position in the majority of clear-dominance Stipa pulchra transects evaluated. Bromus mollis infills areas around Stipa clumps. Transect 3, however, shows what occurs when Bromus mollis does not reign supreme as an infill species. Note several native wildflower species in the transect; one of which (Sildacea malvaeflora) is quite important with respect to cover and frequency. Bromus mollis does not appear to aggressively compete with the dominant needlegrass, but it does occupy space which in a truly pristine native grassland would be the habitat of its wildflower components.

Some idea of the maturity and native/Eurasian association importance can be derived by applying the classification scheme of the foregoing section to each of the transects. Note that light soil associations are not found in the transects, with the possible exception of #7.

- Species categories: % cover and # of species within transects

Category	Transect 1	2	3	4	Location
3N	43.9 (3)	51 (3)	48.8 (4)	71.1 (2)	Group camp are
2N	23.11 (5)	13.05 (3)	7 (1)	14.3 (2)	on lower
3A	12.7 (2)	6.2 (3)	6 (2)	2 (1)	terrace north
2A	12.28 (6)	18.05 (4)	20 (3)	.2 (1)	of unnamed
1	2.0 (1)	0.8 (2)	0 (0)	7 (1)	canyon, from
other	7.3	10	17	5.5	north to south

	5	6	
3N	42.3 (5)	56 (4)	Upper terrace
2N	12.4 (4)	10.7 (2)	north of
3A	19 (3)	12 (3)	unnamed canyor
2A	11.2 (4)	9.7 (4)	from north to
1	0 (0)	1	south
other	14	12.6	

	7	8	
3N	24 (1)	30.56 (3)	Lower terrace
2N	23.2 (3)	42 (2)	south of Ranc
3A	3.6 (2)	3.7 (3)	Carrillo Road
2A	13.9 (4)	10 (2)	from north-
1	17.9 (3)	4 (1)	south. #8 is
other	18.2	8.8	in large grou
			camping area
			site

- Interpretation of Species Category Results

  - Group Camping Areas North of Unnamed Canyon

    Native grassland association components are clearly dominant within these transect reaches, which were selected not because they contained significantly better quality habitat than that surrounding, but rather because the vegetative cover in each typified that of the surrounding area. The degree of dominance in Transect 4 is particularly outstanding. Transect 3 exhibits reduced importance of Bromus mollis, which correlates with increased importance of native grassland herb elements. This transect area receives some daily shade from nearby oaks and sumacs. As has been described before, it has been informally observed on the park site and elsewhere, that edge environments receiving some shade, and north-facing slopes are much richer in

grassland wildflowers than typical sites out in the center of extensive grasslands. The latter (Transect 4 is a good example) may contain heavy Stipa growth but are so densely vegetated that non-competitive wildflowers fail to thrive.

- Upper Level Terraceland North of Unnamed Canyon

While both transects show good native grassland recovery, in Transect 5 the adventive community is also well established in its climax phase. Aggressive intervention to eradicate Eurasian components will probably be required. These upper terraces are much larger than the lower ones. Soil conditions appear to be about the same, but the lower level receives the added benefit of rainfall runoff from the upper, with even some small marshy areas developed along the base of the slope. Somewhat faster recovery in the lower terraceland has also been facilitated by its smaller size and the relatively greater amount of grass-brush interface zone relative to the total extent of grassland. As implied above, recovery seems to be facilitated by these semishaded contact areas, and species diversity is usually best there.

- Lower Terrace South of Rancho Carrillo Road

This area was subject to intense cattle impact three years prior to the present study. The heaviest impact was just south of the Rancho Carrillo underpass. The terraceland had also been burned, a short time prior to the 1984 study.

The two transect reaches on this terrace exhibit the poorest quality grasslands measured on site. Transect 7, in the area of greatest past cattle impact, still contains a large cover of primary succession species.

A combination of management and "beneign neglect" would allow these grasslands to return to a more pristine condition. However, since they are substantially degraded relative to the remaining terrace areas, expansion of camping facilities here correlated with deletion of some sites on the terrace north of the unnamed canyon would help protect more valuable grassland locales.

- Upper Terrace South of Rancho Carrillo Road

No transects were run in this area. An informal walkover revealed that the previously burned grassland was showing, +/- 4 years later, positive effects from the fire. Stipa pulchra recovery was especially good at the foot of the mountain slope and about the outer margins of the terrace. Where Stipa was recovered, it grew in very extensive apparent pure-stand patches. Elsewhere, Bromus diandrus dominated, with relatively minor Stipa intermix.

This terrace is recovering well, but needs aggressive management of Bromus diandrus.

f. Management Plan for Native Grasslands Critical Habitats

In the preparation of this report section, research and project planning documents by two native perennial grassland rehabilitation specialists were utilized. These specialists are Karen Swirsky of Michael Brandman Associates and Suzanne Goode, an independent contractor whose professional affiliations include the U.S. Forest Service Riverside Fire Lab and U.C. Irvine. Key rehabilitation strategies suggested by both specialists which would be appropriate within the terrace grasslands are the pre seed-set mowing of adventive annuals and prescribed burning of native-adventive mix grasslands. Swirsky's paper also recommends cultivation in certain sites; this strategy is not appropriate here and indeed would promote growth of weedy elements. She also recommends herbicide application to broadleaf ruderals. This is not a desired strategy on the terraces because of the presence of sensitive native broadleaf field elements and the fairly low percentage of cover of large, aggressive ruderals. However, as discussed in Section 4.3.2 #1e, herbicide application is one of several appropriate strategies for controlling cardoon and improving raptor foraging habitat in a primarily adventive grassland on the mountaintop bald north of Lucas Canyon. Intensive rehabilitation of that grassland to bring it back to a native-dominated condition is not recommended at this time because of difficult access, low Stipa incidence and extensive climax adventive grassland species cover (especially Avena species). It is the opinion of the HCP team that rehabilitation chances are better on sites like the terraces which contain at least a moderate percentage of cover and frequency of Stipa.

Stipa seed collection and nursery propagation are also recommended as part of a rehabilitation plan by both specialists within the proposed rehabilitation area. Augmentation of existing Stipa colonies by new

plantings would be most appropriate on the upper level south terrace, following successful control of ripgut brome in the large central flat. Careful reconnaissance of the upper level terraces north of the unnamed canyon may reveal additional sites where planting out of Stipa plugs would be an appropriate strategy.

The preparers of the HCP have obtained permission to reproduce pertinent sections of Swirsky's paper from its author. Goode prepared a management plan outline and timetable specifically for the HCP.

Selected portions of the Swirsky paper follow. The paper was prepared in 1986 for Raymond K. Belknap, environmental consultant to Rancho Mission Viejo, and is titled Grassland Rehabilitation Program Phase 1: Initial Technical Review. References cited by Swirsky are included in the Section 6 Reference Appendix.

- "Grassland Restoration Research

  Native grassland restoration has been successfully accomplished in both the short and tall grass prairies of the midwestern United States (Anderson 1946, Curtis 1955, Ode 1970 and Schramm 1970), but until recently, little experimental research had been conducted on California grasslands. In the midwest, most disturbance to grasslands was the result of agriculture. The early prairie had been botanically catalogued to a certain degree prior to the widespread introduction of agriculture, and remnant stands of relatively pristine prairie were not uncommon. Seed stocks were available and species composition was known. Unfortunately, restoration researchers in California have not had these advantages.

  Research into native perennial grassland restoration in California began in the 1950s with researchers from the U.S. Soil Conservation Service and the University of California attempting to improve livestock forage production (McClaran 1981). Work in this area was discontinued for many reasons, including a lack of seed sources, high costs and a shift toward the use of introduced species such as annual clovers for forage. The first two problems remain for those who are interested in restoring native grasses today.

  Current interest in propagating native perennial grasses has somewhat different objectives than the production of livestock forage. These include erosion control, reduction of fire hazard, mitigation for environmental disturbance, improvement of habitat value for wildlife species and conservation

of the existing native grass gene pool. A general awareness of the aesthetics of "appropriate horticulture," including the use of native and drought-tolerant plants for landscaping, has contributed to this increasing interest in native grassland propagation and restoration.

This interest has generated a number of research projects and ongoing field experiments. In Southern California, the majority of these have been directed toward the control and diminishment of alien annual grasses and weeds, and the reintroduction or enhancement of purple needlegrass (Stipa pulchra). Among those who have been active in this field of research have been W. James Barry, State Park Ecologist with the State of California Department of Parks and Recreation; James W. Bartolome, Professor of Range Ecology at U.C. Berkeley; Wayne Tyson and Fred Sproul of Land Restoration Associates in San Diego; Tim Thomas, Natural Resources Manager with the Santa Monica Mountains National Recreation Area; and Richard J. Vogl, Professor of Ecology at California State University at Los Angeles.

Although the focus of ongoing projects in Southern California varies, depending upon the intended objectives, the following general discussion includes parameters, methodologies and conclusions common to all efforts to convert annual grasslands to native.

- Site Preparation

Alien annual grasses and forbs are known for their ability to compete aggressively with native plants for resources (White 1967). Therefore, the successful reestablishment of native perennials requires some site preparation directed toward the removal or suppression of these weedy species. The principal methods that have been attempted include the use of herbicides, tilling, mowing or grazing, and burning.

The purposes of these methods are to create an opening into which the native grasses can be introduced, and to minimize competition for resources during their establishment. Each of the four methods has its advantages and drawbacks.

Herbicides are a quick and inexpensive method for controlling broad-leaved weeds. On sites where the invasive species is mustard, for example, herbicides have proven effective. However, annual grasses are frequently the chief competitors of native perennial grasses, and monocot herbicides have the potential to be as damaging to the natives as they are to the annuals.

Tilling or disking annual grasses and forbs can effectively destroy the plants before they set seed, but the process can potentially expose to light and moisture a new crop of seeds that have remained in the soil from the previous season. At times, record crops of weeds have been produced through tilling. A commitment must be made to periodic tilling throughout the growing season (late October through June) in order to suppress weedy growth. This method is labor-intensive for large or remote areas and has the potential for exposing the soil to erosion. Additionally, operating heavy machinery on moist soils may compact the soil, which will favor invasion by broad-leaved weedy forbs. However, tilling has proven to be effective in small, flat areas, especially in experimental test plots (McClaran 1981; Rogers 1981).

Except in very disturbed places, where broad-leaved forbs are dominant, the major competitors with perennial grasses are annual grasses. In this situation, mowing may provide sufficient control to allow the successful introduction of native grasses.

As with tilling, the object of mowing is to prevent the current season's annual crop from setting seed. Repeated mowings at low heights is usually necessary, because many annual species produce seedheads very close to the ground. The disadvantage of mowing is that it does not subdue the many viable seeds remaining in the soil from previous seasons. Leaving heavy layers of clippings or mulch on the ground will partially offset this drawback, and may favor the perennials, which tend to grow in thick layers of self-produced mulch (Heady 1956). As with tilling, heavy mowing equipment may cause soil compaction.

Some researchers have attempted to use livestock to "mow" the annual grasses (Rogers 1981). However, the intensity of livestock use required to graze close enough to duplicate mowing tends to produce the well-documented effects of overgrazing, including soil compaction. In addition, livestock tends to prefer perennial grass (Sampson 1930) and may selectively graze it, thereby contradicting any beneficial effects of the grazing. Light livestock grazing is not an incompatible activity with native grassland restoration; however, it must be carefully controlled, and is probably not suitable as a site preparation tool.

Controlled burning is the preferred method of site preparation, as well as maintenance, by many researchers (Vogl, personal communication) especially

where the competitors are annual grasses rather than broad-leaved weeds. Fire is widely recognized as a natural component of California grassland ecology (Vogl 1974). Burning at the correct time of year (late summer or early fall) can destroy weed seeds on the ground just prior to the growing season. Large areas can be handled cheaply and, with properly trained and equipped personnel, safely. Moreover, if perennial grasses are present on the site, growth and flowering will be stimulated by burning, resulting in increased seed production the following season. In addition, many grassland soils in southern California are heavily disturbed by rodents. Pocket gophers and ground squirrels are especially abundant in southern California grasslands as a result of ecosystem changes such as predator control and the abundant food source provided by annual grass seeds. Rodent mounds and tunnels cause constant small disturbances or openings that are then invaded by annual grasses and forbs. Fire may be the only practical method of controlling this constant weed invasion.

A disadvantage of fire is that, if fuel accumulation is high enough to support a hot or intense fire, then the seed bed, and occasionally even the soil surface, may be altered. As mentioned above, surface litter forms a natural mulch that is beneficial to perennial species, enhancing the moisture-retaining characteristics of the soil and suppressing annual weeds. If a fire burns hot enough, surface litter will be consumed.

In addition, it is difficult to obtain a burn permit in many areas of southern California due to air quality regulations and long-standing policies of fire suppression. This latter attitude is rapidly changing as the important role of burning in fire control is recognized.

In situations where annual grasses are the dominant competitors and bunchgrasses or other desirable native forbs and wildflowers are already present, controlled burning is the management tool recommended by most restoration researchers in Southern California. However, in actuality, one or more of the four treatments discussed above may prove to be necessary. For example, spot treatment with broadleaf herbicides may be required to suppress species such as artichoke thistle, an aggressive pest species throughout much of Orange County. Mowing may be a necessary substitute for burning if a burn permit is unobtainable.

The most essential component of any or all site preparation treatments is timing. The key sequence is that suppression of annual grasses and forbs should be accomplished at a point between germination and seed set. In southern California, this is usually mid-January, but can be later or earlier, depending on the year's rainfall. Sufficient rainy season should remain after site preparation to allow for the native grasses to become well established prior to the summer drought. The length of period required is dependent upon the methodology chosen for the propagation of the native grasses.

- Propagation

Following site preparation, native grasses are introduced (or reintroduced). In southern California, this species has most frequently been purple needlegrass (Bartolome 1981), so the following discussion will focus upon that species. Researchers have utilized basically two methodologies for this process. The first of these is broadcast seeding, and the second is planting mature plants.

Although purple needlegrass is the most common native perennial grass remaining in southern California, it is not found in great abundance anywhere. Because of this and the low levels of commercial demand for the species, the seed is not available for purchase and must be hand-gathered. This situation may change in the near future, however, as demand for seeds increases (J. Bohn, Tree of Life Nursery, personal communication).

Some researchers have hand-broadcast native grass seed as a method for introducing the species into a prepared site. Broadcasting involves lightly breaking the soil surface with a rake to a depth of one-half inch (not necessary if tilling was the site preparation), scattering the seed on the surface, lightly raking the seeds in, gently pressing the seeds into the surface by walking on them, and covering the seeds with a light layer of native mulch. This is a simple procedure requiring little skill or commitment of resources. However, establishment rates using this method are very low, and the difficulty of obtaining large quantities of the purple needlegrass seed makes this method impractical for all but the smallest areas.

If broadcast seeding is the method chosen, then timing becomes especially critical. The germination period for perennial bunchgrasses such as purple needlegrass tends to be long and irregular, with seedlings appearing after annuals are already

established. Late spring watering may become essential if rains fail, especially at inland sites. Seeding should be accomplished late enough in the season for adequate control of annuals, as discussed above, but not so late that insufficient time remains for the perennials to become established prior to the summer drought.

Another method suitable for small areas, especially for enhancing areas adjacent to existing stands of needlegrass, is transplanting. Transplanting consists of uprooting the bunchgrass, dividing the bunch and replanting the sections in the prepared site. Trial studies conducted in the Santa Monica Mountains indicate a fairly high (80 percent) mortality rate with this procedure.

The method of choice for most researchers in the southern California area is to plant purple needlegrass seedlings grown in a greenhouse from hand-gathered seed. Growing seedlings in the greenhouse has the disadvantage of requiring large amounts of space and planting materials, but is much less wasteful of seed than broadcasting. Land Restoration Associates and researchers at Malibu Creek State Park have successfully used 1-inch cone pots to grow seedlings for approximately 2 months in a greenhouse (W. Tyson and J. Barry, personal communication). Soil, soil-vermiculite and vermiculite have all been used with good results. The seedlings are then placed in the prepared site using a "dibble," a common gardening device that generates a hole the same size and shape as the cone pots. Although this method is labor-intensive, large numbers of purple needlegrass seedlings can be placed in the ground fairly quickly by relatively unskilled workers. The data are not yet in for the Malibu Creek project, but the short-term success rate is encouraging (J. Barry, personal communication).

- Establishment Period

The first year after seeding or planting is considered to be the establishment period. Continued management for control of annuals may be necessary during this period. This management must be coordinated with the natural growth cycle of the bunchgrasses. The production of the culms that eventually produce the bunchgrass seed occurs in the fall, and vegetative growth occurs in the early spring. Burning is probably not an appropriate management technique at this point because insufficient dry fuel may be available to carry a fire. Herbicides continue to have a limited use, mainly for spot treatment of undesirable species.

Mowing is generally considered to be the best method for first year weed control and is a growth stimulator for the bunchgrasses. A weed-whip is a good tool for this procedure in small areas. Some researchers believe that the first mowing should be delayed until early spring to remove any annuals that threaten to overshade the bunchgrass seedlings. Others clip the seedlings as they are planted in order to stimulate root growth (R. Vogl, personal communication).

Because rainfall in southern California can be sporadic, a commitment should be made to utilize a temporary irrigation system. This can be as simple as hand-watering or as sophisticated as a portable agricultural irrigation device, depending on the size of the area, the ruggedness of the terrain and the resources available. Even in the case of severe drought, irrigation should only be required during the period of usual rain, ending in late April or early May.

The newly-established perennial grassland should be mowed again in the late summer. This will destroy any summer annuals about to set seed, and will stimulate the production of fertile bunchgrass culms by simulating a natural grass fire.

- Maintenance

Fire, mowing and grazing are all management techniques that have been used to maintain perennial grasslands. Some researchers continue mowing twice yearly, early spring and summer, with good results (T. Thomas, personal communication)." (Long term fuel break mowing in Laguna Beach has stimulated dense growth of Stipa lepida - HCP Ed.) "After the first year, there is some evidence that light livestock grazing during the same two periods will have similar results. Burning has been used alone, in the late summer or early fall, or in conjunction with spring mowing. For the first years after establishment, it may be desirable to reseed or plant additional seedlings.

There is nothing revolutionary in the techniques described above. The results so far have been encouraging, with mounting evidence that purple needlegrass is well suited for restoration projects (Bartolome 1981; Hull 1977; Swirsky 1986). However, nowhere has the establishment of large areas of southern California's native grassland been accomplished to date. The projects currently ongoing will require years of observation before such judgments as success or failure can be made.

Each additional project contributes important information to the growing science of restoration." (End of Swirsky paper.)

The following information is submitted by Suzanne Goode, prepared 1987 for Karlin G. Marsh.

- Work Plan

"Native grassland restoration projects can extend over a period of from one to five years or more, depending upon the size of the area to be restored, the specific characteristics of the site and the level of funding. Generally, projects lasting over a period of several years have a greater chance of success because weather conditions are variable from year to year, and because the reservoir of exotic grass seeds is usually too great to be eliminated in one year.

Gathering of quantitative and qualitative data prior to treatments is of value in determining which native grasses exist on the site and in establishing priorities for revegetation. Baseline data can also be used in assessing the success of subsequent treatments.

Prescribed burning has been shown to aid in increasing the ratio of native to introduced species in Southern California grasslands, particularly when conducted in late spring or early summer. Repeated burning is often necessary to reduce the number of exotic grass seeds.

Mowing has also been used to reduce the cover of exotic annual grasses by removing the flowering heads before the seeds are mature. Again, this treatment is more effective when performed several years in succession. Native perennial grasses are not reduced by this treatment, since they have the option of producing seeds every year.

Propagation of native grasses from on-site collected seed and planting on the site can be used alone or in conjunction with burning and/or mowing in order to speed the recovery of natives in areas where their numbers are small.

The following is an approximate timetable for a one-year project.

<u>Early Spring</u>

Field survey and map existing stands of native grasses.

Establish permanent plots and gather data on percent cover and frequency of occurrence of native and exotic grasses. These plots can be periodically resampled to monitor treatment success.

Mid to Late Spring

Gather native grass seeds.

Prepare burn sites for prescribed burn.

Conduct prescribed burn." (Note spring, rather than summer-fall burn time as recommended by Swirsky - HCP Ed.)

"Summer

Propagate native grass seedlings.

Fall and Winter

Plant native grass seedlings.

Spring

Resample permanent plots

This plan can be modified to span several years. Resampling of treated areas should be done for several years after the treatment, especially after burning, since the cover of native bunchgrasses decreases in the first two years following a burn. Mowing can be used as a supplement to burning (burning one year and mowing the next, or burning some areas and mowing others). Mowing can also be used as a substitute for burning when weather or smog conditions do not permit a fire in some years. Orange County in particular has very few days in a year on which prescribed burns can be permitted." (End of Goode submission.)

It is recommended that on a pilot basis, the upper north terrace grassland or the upper south terrace grassland be subject to a rehabilitation program which includes parcels left fallow (benign neglect management), parcels which are burned and parcels which are mowed. If the south terrace is selected, *Stipa* seed collection, propagation and planting out should be included in the rehabilitation program. Care should be taken on the north terrace not to work in the vicinity of the black-shouldered kite pair while they are occupying their nesting territory. Care should also be taken to not impact the shooting star population especially along the north edge proximal to the kite nesting site. Some experimental burning of grass-bush mosaic edge containing shooting stars along the west

edge of the high mesa may be appropriate. In both terrace sites, rehabilitation activities should be preceded by a grasshopper sparrow survey, and avoid nesting territories of this sensitive songbird (Sec. 4.2.3e).

Before/after and several year-spaced followup quantitative monitoring and management should be conducted within the pilot management area. The method which appears to work best on site (taking into consideration cost effectiveness) should then be utilized within its other terrace grasslands.

The pilot rehabilitation program should be conducted or directed by a grassland rehabilitation specialist who has conducted successful projects elsewhere involving Stipa pulchra grassland.

- Protection of Native Grassland Resources Within the Group Camping Area

  Design modification and operational practices will help to protect sensitive native grassland resources within camping areas on the lower terraces.

  - Design Modification
    Northern Terrace Group Camp

    It is recommended that the Northern Terrace Group Camp be deleted from the development plan. This group camp consists of only four or five sites. Grassland quality is good and management by spring mowing would probably improve it further by reducing the cover of various brome species. Burning is not recommended here because of the terrace's small size and proximity to flammable laurel sumac and sensitive oak woodland.

    In addition to native grassland preservation, there would be added benefits of deletion of this group camping area. First, casual spillover impact into Lucas Canyon shoud be reduced. Some random use of the canyon will still occur because of the Juaneno Hiking Trail tiein with the "mesa trail" (farm road). However, such is expected to be focused on the trail itself rather than on the environment as a whole. The kind of use that would eminate form the Northern Terrace Group Camp would be casual strolling (especially by children) down into the oak woodland at the base of the terrace, and possible wanderings over to the Lucas Canyon haul road. Oak woodland strollers could disturb the kite pair (see below) during the nesting season as well as trampling understory vegetation. A little use, mid summer to mid winter (the time when the kites have gone else-

where) would not be detrimental. A lot would be. A reduced use level in Lucas Canyon is desired, not so much because of habitat sensitivity but because of the liability risk of having park visitors on the heavily used haul road. As noted elsewhere, it is recommended that the south side of Lucas Canyon Road be barb-wire fenced. Nevertheless, while barb-wire fences are inconvenient to climb over, extensive experience by study team members reveals that they are not imposssible to cross. Signing and visitor education will also be helpful in reducing conflicts between park users and Ortega Rock.

The second benefit of deletion of this camping area would be reduction of impact on the black-shouldered kite nest critical zone and adjacent foraging area. As discussed above, casual ingress into the kite nest critical zone can be expected if this camping area is retained. Ingress would occur both below the nest in the oak woodland and at line of sight to the nest from the north edge of the high terrace. The site of the Northern Terrace Group Camping area is within the foraging land of the kite pair nesting nearby in the oaks. The pair would have ample foraging ground on the upper terrace whether or not the group camping area was built out. However, activity at the site might even discourage kite use of the upper level, as these birds are very secretive and shy away from areas where human use is in the line of sight. The kite issue is discussed further in Section 4.3.2 #2a.

The third benefit of deletion would be protection of a HCP-documented grasshopper sparrow habitat (4.3.2 #1e).

If the Northern Terrace Group Camp is built out, campsite locations should be adjusted slightly on the ground to avoid impact on the oak trees proximal to each camping area.

Central Terrace Group Camp, Northern Segment

Portions of this site contain excellent quality, native herb-rich perennial grassland. Other portions are less sensitive and diverse. Much of the site is grass-laurel sumac mosaic habitat. Some of the grass openings in the mosaic are quite pristine and sensitive; others are less so.

The feasibility of developing this terrace group camp soon must also be weighed against the risk of large predator attack in areas of good cover, as

discussed in Sections 4.3.2 #2 and 5.1.3. Until the probability of predator attack is considered to be reduced to a negligible level, the HCP team recommends that County Parks and Recreation consider delaying the development of this camping area.

When the development plan for the Central Terrace Group Camp northern segment is considered safe to implement, location of campsites should be made on the ground by a team which includes a botanist familiar with native grassland flora. Sites selected should be those exhibiting a reduced level of botanical sensitivity. The total number of sites in the Central Terrace Group Camp should be reduced to permit preservation of the more floristically valuable areas here.

The siting of camping areas proximal to oak trees should also be refined on the ground to reduce feeder root compaction impact from trampling, as described in Section #2, below.

- Central Terrace Group Camp, Southern Segment

The large campsite east of the farm road should either be eliminated or reconfigured into one or more small sites to preserve vernal marsh swales (see Section 4.2.2 #3 below). This design reconfiguration should also be made on the ground.

The northerly campsite location west of the road contains the most dense needlegrass cover of any area of the addition parcel subject to quantitative analysis. It is not known whether or not this high quality grassland extends over to the west margin of the terrace. Some quantitative evaluation should be made of relative habitat quality throughout this terrace segment. If percent of cover of Stipa is significantly less over along the western edge, a reconfiguration of campsites within the segment would be appropriate. As discussed before, Stipa density in grasslands along the farm road is attributed to the greater water availability here from runoff down the slope from the higher terrace.

Deletion of the northerly site and avoidance of the northerly perimeter in designing new sites will also reduce casual spillover impact into the sensitive cove oak and sycamore woodland on the north side of this segment. The woodland is a raptor nesting area and contains a diverse understory which would be impacted by trampling. By deleting sites near the woodland, opportunities

are maintained for raptor foraging along the north edge of the terrace segment.

- Lower Level Southern Terrace, North Segment

No camping facilities are proposed here. From a floristic sensitivity aspect, it would appear advantageous to plan and develop this area for group camping, despite its proximity to Rancho Carrillo Road. Sites could be located here instead of more sensitive areas recommended for deletion in the preceding and following pages. Ingress onto the roadway could be controlled by installing a high chain-link fence, screened by shrubbery.

The feasibility of developing the north segment of this terrace now must be weighed against the fact that it is proximal to a wildlife dispersion corridor on the farm road. As noted before and later, it appears that there is mountain lion use of this corridor, at least on an occasional basis. Wildlife corridors usually follow the path of least resistance and are typically coincident with dirt roads, trails, firebreaks, stream channels and other features which provide a relatively clear path through the ambient vegetation. Therefore, the level of risk here may be equalled within the camping areas on the terraces north and in the unnamed canyon.

- Southern Terrace Large Group Camping Area

No modification of site design is proposed. This setting is of reduced botanical value, though better than the north segment of the lower level southern terrace.

Timing of site improvements probably should be coincident with a determination of reduced risk to negligible level, of mountain lion attack. The dense brush surrounding this mesa provides excellent cover for an approaching predator. If developed now, use should be restricted to the open central portion.

- Landscaping

Jeff Bohn and Mike Evans of Tree of Life Nursery are of the opinion that only certain kinds of vegetation species are suitable for use in the heavy, rocky soil of the terraceland camping areas. They recommend Mexican elderberry, the indigenous laurel sumac and lemonadeberry (Rhus integrifolia).

The only trees marginally feasible for use here are coast live oak (Quercus agrifolia) and (propagated from local source) Engelmann oak (Q. engelmannii). Riparian species such as California sycamore (Platanus racemosa) or cottonwoods (Populus trichocarpa, P. fremontii) are not recommended.

The thrust of campground enhancement plantings should be preservation of the grass savannah aesthetic setting (such a savannah can have scattered trees or shrub clusters) while providing privacy screening between campsites. The landscape plan should be carefully designed to minimize risk of predator attack, as discussed in Section 4.2.3 and 5.1.3. Extending contiguous areas of continuous brush or trees by landscape plantings provides a corridor of cover for predators. Separation of landscape plantings from the surrounding brushland by areas of open grassland might provide some measure of safety. Using shade structures instead of landscaping for shading during the day is an alternative which should be considered.

- Facilities Operations

The native grass vegetation should be retained within the terrace camping areas and individual group campsites. The sites should be mowed as required, and the remaining grassland be left as is except for early spring mowing to control adventive annual grasses in locales which do not contain significant native herb vegetation such as Cleveland shooting stars or checker bloom.

Trails should be cleared from campsite areas to viewpoint amenities to reduce random trampling of grassland.

Signs should be posted adjacent to campsites and trails warning of rattlesnakes and enlisting visitor cooperation in protecting grassland and flower field habitats.

Groups which are assigned to terraceland north of the unnamed canyon should be preselected to exclude those desiring a large active recreation site for horsehoes, frisbee, softball, etc. Groups which desire large active recreation sites should be assigned to the Southern Terrace south of Rancho Carrillo Road. The native grassland stands north of the unnamed canyon would be damaged by dispersed active recreational use outside of developed and maintained campsites.

Camping areas should be subject to periodic qualitative and quantitative monitoring to assess impact on grassland, as well as woodland and vernal marsh habitats. Indication of deteriorating biotic condition within grasslands is correlated with an increase of bare ground and primary succession vegetation species, including broadleaf weeds and foxtail barley. Areas showing marked deterioration should be allowed to rest and, as needed, be subject to rehabilitation. Rehabilitation might include spot application of broadleaf herbicide, early spring mowing and revegetation with nursery propagated Stipa clumps, followed by first-year irrigation (as described by Swirsky, above). Monitoring may be conducted by qualitative walkover examination, and quantitative percent cover/frequency line transects or quadrants. Park personnel and volunteers should receive training on plant species identification and quantitative analysis techniques so they can conduct the monitoring studies accurately. At the present time, as noted previously, one Park employee has received training in quantitative assessment transect monitoring. She, and one volunteer have excellent knowledge of flora species. Two other Park employees have a general familiarity with transect techniques and the purpose of quantitative analysis.

- Interpretation of the Grassland Ecosystem

The goals and objectives of environmental interpretation include engendering a sense of appreciation of natural resources and processes which will hopefully be translated into acceptance of stewardship responsibility for the protection of these. Thus, an effective interpretive program could result in reduced visitor impact on sensitive grassland and flower field resources through such practices as staying on established trails and not picking wildflowers.

The content of an interpretive program for native grasslands can include the history of their near-demise in the Rancho era and later, the very limited extent of the community today, and why it has begun to recover at Caspers Park (which relates to substrate characteristics coupled with a reduced level of cattle grazing impact on Rancho Mission Viejo and the old Starr Ranch, followed by present-day elimination of grazing, and careful management). Grassland flora and fauna should be described and portrayed via exhibits, slide programs and nature walks. The expansive beauty of native prairieland should be experienced. The sensitivity and attitude

of the interpreter toward this resource's aesthetic character are important in relaying an attitude of appreciation to his or her audience. Finally, the fragility of native prairieland should be emphasized and the audience or field trip group given some guidelines as to how each person should interact with the grassland to reduce impact upon it.

2. Woodland and Woodland-Savannah

a. Location and General Description

Two woodland types occur in canyons and coves within and proximal to the addition parcel. Southern oak woodland is dominated by coast live oak (Quercus agrifolia). Some scrub (Quercus dumosa) - Engelmann oak hybrids occur within oak woodlands in the immediate vicinity of the park, and possibly onsite. One pure strain Engelmann oak (Quercus engelmannii) was found in the upper part of Lucas Canyon within the addition parcel during the ongoing site survey. This mature tree with several seedlings or suckers beneath in one of only a very few unhybridized Engelmann oaks known from Orange County. In areas where shading doesn't inhibit growth, oak woodland understory vegetation commonly consists of poison oak (Toxicodendron radicans diversilobum), currants and gooseberries (Ribes), climbing penstimon (Keckiella cordifolia) and large understory shrubs such as toyon (Heteromeles arbutifolia) and holly-leaved redberry (Rhamnus ilicifolia). A variety of mesic herbs and ferns are often found. Some common kinds are miner's lettuce (Claytonia perfoliata), common chickweed (Stellaria media) and western wood fern (Dryopteris arguta). One uncommon and sensitive herb of oak woodland edges is western lady's mantle (Alchemilla occidentalis), found in the "Dead Cow" lateral of the unnamed canyon. Another is venegasia (Venegasia carpesioides), scattered along woodland margins on the north-facing slope of Lucas Canyon and near the canyon bottom pond in the Ortega Rock lease.

A more complete description of the site's oak woodland biota is contained in Marsh and Roberts, 1985, pp. 10-12.

The second significant type of woodland on site is sycamore riparian woodland-savannah. While oak woodlands are often restricted to protected narrow canyons, coves and north-facing slopes, sycamore woodland-savannah is found along summer-dry streamcourses. The broad-leaf deciduous California sycamore (Platanus racemosa) captures deep underflow and so can survive on high stream benches and lateral canyon floors away from the margins of permanently flowing streams. The

survival strategy, dependence on subsurface moisture from runoff, differs from that of the oak, conservation of winter rainfall supply by selection of partially shaded slopes and inhibition of transpiration via leaf sclerophylly.

Sycamore trees occur on site dispersed through canyon floor, stream bench or cove grassland of adventive ripgut brome. These woodland-savannahs received substantial impact from cattle during the Rancho Mission Viejo ownership. Shaded and cool in summer, these were favored resting and grazing places. Areas of substantial cattle trampling, as within the immediate canopies of sycamore trees are now taken over by milk thistle (Silybum marianum), an aggressive and robust winter annual or biennial weed. A second invader, more common in mulefat scrub on site, is Italian thistle (Carduus spp.). Where the skirts of sycamore clumps are not underpinned by these prickly, noxious plants, a variety of native grasses, shrubs and forbs are found. These include giant rye grass (Elymus condensatus), Mexican elderberry, California wild rose (Rosa californica), poison oak and branching phacelia (Phacelia ramossima).

In many areas, sycamore and oak woodlands are admixed, though there may be some spatial differentiation between the aarrangement of oaks (back along the hillside) and sycamores (out on the flats) within these groves.

The biota of sycamore woodlands are more fully described on pp.8-10 of Marsh and Roberts, 1985.

A third woodland type, willow riparian, occurs within limited areas of the unnamed canyon, chiefly between the hillside water tank and the cattle trough on the canyon bottom northeast of the mesa farm road - canyon road intersection. Arroyo willow (Salix lasiolepis) and mulefat (Baccharis glutinosa) are component species.

The locations of woodland and woodland-savannah critical habitats within the Caspers Park Addition Parcel are depicted on the critical habitats map set and are summarized, following.

- North-facing slope of San Juan Canyon at north boundary of site (described 2.2.7 of Marsh and Roberts, 1985).

- North Cove, north of Nichol's Institute property (described 2.2.1, pp. 22-23 of Marsh and Roberts, 1985).

- Lucas Canyon: north-facing slope, adjacent canyon floor benchland and upper reach within area of summer water availability (within Ortega Rock lease). Resources dispersed except at east and west end. West end near mouth contains oak-filled lateral. Trees continue downstream from the lateral to Ortega Highway. (Resources described in Section 2.2.5 and on p. 23 of Section 2.2.1, Marsh and Roberts, 1985.)

- Cove Between North and South Segment of Central Terrace Group Camp. (Described in Section 2.2.1, p.24 of Marsh and Roberts, 1985.) This cove contains particularly undisturbed, diverse understory vegetation. Apparent evidence of mountain lion kill was seen here during the 1985 reconnaissance (bones of deer, cattle).

- Unnamed Canyon

  Woodland resources best developed in lower third of canyon, "Dead Cow" lateral and extreme upper end of canyon. (Resources described in Section 2.2.3, Marsh and Roberts, 1985.)

Individual oak trees and tree clusters are dispersed elsewhere within the Addition Parcel. Where these are proximal to campsites, design configuration adjustments are specified to protect tree health.

b. Survey Methods to Monitor Ruderal Infestation in Woodland-Savannah Understories

Two woodland-savannah habitats would benefit from management intervention to control weedy undergrowth infestations. This would enhance the aesthetic and biotic setting if habitats were revegetated with appropriate natives. Within the second area, such control is also necessary for visitor comfort. Raptors nesting in these habitats would benefit from improvement of grassland understory ground cover, easier to hunt than thorny thistle patches or the "forest" of dead sticks and tall living wands which characterizes a black mustard (Brassica nigra) thicket.

The only statistical monitoring within woodland or woodland-savannah habitats was conducted in these proposed management areas. They are the North Cove and the lower 1500 feet of the unnamed canyon.

The method of survey involved a systematic walkover of each to locate and map infestation sites of milk thistle, black mustard and Italian thistle. Then the width and length of each stand was measured with a intermediate distance (50 - 600 feet) rangefinder. A rangefinder works somewhat like the focus device on a camera. The ocular is adjusted for sharpness and then

the rangefinder wheel is turned until an object focused upon at the other end of the noxious weed patch forms a single rather than a double image. Most of the ruderal infestations were measured by HCP team member Marsh and Park groundsperson Randy Dimeo. Scott Smith assisted with measurements taken in the unnamed canyon. Dimeo found that the most effective focus object was an 8 foot long dead mustard stalk which he held high over his head and the intervening vegetation, moving it around slightly until Marsh was able to locate it using the rangefinder.

Some weed patches were too broad or long to measure with one reading by an intermediate distance rangefinder. A series of measurements were then required. The Italian thistle infestation in the south portion of the North Cove proved impossible to measure, being spread out through most of the understory of the mulefat thicketland. Most of the milk thistle infestations proved unnecessary to measure, as they followed the exact drip lines of the sycamore trees in the lower reach of the unnamed canyon. These could be measured on the 1" = 200' aerial photograph of the canyon.

The purpose of obtaining measurements from at least two directions was to calculate area of cover for each noxious species and make mapping more accurate. An area of cover figure is needed to calculate herbicide amount required and cost to be expended, if herbicide application is selected as the method of control. Area of cover also provides a base year figure for those sites where beneign neglect "management" is practiced. Some species, like milk thistle, may be self limiting in certain sites. In the North Cove, milk thistle infestation appeared to be less extensive in 1987 than two years previous. The phenomenon was also observed in some portions of the cardoon stand on the ridgetop north of Lucas Canyon. In summary, baseline year cover will provide the yardstick against which the success of various control practices, including "do nothing", can be measured.

c. Survey Results

- North Cove

The North Cove contains woodland growth along its back, eastern edge. The area between the trees and Ortega Highway contains a melange of adventive grasses (wild oats and red brome toward the highway and ripgut brome near and beneath the woodland stands), and thicket patches of prickly pear (*Opuntia occidentalis*), Coulter's matilija poppy (*Romneya coulteri*), California sagebrush (*Artemisia californica*) and assorted native herbs and weedy

species. There is a windmill tower toward the south end of the cove, and reportedly, a water trough nearby in the dense mulefat scrub which dominates this lower area.

Weedy species infesting much of the cove include black mustard, poison hemlock (Conium maculatum), Italian thistles, cardoon (Cynara cardunculus, also known as artichoke thistle) and some milk thistle. A total of 18 weed patches was inventoried and mapped in the cove. Description and size of major infestations follow. Locations are from north to south.

- Unnamed Canyon

The lower reach of the unnamed canyon contains woodland savannah of sycamore tree clones and ripgut brome-dominated grassland. Beneath the canopies of five large clones are dense milk thistle infestations which do not appear to be self limiting. Park grounds crews have mowed the colonies in spring, but this measure has, to date, not controlled them. The location of the infestations beneath sycamore trees makes herbicide application risky (because of potential uptake by the trees). The outer edges of the five infestations follow perfectly the drip lines of their sycamore canopies, and extend inward to the tree trunk clusters. The total area of milk thistle cover is about 48,700 square feet (1.1 acres). The areas of major infestation are beneath trees near the water trough. These were obviously resting locales for cattle in the past.

d. Management Plan for Woodlands

- Ruderal Infestation Control

The following text is reproduced from California Agricultural Extension Circular No. 97, revised, as published in Robbins, Bellue and Ball, 1951. Though old, it provides an outline of working principles which forms the basis for additional research and recommendations for the control of specific weedy species both in woodland savannahs and, discussed later, adventive grassland raptor foraging habitat on the ridgetop bald north of Lucas Canyon and trailside grassland habitat on the ridge north of the unnamed canyon.

#	Location	Size in Square Feet	Dominant Weed	Other Species
1	North end near hillside	3355	black mustard	-
2	Margin of woodland	7991	black mustard	milk thistle poison hemlock
3	Near Ortega Highway	1775	black mustard	Coulter's matilija poppy prickly pear meadowrue (*Thalictrum polycarpum*) *Phacelia* sp.
4	Woodland understory edge	810	milk thistle	coast live oak overstory
5	Woodland edge	990	cardoon	black mustard prickly pear mugwort (*Artemisia douglasii*)
6	Woodland edge, south of 5	7504	cardoon and black mustard	young coast live oaks nearby coastal goldenbush
7	Edge of drainage on bench above cove	400	milk thistle (thin, possibly self-limiting)	coast live oak overstory
8	South central cove flats	6634	black mustard	-
9	Just south of 8	1100	black mustard milk thistle	-
10	Edge of mulefat zone, and invading zone	6000	black mustard	C. sagebrush milk thistle mulefat
11	Mouth of drainage, south terrace, south of 10, east of 12	7735	cardoon	-
12	South cove around old windmill	60,000 (1.38 acres)	black mustard	milk thistle under live oak cardoon mulefat Italian thistle
13	South end of cove	impossible to measure. Exceeds area of 12, above	Italian thistle	mulefat overstory

Mowing can be effective before seeds are produced although there is a danger of poisoning if there are any grazers in the vicinity.[1] If there is no threat to stock, it is important to mow before the flowers are fully developed because fertile seeds may still form in the heads (Parson 1973).

In California, a mowing regime should begin in May, and mowing should be repeated four to six times during the spring and summer to suppress seed development. This program could take two years before control is visible (pers. comm., R. Lesco, Resource Management Specialist, Pt. Reyes National Seashore, 1985). This method has not been proven successful for eradication unless forb seed is introduced to the affected area.

Physical removal of thistle in troublesome spots has had limited success in Pt. Reyes National Seashore (pers. comm., R. Lesco, Resource Management Specialist, Pt. Reyes National Seashore, 1985). However, Lanny Waggoner, Chief Ranger at Marin Area Headquarters, California State Parks, suggested that digging the individuals out by hand was creating ideal conditions for germination (pers. comm., L. Waggoner, Chief Ranger at Marin Area Headquarters, California State Parks, 1985).

Opinions about burning as a form of controlling milk thistle are opposed. Mr. Waggoner mentioned that he observed a remarkable percentage of mortality in a thistle complex that was burned in an 'accidental fire' in January 1980. Other individuals have explained that seed germination may be enhanced by the disturbance created by burning, thereby encouraging *Silybum* establishment (pers. comm., R. Lesco, Resource Management Specialist, Pt. Reyes National

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1 "*Silybum marianum* has caused some of the worst cases of stock poisoning in the Northwest Tasmania. The poisonous principle is nitrate (Macadam 1966). Cattle and sheep eat the plant material which contains potassium nitrate and break it down by means of ruminal bacteria into the poisonous form (Knott 1971). 'The nitrite ion...combines with haemoglobin to form methaeglobin... [which is] incapable of combining with oxygen. If large amounts of methaeglobin are present in the blood stream, affected animals will begin to show respiratory distress for lack of oxygen.' (Knott 1971) Poisoning threats are increased when the plants are wilting after being cut or partly turned under during plowing and in wet weather (or) when soil moisture is high. In dry conditions they are not considered dangerous (Parsons 1973)."

Seashore, and N. Havlick, Resource Analyst, East Bay Regional Park District, 1985).

Herbicidal: Silybum marianum is most readily killed in the seedling and rosette stages of growth. The more mature the plant, the more resistent it becomes to treatment. One method of herbicide application is spot spraying with ester 2, 4-D (80% a.i.) at the dilution of one part in 1,600 parts water, increasing to one part in 400 as the plants near maturity. For boom spraying Parsons recommends 1/2 pint per acre increasing to 1 1 /2 pints per acre. Because germination occurs over a period of several months in the fall, autumn spraying will have to be followed up in the winter to deal with plants germinating later." HCP Ed. Note - 2,4-D is now replaced by Round-up as the preferred herbicide for milk thistle control.

"In an experiment of herbicide use on Silybum marianum in wheat, authors R. Meissner and C. Mulder found that when sprayed selectively at the two to three leaf stage, the thistle was controlled 100% by picloram and methabenzthiazuron in combination with phenoxyacetic acid compound, 'at rates normally recommended.' After forming a rosette of three whorls or so, they discovered that S. marianum was not adequately controlled by methabenzthiazuron alone. They mention that spot treatment with dicamba may prove successful at later stages.

Biocontrol: The seed weevil, Rhinocyllus conicus may attain densities sufficient to destroy the seeds of thistles in amounts necessary for effective biological control. In June 1971, 316 weevils were collected near Rome, Italy and experimentally colonized on S. marianum at a site near Santa Barbara. In September of the same year 9% of 154 dissected mature flower heads had been attacked (Goeden 1971). By 1973 94% of 208 flower heads examined were infested.

The eggs of R. conicus are found on the lower surface of the bracts of the newly formed flower heads (Hawkes et al. 1972). When the larvae hatch they bore directly through the bracts and into the flower where they feed upon and destroy the immature seeds and pupate in cells constructed among seed fragments. Adults emerge from these cells after the mature flower heads open to shed their seeds (Goeden and Ricker 1974).

Recently, the introduced seed weevil has been discovered on a variety of native Cirsium species (pers. comm., C. Turner, Botanist, USDA Biocontrol,

Albany, California, 1985). The United States Department of Agricultures (USDA) Biocontrol Station in Albany, California, is now advising against its release because of the potential harmful effects of its spread. Research concerning this information is now in progress.

Goeden reports that the list of biological control agents effective on S. marianum has the potential to expand, given further understanding and research on the effects of introducing new insect species."

Ongoing Pilot Control Projects

"Ms. Thomas of the GGNRA is conducting informal management-related research on a milk thistle complex in the Marin Headlands. In the winter of 1983 the three acres of infested area was mowed. By the spring of 1983 the thistle population was observed to be more dense than the control stand. However, in the following spring (1984) only a small percentage of individuals established, and large areas of bare ground were visible among them. Ms. Thomas broadcast Festuca seed in two 10' x 20' plots at this time. In one plot the remaining thistles were pulled by hand. In the other plot the thistles were left standing. By winter 1985 the area surrounding the plots was hosting a dense stand of thistle again. In the experimental plot that had been cleared of thistle before sowing Festuca, the percentage of thistle occurrence was twice as high as it was in the uncleared plot. Both plots support a much denser grass stand than the surrounding three acres. Although it appears that the control measures were successful, the evidence is still inconclusive (pers. comm., T. Thomas, Plant Ecologist, GGNRA, 1985). Contact:

Terri Thomas, Plant Ecologist
National Park Service
Fort Mason, Building 201
San Francisco, CA 94123
(415) 556-1838

Management of Silybum marianum has been underway at Kaweah Oaks Preserve since 1984. In February of that year an experimental application of 2, 4-D was applied to Silybum at its maximum rosette stage of development. The treatment has focused on dense stands under oak trees where cattle had traditionally congregated. This method of control proved to be successful. In 1985, however, herbicidal methods of control will not be employed. This year a 40 acre infested area will be mowed with a 'bushwhacker' before flower heads mature. Contact:

Rob Hansen, Preserve Manager
3450 Avenue 144
Corcoran, CA 93212
(209) 992-5308"

Summary of Recommended Control Measures

"To achieve control and potential eradication of S. marianum, physical removal, cultivation and mowing can prove effective if complemented by sowing a perennial, or otherwise competitive grass.

The most effective herbicides used on S. marianum are 2, 4-D" [and Round-up]. "The plant is most susceptible to the chemical from the seedling to the rosette stages of growth.

The introduction of the biocontrol agent Rhinocyllus conicus on milk thistle populations has provided some degree of control of S. marianum in Southern California. However, specialists at the USDA office of biocontrol are advising against its release due to the fact that it has been found on at least ten species of native Cirsium.

There are no completely satisfactory techniques to eradicate Silybum. All techniques should be considered experimental and treated as such, with the use of controls and careful documentation and reporting." (End of Bean paper.)

Based on the foregoing information, the HCP team recommends continued mowing of milk thistle stands in the unnamed canyon. The key mowing must be when the plants have committed energy to flowering but have not yet come into bloom. As stated above, mowing should be repeated four to six times during the growing season and continued for several years. The reason single mowings fail to control is that some seeds previously dispersed may rest in the soil for several years before germinating.

Areas cleared of milk thistle may be heavily mulched, or sown to fast growing but not long-persisting grasses, such as annual ryegrass (Lolium multiflorum), preliminary to establishing native perennial groundcover (see next section) when eradication of Silybum appears to be finally successful.

If it is deemed acceptable to use herbicides within the unnamed canyon, an integrated mechanical/herbicide strategy would incorporate one or more years of mowing as described above, followed by planting out rhizomes of beardless wild rye, Elymus triticoides (see discussion later). Later-germinating milk

thistle plants coming up through the rye would be sprayed with 2, 4-D amine (see discussion above), a broadleaf contact herbicide.

Yielding even faster results would be application of Round-up. There is some risk to the overstory tree vegetation through the use of this nonselective (a herbicide which kills everything), though at recommended application rates and concentration the risk is considered low. Round-up has low soil activity (breaks down quickly into harmless compounds) so is considered one of the more environmentally beneign herbicides. Either full control of undesired elements would have to be achieved before planting out of Elymus rhizomes, or latent-germinating seedlings spot-treated with 2, 4-D amine.

Cardoon, Cynara cardunculus

A comprehensive discussion of cardoon (artichoke thistle) control is included in Section 4.3.2 #1 f, which deals in part with improvement of raptor foraging habitat on the ridgetop bald north of Lucas Canyon by eradication of this species.

Artichoke thistle is not as serious a pest species in woodland-savannah environments as it is in previously disturbed grassland. However, as described before, an infestation site and additional dispersed plants occur in the North Cove.

This robust thistle is a taproot perennial. Control methods tried in the past include grubbing out the plants and root stalks early in the spring (before flowering), mowing, burning in late spring and applying nonselective herbicide (Round-up) and selective herbicide (Banvel). At Crystal Cove State Park, the most successful treatment in their four-year program is Banvel application. Banvel, however, is residual in the soil and can be carried by subsurface runoff into wetlands and areas with trees and other sensitive resources. While its use may be appropriate on the ridgetop bald, EMA weed control specialist Bill Tidwell recommends the use of Round-up in situations close to water or trees.

However, as noted before, spraying even Round-up within the drip zones of oaks or sycamores carries some amount of risk. "When only a small number of plants is involved (as in the North Cove), grubbing is a practical and effective method of control. The bulk of the main root must be removed, however, or new growth will occur." (Parsons, 1973).

It is recommended that the major effort to eradicate cardoon from the North Cove be expended on mechanical means (grubbing). Spot use of Round-up on persistent pockets, and application of a preemergent herbicide to eliminate newly germinating seedlings may also be necessary. As with the noxious weeds discussed above, patience and persistence are the keys to eventual control of artichoke thistle here.

Areas cleared of artichoke thistle should be revegetated wtih thick growing annual or perennial grasses preferably of native, indigenous species such as beardless wild rye or deergrass (Muhlenbergia rigens).

- The Do Nothing Approach to Ruderal Infestation Control

  This strategy (or lack of strategy) assumes that, with the removal of cattle and the disturbance they perpetuate, the environment will eventually stabilize on its own, and in the interim, even weedy species provide some environmental benefit by providing cover and seed food resources for wildlife. In more remote portions of the Park, "do-nothing" may be a reasonable and economically feasible approach. The measurements of cover and mapping of locations of ruderal infestations conducted for the HCP provide a basis for future monitoring. If this indicates that infestations are tending to be self reducing, then operations management funds could be allocated to more critical infestations within Caspers and other parks in the system (such as Arroyo Trabuco and Salt Creek). If infestations are not self reducing, their management can be phased to keep in balance with funding.

- Rehabilitation of Woodland-Savannah Understory Habitat

  In addition to the ruderals discussed above, these settings are dominated by the adventive annual grass, ripgut brome. Early spring mowing can be effective to control brome where control is desired Mowing should be conducted when the species has committed to flowering but before seed set. However, native replacements to brome in shaded situations do not tolerate trampling during the wet season and are of fairly robust habits, making them unsuitable for turf within camping areas. Current practice within Caspers Park West is to mow in late April - early May. This perpetuates the brome ground cover in picnic and camping areas, as the seed heads have usually matured by that time. These are incorporated into the mulch of down grass after flail

mowing, providing seed source for next year's ground cover. The lush green of the young grass in early spring and golden stubble later, after mowing, provides a suitable groundcover in wilderness-type woodland-savannah camping and picnic areas. For this reason eradication of the non-native from woodland-savannah recreation-site habitats is not stressed in the HCP.

However, beneath the drip lines of sycamore trees, where restriction of human ingress is a desired management objective (to prevent undue soil compaction), the introduction of indigenous savannah understory species is recommended. Chief among these is the robust, thick-growing native, beardless wild rye. Even better and more appropriate here, if a rhizome souce can be located is the naturally occurring hybrid between beardless wild rye and blue wild rye (Elymus glaucus). Blue wild rye is of lower growth form and finer texture than the former species, but fails to produce a thick stand of growth which excludes Silybum and bromes. The hybrid, however, combines the desired aesthetic characters of blue wild rye with the dense growth pattern of alkali or beardless wild rye. Locations of hybrid stands to use as rhizome sources in Orange County are unknown. They may occur in the Arroyo Trabuco and possibly Aliso-Wood Canyon Regional Park. Wayne Tyson, Land Restoration Associates, reports a large hybrid stand in Malibu Creek State Park in Los Angeles County. The population, of an acre extent is located near Las Virgenes Road.

However, it would be more desirable to utilize indigenous Orange County material for propagation. The Arroyo Trabuco Elymus stands possess the fine bladed characteristics desired, regardless of their taxonomic status. Those in Aliso-Wood Canyon are probably adapted to a more highly saline/alkaline groundwater regime than is present at Caspers Park.

Once a donor population is selected (from Arroyo Trabuco or yet undiscovered stands within or closer to the San Juan Creek watershed), according to Tyson rhizomes should be stripped out with a geology hammer pick at about 1 foot intervals. These are placed in a wet burlap bag for transport. A portion of the top growth of each rhizome is clipped to reduce transpiration. The salvaged rhizomes are planted in a growing medium in containers. These may be "book-type", salvaged 1/2 gallon milk cartons or whatever is at hand. Rhizomes are planted in the containers with the growing tips pointed upward. They should be held in the containers at least 6 weeks before planting out. Planting out should

occur when the soil is at field capacity (wet to several feet depth) during the rainy season, unless the transplant site is to be irrigated.

Recommended sites for planting out are locales under the sycamore trees in the unnamed canyon where milk thistle infestations currently occur, and sites in the North Cove where there are currently stands of wild artichoke, black mustard or milk thistle. Elymus introduction should be part of an integrated program of weed eradication and revegetation of eradication areas. Elymus species (the other is giant wild rye, E. condensatus now indigenous to the unnamed canyon) are excellent soil binders, useful for erosion control. In this role, their use may be appropriate to slow erosion in portions of Lucas Canyon and in gully sites on the lower mesa north of the unnamed canyon and at the Rancho Carrillo Road underpass. Tyson has pioneered the use of E. triticoides in a variety of rehabilitation situations in southern California, and praises the species' usefulness not only for woodland-savannah revegetation but as a drought-tolerant slope stabilizer.

In addition to planting beardless or beardless plus blue wild rye, the understory of the woodland-savannah in the lower portion of the unnamed canyon can be enhanced by native riparian shrubbery and other native grasses. Species such as deergrass, wild rose (Rosa californica), Mexican elderberry (Sambucus mexicana), California coffeeberry (Rhamnus californica) and lemonadeberry (Rhus integrifolia) are suitable for privacy screening between campsites, and the first 4 species can be used to enhance habitat structure within the drip-zones of sycamore trees. At the outer margins of live oak (Quercus agrifolia) drip zones, lemonadeberry, holly-leaved redberry (Rhamnus ilicifolia) and toyon (Heteromeles arbutifolia) can be used to extend the tree/grove microhabitat and provide a measure of protection from human ingress into the oak's drip zone, resulting in deleterious soil compaction.

Ongoing monitoring and care of rehabilitated areas and plantings should be conducted as part of normal operations maintenance. Initial maintenance may include periodic deep soak irrigation through the first dry season following planting.

- Expansion of Woodland Area in Upstream Portion of Unnamed Canyon

Tree resources are widely dispersed upstream from the woodland savannah near the canyon mouth. The

upper central portion (see hiking trail description) contains a melange of chaparral and coastal sage scrub elements, although there is a sycamore stand near the upcanyon headwater.

In implementation of camping facilities, features like the natural dry streamcourse and its fringing vegetation, and the brushy vegetation skirts around existing sycamore clumps should be retained. In the walk-in camping area and for a distance above, in locales where mulefat is growing, planted California sycamores should be able to survive without irrigation once well established. The addition of more trees (sycamores and oaks) to the canyon bottom will further enhance its wildlife carrying capacity. In addition to oaks and sycamores, Mexican elderberries should do well here and lend habitat structure.

- Adjustment of Campsite Locations to Avoid Oak Feeder Root Impact

Impact to oak trees proximal to campsite locations could occur in the Northern Terrace Group Camp, the northern node of the Central Terrace Group Camp, the walk-in camp in the "Dead Cow" branch of the unnamed canyon, and possibly in the large group site at the lower end of the unnamed canyon. The shade and beauty of oak trees are valuable amenities lending attractiveness to campsites. However, undue compaction from foot traffic within the canopies of oaks will contribute to their decline.

Oak feeder roots are vulnerable to compaction because of their shallow depth. They require well aereated, friable soil with ample incorporation of humus (supplied by the accumulation of dead leaves). Feeder roots extend 3 feet or more beyond the edge of the drip line. The drip line is defined as the margin of the canopy projected onto the ground below. According to POD Landscape Architecture, as much as 50% of the feeder root zone can be subject to such impacts as paving, (and presumably foot compaction) so long as the remainder is protected. This tolerance would allow for some infringement of a campsite pad into the shade of an oak's drip zone so long as the rest was prtoected, as by split rail fencing and signing (in much the same way as redwood (Sequoia sempervirens) drip zones are protected at John Muir National Monument and in high use areas of Humboldt Redwoods State Park). The area inside the fence should contain a good accumulation of dead oak leaves. As well as promoting good soil tilth, these, with their sharp exerted vein spines will discourage those who might choose to sit or lounge there.

Because of their fairly shallow feeder roots and the deep shade of their canopies, supplemental understory plantings should be located toward the margins of oak canopies rather than near tree trunks. Plantings can also function as ingress barriers as well as enhancing campsite privacy and structural diversity for avifauna and other wildlife. Appropriate planting material in the vicinity of oak trees is enumerated briefly in the last section. As well as shrubs such as toyon, redberry, lemonadeberry, elderberry and coffeeberry, there are several desirable subshrubs and forbs which could be used. Some of these are snowberry (Symphoricarpos mollis), climbing penstemon (Keckiella cordifolia), monkeyflowers (Diplacus spp.) and California goldenrod (Solidago californica). Selection will be more severely limited on the heavy cobble/clay-loam of the terrace camping areas. (See Section 4.2.2 #1 f, above).

- Erosion Control in Lucas Canyon to Protect Woodland-Savannah Habitat

Several portions of Lucas Canyon wash are cutting into the terraceland south. Some reaches are on the south edge of the floodplain; there, sidecutting is actually eating into the mountainside, causing erosion. In one instance, a long span of water pipe is exposed and suspended in the air (see #3 c, below). In at least one case, a meander sidecut is eroding the edge of a stream terrace which contains attractive woodland-savannah habitat of oaks and sycamore. This locale is immediately upstream of the cattle water trough in the lower canyon.

Some method of erosion control may be appropriate to halt further terraceland loss. Commenting on the appropriate physical methods which could be utilized is beyond the HCP scope; among biological methods are slope wattling and the planting of beardless or giant wild rye. Wattling, as described by Hardesty, 1984, is a "method of erosion control using live twig bundles of creekside plants embedded in soil." Bundles are typically 12-24" long, 5" in diameter of twigs 1/2 - 1 1/2" in diameter. Twine holds the bundles together. Species used in wattling which would be appropriate here are black cottonwood (Populus trichocarpa), arroyo willow or Mexican elderberry. The wattles are layed on their sides in horizontal trenches cut in the erosion slope. The slope, if vertical like much of the sidewall cutting in Lucas Cnyon should also be recontoured by addition of fill dirt and rock, ideally to 1:1 (45 degrees). Plantings should be made when the soil is at or near field capacity during the rainy season.

It is important that the bundles not dry out, but remain moist until they have rooted in the soil. Some irrigation augmentation would be needed to keep the rooted plants going until they were well established. This probably can be achieved by running a pipe or hose from the water trough over to the eroded slope and irrigating the wattled area by gravity flow. The water line should be checked periodically to make sure it is functioning properly. The inlet can get clogged up with the leafy algae (Chara, c.n. muskgrass) which proliferate in the trough, so should be screened. The hoped for result of wattling would be a brushy bank which reduced floodwater energy and erosion potention. As discussed later, wattling combined with slope recontouring may also be appropriate in the upper wash reach to protect the water pipe.

- Facilities Operation of Camping Areas Within Woodlands

Oak trees within recreational use areas should be examined periodically. The examination should look at the canopy, trunk and understory. Signs of stress exhibited in the canopy (especially in oaks) include a general thinning of its density and significantly dieback of a greater extent than seen in trees nearby which are not stressed by facilities use. (Some dieback "flagging" in substained drought conditions, as during the HCP survey period is probably caused by twig girdles and is a normal means of self pruning, reducing canopy amount to balance with low amounts of available water.) Among signs of stress and disease exhibited by the trunk of the tree are bloating near ground level (Phytophthora water mold, blocking the xylem tubes which carry water from roots to leaves). This pathogen also causes trunk canker. The symptoms of trunk canker are "sparseness of foliage, loss of foliage, death of variable numbers of smaller branches, various size cankers at the soil line, and death of the tree" (Raabe, 1979). This condition is exacerbated by "excessively wet soil conditions due to prolonged rains, overwatering, poor drainage and raising the soil level on the main trunk" (Miller, 1941). "The importance of summer irrigation as the most important contributing factor cannot be overemphasized." (Raabe). Signs of oak root fungus (Amillaria mellea) can also be detected by examining the lower trunk and digging around the base of the tree to expose some of the root crown. Look for layers of white fungus tissue between the bark and wood here. Smell the trunk for mushroom-like odor. Sometimes the base of the tree will be ringed with tan Amillaria mushrooms. Amillaria, like Phytophthora, is stimulated by summer watering.

The soundness of trunk and limbs should also be evaluated. Many older oaks are afflicted with heart rot, a condition caused by a number of fungus species. Look for fungus fruiting bodies on the tree trunk. Old trees can survive hollow with heart rot so long as there is adequate xylem and phloem tissue retained in the outer wood layers to transport water from roots to leaves, and food from leaves to roots. However, trees proximal to campsites may pose liability risks. Sycamores should also be evaluated for limb and trunk soundness if they are located near campsites.

There are a number of insects which live in the oak canopy whose caterpillars eat foliage. Most are not significantly harmful in the absence of other sources of stress (prolonged drought, poor management in recreation areas). However one, the California oak moth, a small, evenly tan, unpatterned moth is a serious defoliant in its larval (caterpiller) stage. Oak moth populations tend to peak and crash from year to year (Brown, 1979). In a peak year, substantial foliar damage will be observed throughout oak stands. Twig girdlers (Agrilus angelicus, a Buprestid beetle) exert substantial damage during drought years; flagging within the canopy (clusters of dead leaves) is a symptom. As noted before, the sum results may be beneficial by reducing canopy volume during drought years.

Management of insect pests is probably not necessary in a wilderness park. The species described above and others have coevolved with coast live oak and other Quercus taxa. Some years will be characterized by heavy insect infestations; these, in turn will be boom times for insect eating avifauna ranging from orioles and tanagers to titmice, vireos, warblers and flycatchers. Management of Phytophthora and Amillaria, once detected should be under the direction of a plant pathologist familiar with these infections. Prevention is the best management; oaks (and sycamores, see below) are intolerant of summer watering. Location of hose bibs away from trees is one design means to prevent later problems.

Sycamore trees also should be inspected periodically Limb drop is a problem which can pose a liability risk. Hollow old trees proximal to campsites should be evaluated for soundness, and remedial cabling or other measures as directed by an arborist employed as needed. Trees out away from facilities areas should be left to natural processes as befits beneign management within a wilderness park.

Arborist Jim Griffin (pers. comm.) considers the principal problems inherent to sycamore trees as spring mildew, mistletoe,, oak root fungus and heart rot. In the majority of years, the first set of sycamore leaves are attacked by blight (mildew) and Anthracnose. These leaves will wilt and die, but the tree is able to put out a second, or sometimes third set which will survive through the summer. This is a natural condition to which sycamores in the cismontane area are adapted. New sycamore plantings should therefore, be propagated from local stock. Mistletoe infestations attack the cambium on the outer branches, causing stem brittleness and windfall. Heavy infestations on sycamores in recreation areas should be pruned out. This can yield a small cash benefit before Christmas, when mistletoe. is a salable item. Oak root fungus (Amillaria) also attacks sycamores subject to summer water. The sycamore near the water trough in the unnamed canyon should be monitored for Amillaria. The location of hose bibs away from sycamore trees should also be a design criterion. The last major problem of sycamores noted by Griffin is heart rot, which causes old trees to become hollow and subject to windthrow. This is a naturally occurring condition in old trees, as it is in oaks and other genera.

Understory condition within oak and sycamore canopies can be evaluated by using a point penetrometer at soil field capacity. Initial testing before facilities are opened to public use will establish the baseline of soil density against which subsequent compaction can be measured. Point penetrometer testing was not done as part of the HCP because field capacity conditions were not attained during the survey period. There is also a problem with point penetrometer use in Caspers Park East, because of the high cobble content of the floodplain and terrace soil. Achieving a penetration area of 2 feet depth without running into rocks may be impossible. Joe Osborne, U.C. Riverside (714-787-3143) owns a point penetrometer which he was willing to loan to a qualified County consultant or employee after initial training in its use. A good quality recording penetrometer like the one owned by Mr. Osborne can be machined at U.C.R. from a design developed by Donald E. Little of the USDA Colton Research Center in Shafter, CA (767 Central Avenue, Shafter, CA 93263). Little was marketing the item for about $500.00 in 1976, and the estimated cost of replicating it now, if no longer available from this source, is from $800.00 to $900.00. Such a device would be a desirable acquisition for Parks and Recreation Operations, since understory soil compaction is a management problem throughout the County Parks system.

Management of compacted understory habitat includes renovation of the soil and addition of mulch, and campsite rest/rotation. Methods are outlined by Nesbitt, 1984 in a comprehensive study commissioned by EMA Parks and Recreation. Some strategies include loosening the compacted soil with a rotohoe or a golf course renovator, surface mulching (preferably with incorporated oak leaf litter), some vertical mulching (penetrating 3-4' deep into the root zone with an auger, and filling the hole with mulch) and, if determined necessary by an arborist, some supplemental fertilization (low dose, organic nitrogen broadcast or injected 10-18" into the soil).

The condition of understory vegetation within and near recreational use areas should also be monitored. Signs of impact to woodland habitats can be loss of diversity of understory flora against what was present previously. Especially vulnerable areas are the "Dead Cow" branch of the unnamed canyon, the cove between the north and south segments of the Central Terrace Group Campground and the south lateral of Lucas Canyon adjacent to the Northern Terrace Group Camp. Each of these areas is described by Marsh and Roberts, 1984, and the former is also discussed later. Monitoring would involve a pre and post checklist. Prior to opening the camping facilities in Caspers Park East, each site's understory should be inventoried and archival photographs arrow-keyed on a 1" = 200' or larger scale map taken. This survey, as described subsequently should also include an inventory of birds and other fauna present. The photos and floral/faunal checklists then form a basis for future monitoring. The photos, maps and checklists can be set up in booklet form for ongoing yearly monitoring, as illustrated on the following page.

Space should be left to add new species detected through the monitoring years. A change in species composition to kinds occupying disturbed sites, as well as a loss in species diversity can indicate habitat degradation and need for management intervention. Thus, an influx of weeds not present before, or of fauna species of disturbed places is an important monitoring clue.

The monitoring program for woodland critical habitats would be an ideal joint project for Caspers Park staff and knowledgeable individuals from the volunteer group. It is one of many ways that the Caspers Volunteers can make a valuable contribution to the operations management of Caspers Park East.

CRITICAL HABITAT: Cove between north and south segment, Central Terrace Group Camp

	Base Year	Use Year											
UNDERSTORY FLORA	0	1	2	3	4	5	6	7	8	9	10	11	12
western wood fern													
maidenhair fern													
Alaska rein orchid													
California wild rose													
blue wild rye													
FAUNA													
ring-necked snake													
red-shouldered hawk													
plain titmouse													
acorn woodpecker													
dusky-footed woodrat													
mule deer													

Management of vulnerable woodland habitats predicated on monitoring results which show habitat degradation includes the following elements:

- Closure and rest of site: barriers and signing to discourage entry
- Trash cleanup
- Increased ranger patrol of sensitive woodland areas
- Rehabilitation: weed eradication, soil renovation, mulching, revegetation of understory.

3. Freshwater Springs, Marshes and Swales

a. Location and General Description

The focus of this discussion is on the floristic aspects of natural and artificial wetlands within and adjacent to Caspers Park East. These locales are also of significant value for wildlife species; that role is discussed in Section 4.2.3, #2 c.

Wetlands on and near the HCP area include the following:

- North Cove Scrub/Shrub Wetland

  This habitat, dominated by mulefat, is located in the lower, southerly portion of the North Cove. The palustrine wetland is located in the lower elevation, southerly part of the cove adjacent to the Nichols Institute boundary. Scrub/shrub wetland with scattered riparian tree inclusion covers 7 acres of the cove.

  The reasons for occurrence of this mulefat stand include topography at the low end of the cove, the damming effect of the Ortega Highway embankment which blocks westward drainage into the San Juan Creek floodplain and possibly, surface or subsurface leakage from the old well at the upper end of the mulefat thicket. There is reported to be a cattle water trough near the well (Bob Clark, Rancho Mission Viejo) though it was not found in the dense brush during the field reconnaissance. The well was once equipped with a windmill whose wooden tower still remains.

  Although palustrine shrub/scrub wetland is included in the National Wetlands Classification System (Cowardin et al., 1977), its value in Caspers Park East is more potential than actual. Site conditions indicate that if the well in the North Cove could be brought back into operation, it would supply water for a more structually diverse wetland here that might include willow thickets, marshes and ponded areas. This would be a significant offsetting mitigation for habitat impact on the grassland terrace north of the unnamed canyon, and within the canyon itself (though it would not be mitigation in kind).

- Lucas Canyon Springs and Pond

  These aquatic features are a short distance north of the Park's boundary with the Ortega Rock mining lease. Although not in Caspers Park East, they are important as watering sites for fauna which live in the park. The pond and springs are surrounded by lush woodland of oaks, sycamores and a few white alders (Alnus rhombifolia). The pond is an artificial impoundment utilized by Ortega Rock for its mining operation, specifically for water trucks which sprinkle the roadway to keep down dust. This indirectly benefits parkland along the access road by reducing (though not eliminating) airborne particulates which settle on the vegetation. The impoundment, however, effectively blocks downstream

flow of summer water which would, in its absence enhance riparian habitat along the wash in park property.

The pond is the water source for the cattle troughs in Lucas and the unnamed canyon, according to Bob Clark. He states, however, that Ortega Rock has first rights to the water and if needed, can use it all, eliminating flow through the pipeline to the troughs.

Around the upper part of the pond in April, 1987 was a diverse assortment of marshland plants edged by riparian woodland undergrowth. Marsh species inventoried include the following:

iris-leaved rush (Juncus xiphioides)
San Diego sedge (Carex spissa)
tall flatsedge (Cyperus eragrostis)
celery (Apium graveolens)
bristly oxtongue (Picris echioides)
weedy cudweed (Gnaphalium luteo-album)
watercress (Rorippa nasturtium-aquaticum)
California cottonweed (Epilobium adenocaulon)
Hooker's evening primrose (Oenothera hookeri)
broad-leaved plantain (Plantago major)
green dock (Rumex cf. conglomeratus)
scarlet monkeyflower (Mimulus cardinalis)

This melange was edged by woodland undergrowth of California blackberry (Rubus ursinus), venegasia (Venegasia carpesioides), poison oak (Toxicodendron diversilobum) and other species.

Fauna seen in the mesic habitat were a ringneck snake, lesser goldfinches, black phoebes, song sparrows and an Anna's hummingbird.

In July, 1987, HCP author Loe visited the pond site again. Recent maintenance activity had resulted in eradication of most of the freshwater marsh and contiguous riparian woodland resources.

The pond is at a turnaround spur of the leasehold road. A dim trail marks the remnant of an old road which continues upstream to the area of the springs, about 1/3 mile east. Here, there was about an acre of marshy land, with areas of natural pooling. Sedges (Cyperus, Carex) and cattails (Typha) were predominant in the marshy habitat, which was flanked by lush riparian-oak woodland. When Loe revisited the springs in July, he found that several ponds had been excavated there, and most of the marsh and some of the woodland destroyed.

Just above the springs are mine pits very close to the canyon bottom, and accumulated mining debris. Ortega Rock mines "hard rock" for rip-rap and other uses. The mine workings are mapped as being upper Cretaceous Trabuco Formation conglomerate, a hard, reddish rock with inclusions of cobblestone. This overlies Jurassic Santiago Peak Volcanics, red and gray-green igneous rock (Morton and Miller, 1973, Stadum, 1973).

- Swales on Lower Terrace Between Lucas and Unnamed Canyon

  These are small, vernally marshy depressions distributed along the eastern edge of the lower terrace, where runoff from the higher terrace augments rainfall received directly. Moisture-indicator species growing in these depressions are western ragweed, curly dock and some mulefat. Swales were noted in the Northern Terrace Group Camp and the southern segment of the Central Terrace Group Camp.

  Like the scrub/shrub wetland of the North Cove, the value of these swales is more potential than actual. They may be filled-in remnants of vernal pools. If so, it might be feasible to excavate the swales so that spring pooling could occur and vernal pool biota become established. Vernal pools are unusual, endangered habitats in California. Orange County once harbored a number of pools on its coastal mesas (Newport Beach, Dana Point) and inland flats in now-urbanized El Toro. The last known extant pools were in Dana Point; these were obliterated just a few years ago. Apparently, the only locales left which harbor many vernal pool plants are the margins of some semipermanent bodies of water, including the Laguna Lakes and a stock pond in the Horno Creek watershed within Rancho Mission Viejo. Closest extant vernal pools are on the coastal mesas within Camp Pendleton and, across the Santa Ana Mountains, on the Santa Rosa Plateau.

  Vernal pools occur in areas of impermeable or very slowly permeable substrate. Permeability can be restricted by soil clay content and subsurface hardpans, or by subsurface bedrock. Winter rains accumulate in low depressions instead of percolating into the soil. These ponds slowly dry up with the advent of spring and summer drought. Biota adapted to vernal pools have evolved in these restrictive settings of temporary water and long periods without. Fauna consist of species that can complete their life or reproductive cycles in the brief period between winter and summer, persisting through

the dry period in the egg stage or as aestivating adults buried in the pool-bottom mud. Two examples are shield shrimp (Apus) and western spadefoot toads. Flora species sometimes appear in successional bands around the slowly drying pool. These concentric rings of vegetation often contain colorful species such as the blue Downingia, the yellow goldfields and the deep pink mesa-mint (Pogogyne). Many rare and endangered plant species have coevolved with vernal pools; even more the common flora of the pools is fairly restricted to them and not often seen elsewhere.

Evidence of actual pooling was seen on the ranch road and within the old graded flat on the Nichols Institute property. The Nichols pools contained brass buttons (Cotula coronopifolia) and Lythrum. Park personnel state that habitat along the ranch road is marshy during the rainy season and the roadway itself is treacherous to drive. These conditions may limit winter use of the terrace group camps.

- Unnamed Canyon Water Trough Marsh

As described before, there are two or three old cattle water troughs within Caspers Park East, one reported from the North Cove which was not found, one in lower Lucas Canyon and one in the unnamed canyon. The Lucas and unnamed canyon troughs are fed from the upper Lucas Canyon impoundment[1] through a pipeline which runs down Lucas Canyon and thence across the lower terrace to a water tank on the slope of the unnamed canyon. Water from this tank then drains through a pipe to the water trough on the canyon floor below. Either the tank or pipe leaks, creating a moist slope habitat vegetated by willows (Salix). The trough below also overflows. The overflow has created a marsh habitat around the trough. The marsh contains an abundance of curly dock (Rumex crispus), some cattails, and other marshland species such as tall flat-sedge, Mexican rush (Juncus mexicanus), clustered field sedge

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1 Loe reports seeing pipe debris "lying all over the place" after the recent maintenance of the Lucas Canyon pond. While both troughs were full as of mid-July, 1987, it is not known whether the con-connection to the pond is still intact.

(Carex praegracilis), dallis grass (Paspalum dilatatum), weedy cudweed, prickly sow thistle (Sonchus asper), watercress and speedwell (Veronica anagallis-aquatica). The trough itself, like the one in Lucas Canyon (which does not overflow) is filled with the leafy alga, Chara. Mosquitofish (Gambusia) have been stocked in the trough.

While the marshy area is interesting from a floistic standpoint, and may be of interpretive value, its presence indicates a soil saturation condition which may threaten the large old sycamore clump nearby, making it subject to Amillaria oak root fungus attack.

b. Survey Methods

Surveys of wetland habitats were qualitative. Sites were recorded and associated species inventoried. All sites except the Lucas Canyon springs were initially examined by Marsh (with Krucki, Smith or Dimeo). The Lucas Canyon Springs were surveyed by Loe. No quantitative analyses of wetlands biota were conducted, nor deemed necessary to conduct.

c. Management Plan for Wetland Habitats

- North Cove

The condition of the well in the North Cove should be examined, and a determination made of the cost feasibility of bringing it back into use. If a finding of feasibility is made, then a design should be prepared to excavate portions of the lower, southern end of the cove to create a series of shallow depressions, of a depth sufficient to contain ponded water and slope gentle enough to support fringing emergent vegetation (cattails and tules) at water edge and freshwater marsh species above. Locales containing sycamore trees in the 7 acre existing palustrine scrub/shrub wetland should be retained as islands above the marsh and pond depressions. The wetland system would be fed from the well, re-equipped with a functioning windmill.

Wetland creation in the lower cove might be funded by a developer or public agency which through project implementation must destroy wetland habitat elsewhere. The Federal Clean Water Act stipulates that if more than 10 acres of wetland are to be destroyed (and from 1-10 acres at the discretion of the Corps), a Section 404 permit must be obtained from U.S. Army Corps of Engineers. U.S. Fish and Wildlife Service reviews Corps permits, and attaches as a condtion of approval, the pre-project creation

of wetlands elsewhere (in a ratio to loss determined by the Service) funded by the developer or agency. Public lands such as regional wilderness parks can provide ideal sites for in-kind habitat replacement or upgrading. A preliminary recommendation would be for EMA Parks and Recreation to inform the Service (Laguna Niguel office) that it has available, sites suitable for wetland creation/rehabilitation, and cooperatively with the Service, commission a design and action plan for wetland enhancement in the North Cove.

Weed eradication activities recommended before could be conducted concurrent with wetland creation here. Major construction activities within the cove should take place in the period from mid summer to mid-late winter, to avoid disturbance of raptors which may nest in the cove's trees.

Once in place, the proposed wetland habitat would provide excellent opportunities for environmental interpretation. A system of observation blinds, decks and raised walkways integrated into the wetland enhancement design could permit later interpretive activities without harm to the environment.

Access should be restricted to conducted group tours and, if possible, observation from a parking area along the Ortega Highway. The area is now fenced and gated, and should remain so. Since the site is close to Nichols Institute, it might be worth exploring the feasibility of joint tour group visits of the Institute's future native plantings and the wetland, which could be accessed through Institute property. Tour group bus parking space and restroom facilities would then be available at the Institute. Another potential interpretive feature within the park which would have to be accessed through the Nichols site is a good quality marine fossil bed along the old farm road on the mountainside east of the Institute. Visitations of the three sites: wetland, plantings at Nichols and fossil beds could be combined as part of a school day's outdoor education activity (±5 hours total) in a program which would probably be attractive to the O.C. Dept. of Education Orange County Outdoor School.

- Lucas Canyon Pond and Springs

These locales are outside of park property, so any influence the park has on their management must be derived from amicable communication between Parks and Recreation and Ortega Rock Co. A desired objective is a guarantee of water from the pond for

the Lucas and unnamed canyon cattle troughs.

Since the wetlands are of such value to wildlife in the park, it is important that access to them for wildlife not be restricted, as discussed subsequently.

The wetlands and forestland in upper Lucas Canyon are a lush green oasis, or were before recent maintenance activities. It is expected that in the absence of trails in Lucas Canyon and restriction of access to the road, few people will venture the several miles up the cobbly, channel dissected and cactus-studded floodplain to discover this verdant setting. Because of their location proximal to the high-hazard mining site, the woodlands and wetlands should not be utilized for guided nature walks. Once discovered, visitors would probably seek out the area again, and spread word of its existence.

As discussed before, the pipeline from the pond to the water troughs is exposed and hanging in mid air along upper Lucas Canyon wash. This condition, within County property, needs to be corrected by slope recontouring and wattling, or by other means. It also must be determined whether the pipeline is still receiving water from the pond.

- Terrace Swales

On an experimental basis, one or more of these small swales should be excavated (but not to a depth which would pose a liability risk). If these successfully function as shallow vernal pools, the program could be expanded to other swales. If it is determined that vernal pools, even very shallow ones, pose an attractive nuisance within a group camping area, only the northern terrace swales shoud be excavated (assuming deletion of the Northern Terrace Group Camp). Another amelioration of the "attractive nuisance" issue would be to fence the pools in such a way that wildlife could visit them for water but human access would be restricted. However, the pools are envisioned as an interpretive amenity. Conducted programs, educational signing and trails designed to provide points of access to pool edges (focusing impact so that other areas can support naturally occurring biota) are all features to permit people to become acquainted with vernal pools.

Vernal pools created on the terraces could be stocked with rare or regionally extirpated flora and fauna collected with owner cooperation from the nearest pool areas on Camp Pendleton (U.S. Marine

Corps) and Santa Rosa Plateau (the Nature Conservancy), the cattle pond on Rancho Mission Viejo and the Laguna Lakes (City of Laguna Beach, Irvine Co.). Many species will find their own way, via mud on the feet of birds from other ponded sites, despite their distance.

Vernal pool creation may or may not qualify as wetland creation/enhancement by U.S. Fish and Wildlife Service. If it does, then developer/agency funds could become available as part of service required offsite mitigation (see above).

- Unnamed Canyon Water Trough Marsh

  The marsh created by the overflow of the cattle trough is floristically diverse and of value for interpretative programs. However, the overflow may be threatening the sycamore tree nearby. As stated before, It is recommended that this specimen be evaluated by an arborist/plant pathologist, and the runoff situation be examined to assess its potential threat to the tree. While the sycamore as a riparian bench species utilizes deep underflow during the dry season, it does not normally occur in areas where there is summertime surface flow. As noted before, sycamores are susceptible to oak root fungus, and should not be irrigated or subject to summmertime surface runoff. If it is determined by the plant pathologist that the overflow constitutes a risk to the tree that cannot be mitigated by diversion of surface runoff away from its drip zone, then a float valve or other mechanism should be installed in the tank to prevent its overflow. If it is determined that it is possible to adequately mitigate impact on the tree by diverting surface flow away from it, this should be done. If the marsh is to be retained, there should be some type of elevated walkway through it for interpretive purposes. This raised walkway could also function as a small diversion levee directing flow into the wash upstream of the sycamore.

  The campsite depicted within the area of the marsh, trough, specimen sycamore clump and an additional tree upstream should be deleted. In addition to the marsh, this site is important as a water source for wildlife and is within the immediate nest critical zone of a red-tailed hawk pair in the sycamore clump.

4. Highly Vulnerale Resources

These botanical settings contain unique and aesthetically valuable resources which are vulnerable to exploitation

(gathering of wildflowers), trampling, roadside grading, fuel abatement stripping and possibly wildfires or controlled burns. Three types of vulnerable resources are identified in Caspers Park East: the flower field association within the native grassland community, the xeric "barrens" association, usually within the coastal sage scrub community, and the mesic herb association located at the margins of and openings within southern oak woodland. Descriptions of and management plans for each are discussed in the following pages. Survey methods to determine location and assess composition of these habitats consisted of selected followup walkovers of site identified by Marsh and Roberts, 1984. No quantitative surveys were conducted.

a. Flower Field Association of Native Grassland

- Location and General Description

There are two types of flower field associations found within undisturbed native grassland. The first, not well represented in the HCP area, is the light soil flower field association. Prior to the introduction of Eurasian annual grasses, these habitats were found in well drained light soil areas within the historic Valley Grassland community. The best preserved examples still extant in California are in the southern Antelope Valley north of the San Bernardino/San Gabriel Mountains. This area contains the famous California poppy (Eschscholzia californica) fields, interspersed with swaths of lupine (Lupinus), goldfields (Lasthenia), Gilia species and other vernally evident herbs. In the historic flower fields, grasses were not an important element, though the ecological setting was part of the Valley Grassland ecosystem. In most of cismontane and interior cismontane southern California, Eurasian annual grasses (mainly red brome and soft chess), and forbs (filarees, cat's-ear) replaced native flower fields after the advent of European settlement. Today in Orange, Riverside and San Diego Counties, light soil flower fields persist mainly in mosaic grass/coastal sage scrub or chaparral habitats which were not substantially impacted by range cattle. Good examples can still be seen in Temescal Canyon, Railroad Canyon and in the vicinity of Alberhill and Corona in western Riverside County, in mosaic habitats in southern San Diego County, as in Mexican Canyon near Jamul, and, in Orange County, on Rattlesnake Peak in Santiago Oaks Regional Park and on the still undeveloped portions of the U.C. Irvine Ecological Reserve. Prominent genera still represented in the Tri-County area are goldfields, owls clover (Orthocarpus), lupines, johnny jump-ups (Viola), baby blue eyes (Nemophila), popcorn flowers (Plagiobothrys), ground pinks (Linanthus), tidy tips

(Layia) and Gilia. An excellent discussion of the composition and demise of the light soil flower fields is given by Oberbauer, 1987.

Within the HCP area, some examples of the association are found in mosaic edge habitats of grassland and laurel sumac, as in the north segment of the Central Terrace Group Camp, on the upper level northern terrace, and in coastal sage scrub openings along the hiking trail on the mountain ridges east of these Pleistocene stream terraces of San Juan Creek. Species represented are goldfields, fringed ground pinks (Linanthus dianthiflorus), two kinds of Microseris, white forgetmenhot (Cryptantha intermedia), rusty popcorn flower (Plagiobothrys nothofulvus), and some others.

A second flower field association occurs within native perennial grassland on heavy soils. Its development in Caspers Park East is very good, and it is an association which is of enough prominence and visibility to warrant management protection. Heavy soil flower fields dominated by Cleveland shooting star (Dodecatheon clevelandii) occur about the margins of the uplifted terrace grasslands, especially on the north and west facing sides, as native grasslands abut and grade into laurel sumac chaparral and oak woodland. Locations are depicted on the critical habitats map set. On shaded slope habitats grading into oak woodland, mesa saxifrage (Jepsonia parryi) is also found. A heavy soil flower field dominated by blue-eyed grass (Sisyrinchium bellum) is located on the north-facing slope of the unnamed canyon east of the "Dead Cow" lateral. This slope is accessible from the proposed hiking trail. A third heavy soil flower field dominant, red-skinned onion (Allium haematochiton) is found in bunchgrass (presumably Stipa lepida) openings in coastal sage scrub on the south-facing slope of Lucas Canyon, within the proposed wilderness area of Caspers Park East.

The majority of the components of the heavy soil phase of the flower field association are bulb/corn wildflowers, or other perennials which possess a sturdy, fibrous rootstalk. Other species beside those enumerated above which are found in Caspers Park East are wild hyacinth, purple sanicle, checker bloom, Parry delphinium (Delphinium parryi), Alaska rein orchid (Habenaria unalascensis), mariposa lily (Calochortus sp.), golden stars and small-flowered amole (Chlorogalum parviflorum).

Heavy soil flower fields are typically found in transition margin or mesic slope habitats of purple

needlegrass prairie because there, Stipa clumps are well spaced rather than densely matted. The interstitial openings provide habitat for the (less competitive) herbaceous elements, as described previously. Out on central flats in recovering Stipa prairie, bromes, filarees and cat's-ear fill these interstices. In fully recovered climax stands, the needlegrass clumps grow so close together that only a few wildflowers (usually Dichelostemma) can push their way through.

- Management Plan for Flower Fields

Key elements of a management plan for preservation and enhancement of flower field associations include:

- Public education
- Spur trail design
- Control of competing elements in transition zones
- Assessment of the effects (positive or negative) of controlled burning
- Seeding or planting indigenous wildflowers from locally gathered seed
- Design modifications of northern segment of Central Terrace Group Campground.

These elements are discussed below.

- Public Education

One of the "cherished rights" of rural Americana was the picking of wildflowers and the preparation of bouquets for the dining table. However, here in southern California, population has grown and wildflower areas diminished. No longer can responsible individuals gather or permit the gathering of flower field elements. This message must be imparted to the visitors of Caspers Park East. The message may be: "See, enjoy, smell the delicate fragrance. Take only pictures and memories. Please try not to leave even footprints; the trail is provided to allow you access without harm to this beautiful spot."

- Spur Trail Design

In order that visitors may enjoy flower fields without trampling them unduly, loop or dead end spur trails off the Caspers Park East hiking trail may be designed to provide focused access to certain flower field areas. One spur trail may enter a shooting star stand. Another may loop up the

hillside in the unnamed canyon to view the blue-eyed grass-studded slope. Selection of the precise location of these spurs should be made "on the ground" during the spring flowering season. Equestrian use of spur trails should be prohibited and physically prevented. A hitching post could be provided at the entry of each spur so that horseback riders could walk into the sensitive areas without their steeds. (It is acknowledged that the Phase III GDP does not accommodate equestrian use of Caspers Park East. However, park operation does not specifically exclude horseback riders from this area at the present time. Unless such an exclusion is enforced and physical barriers erected at underpasses [difficult if they are to be used by vehicles], a sensible management plan recognizes that the equestrian factor must be dealt with in Caspers Park East).

- Control of Competing Elements in Transition Zones

In areas along the margins of grassy meadows which contain dispersed Stipa clumps and an infill of soft chess, red brome, smooth cat's-ear and broad-lobed filaree, but few or no native flower field elements, a control program might be attempted on a small-plot experimental basis to eradicate annual grasses by mowing, annual forbs by hand application of a contact or preemergent broad-leaf-specific herbicide, or both by controlled burning. The control program would probably require several years of effort to control the products of resting seeds in the soil. If the program successfully reduced cover of adventive elements, shooting stars could be introduced to these cites via seeding and/or planting out of nursery-grown stock propagated from locally gathered seed. If the small plot pilot program indicated success, the control and revegetation technique could be used elsewhere in locales where shooting stars had not yet established on their own.

- Controlled Burning

The effect of controlled burning on Cleveland shooting star has not been determined, to the knowledge of the HCP team. As controlled burning has the potential of improving grassland habitat quality generally, an experimental burn may be conducted on a small section of a less dense portion of the shooting star stand to assess fire effects on this wildflower species. The hoped-for objective of the burn would be to reduce Eurasian annual grass/forb cover to open up more habitat

for the native perennial wildflower. Unknown is shooting star's tolerance for fire. Therefore, careful pre and post fire quantitative analysis of the burn plot would be required. Fire also has to be managed very carefully in shooting star stands because of their proximity to laurel sumac chaparral and oak woodland. No burning is recommended in or near the latter community, because of its sensitivity and because in general, the best quality heavy soil flower field are found here.

- Campground Design Modifications

  Design modifications are recommended in the northern segment of the Central Terrace Group Campground, to protect native grass and flower field elements within certain portions of the grass/laurel sumac mosaic habitat. These modifications are discussed in Section 4.2.2 #1 f, before.

b. Xeric Association Flora

- Location and General Description

  Xeric habitats are found on dry, sunny ridges and steep slopes. Soils may be very shallow over bedrock, or alternatively, contain substantial cobble. Within the HCP area, several xeric habitats are found about the margins of lateral canyons and atop exposures of Trabuco Formation bedrock on the higher south-facing slope of Lucas Canyon. To the south, other exposures are found in cobbly soil on ridgetop between Lucas and the unnamed canyon, and on steep banks and roadcuts along Rancho Carrillo Road. The location of xeric flora habitats is depicted on the critical habitats map set. Two sensitive sites are in areas of existing and potential human use. The first is on the Central Terrace spur of the hiking trail just west of its junction with the North Terrace spur. This is high on the ridge crest between Lucas and the unnamed canyon. The second consists of several steep slope and roadcut exposures along Rancho Carrillo Road.

  Flora of xeric habitats varies from site to site. Cactus (Opuntia spp.) and yucca (Yucca whipplei) are often common components along with tall-growing beardgrass (Bothriochloa barbinodis) and crested stipa (Stipa coronata). Habitat atop Trabuco bedrock on the north side of Lucas Canyon contains carpets of Bigelow spike moss (Selaginella bigelovii) which color to vivid emerald green in winter. Some of the xeric sites, but not all, contain populations of the CNPS (California Native Plant Society) rare and endangered many-stemmed dudleya (Dudleya

multicaulis). Some of the most interesting xeric barrens" floral components are low-growing grass, herb and suffrutescent elements such as annual muhlenbergia (Muhlenbergia microsperma), Parish's three-awn (Aristida parishii), annual three-awn (A. adscensionis), fringed spineflower (Chorizanthe fimbriata) and odora (Porophyllum gracile). It is the variety of delicate small species that is most vulnerable to the impact of trampling along the hikng trail. Species inventoried in its xeric ridgetop habitat were, on the flanking slopes, yucca, prickly pear cactus (Opuntia occidentalis), beardgrass and crested stipa, and on the ridgetop along the existing wildlife trail, Parish's three-awn, annual muhlenbergia, fringed spineflower, loosely-flowered annual lupine (Lupinus sparsiflorus) and white forgetmenot (Cryptantha cf. muricata). Along Rancho Carrillo road, diversity is similar. Added species occurring there are odora and many-stemmed dudleya.

- Management Plan for Xeric Habitats

The impact of controlled burning on xeric habitat areas has not been documented, to the knowledge of the HCP team. Because these are low fuel sites, natural fires may skip them entirely or burn them only lightly. Burns in surrounding locales may actually benefit xeric flora by reducing competing brush. In controlled burns conducted near identified xeric flora habitats, fire-starter fuel should not be applied directly on them, or close enough that they would be subject to intense flame. Pre and post-burn analyses of these sites should be conducted. These assessments may be qualitative, using a checklist of flora species present before and after a controlled burn, or may be quantitative, using line transects or quadrats to measure amount of cover and percentage of cover and frequency of component species. The analyses could be conducted by volunteers and Park staff familiar with xeric "barrens" flora, assisted as required by a knowledgeable botanical consultant.

Xeric "barrens" outside of proposed recreational use, firebreak and road maintenance zones would require no other management except that specified above.

The xeric habitat on and adjacent to the hiking trail requires special protection. The hiking trail alignment should be kept as narrow as feasible (single file width) as it passes through this habitat. Signing should be erected at the site requesting visitors to stay on the trail so that

sensitive plants are not trampled. The ridge is quite narrow here, and pitches off steeply to the right and left of the trail. Therefore, signing should also warn the hikers of these hazardous conditions. A knowledgeable botanist should work with design and construction crews during trail building or clearing. Caspers Park groundskeeper personnel should be made aware of the area's sensitivity, so that resources are not destroyed during subsequent maintenance. A copy of the HCP critical habitats map should be posted or otherwise available at the maintenance yard or other location where it can be checked prior to various grounds care activities in Caspers Park East.

The hiking trail's Central Terrace branch must be off limits to horses, enforced by the placement of gates, stairsteps or other physical barriers, and by signing and patrol. There should be a physical barrier and signing at the farm road, stairsteps on the trail as it climbs the mountainside above the upper mesa and a physical barrier and signing at the junction with the Northern Terrace branch.

As the Central Terrace trail branch is the only place visitors to Caspers Park East can see a good example of this unique association, an interpretive guidebook for the trail should include a description of its resources (including line drawings of representative plants). There are several critical habitats and many interesting features along the hiking trail, which passes up onto the ridgeline east of the mesa and later drops down into the unnamed canyon. A trail guide would promote visitor enjoyment and hopefully good visitor behavior and resource stewardship. A description of the resources of the hiking trail which may be used as the basis for a trail guide is included in the HCP appendix.

The sensitive xeric flora habitats along Rancho Carrillo road should also be protected. Both sides of the road are within the jurisdiction of the park. County ownership extends approximately 75 feet south of the alignment, east of the higher Southern Terrace, according to the GDP Phase III map. Shoulder grading and firebreak disking or vegetation stripping should not take place within the xeric flora habitats, some of which contain many-stemmed dudleya. As these activities may be conducted by the Orange County Fire Department or the Rancho Carrillo community association, as well as by the park, a mechanism for interagency communication should be developed. The lack of such a mechanism between agencies having joint jurisdiction within a

single area of land has resulted in the recent past in significant habitat loss, even though the resource in question was being protected by the agency thought to have overriding jurisdiction[1]. As can be seen from the footnoted discussions, lack of communication between agencies, when one is "in the know" and the other is not can be a serious problem and in the recent past has even contributed to extinction of a protected species (the Palos Verdes blue butterfly). Interagency communication can be utilized to achieve common objectives as well as resolve conflicting ones. An example would be a cooperative controlled burn plan between the Park and the adjacent Cleveland National Forest and Rancho Mission Viejo.

The best safeguard for critical habitat areas proximal to activities which substantially modify the environment (such as disking or road shoulder work) is pre-activity flagging and fencing (a tape or rope is adequate if it is highly visible) and onsite supervision during heavy equipment operations. This method was used successfully to protect many-stemmed dudleya populations in Laguna Beach's Sycamore Hills Park during construction grading for the adjacent Kaufman and Broad housing development.

c. Western Lady's Mantle (*Alchemilla occidentalis*) and Other Woodland Edge Plants

- Location and Description

Western Lady's Mantle, a delicate rose family herb, is low growing and has finely divided, fern-like leaves. It is an uncommonly occurring component of mesic oak woodland margin and opening habitats. Other components of this often diverse and sensitive association are miner's lettuce (*Claytonia perfoliata*), wild geranium (*Geranium carolinianum*),

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1 Case 1 City of Laguna Beach (Community Planning Dept. vs. Fire Dept.). Community Planning maintained ESA (Environmentally Sensitive Area) mapping (mandated in the LCP) depicting precise location of only United States population of crownbeard (*Verbesina dissita*). L.B. Fire Dept. cut wide fuel break through most significant area of species without first consulting Planning Dept.

Case 2 Orange County Sanitation District, Southern California Edison in separate incidents removed significant vegetation from Featherly Regional Park "wilderness" nature trail area, impacting aesthetic and biological resources including old growth cottonwood specimens.

Pacific sanicle (Sanicula crassicaulis) and other herbs. The mesic edge habitat is vulnerable to trampling, especially in winter and spring when its plants are in evidence and the ground moist. The key area of occurrence is in the "Dead Cow" lateral of the unnamed canyon.

This lateral drains off the north-facing slope of the unnamed canyon about 2200 feet northeast of the Ortega Highway. Three large stands of coast live oak grow on the lateral's north-facing slope, within a matrix of scrub oak chaparral. Coastal sage scrub grows on the lateral's south-facing slope. The lower cove floor contains ripgut brome and dispersed cactus, sagebrush and buckwheat (Eriogonum fasciculatum). The floristically diverse woodland margin habitat is found in the contact zone of oak woodland and savannah edge.

The mesic edge habitat containing western lady's mantle extends out from the edge of the north-facing slope oak woodland at least 10 feet. The population wraps around to the edge of the cove flat below the headwater. Some cactus is also present on the upper flat.

The unusual name assigned to this lateral of the unnamed canyon came about through the find of a large number of cattle bones within the scrub oak chaparral understory by Steve Loe, HCP coauthor.

- Management Plan

There are several alternatives to the management plan for the mesic woodland edge habitat. The most protective would delete the two campsites in the "Dead Cow" lateral cove, and place a barrier fence and signing to restrict equestrian and pedestrian access. Alternatively, the sites could be developed, but designed on the ground to avoid direct impact on the edge habitat. A botanist familiar with western lady's mantle and other components of the edge association would assist in on-the-ground site design and location of pad boundary stakes. A low split rail-type fence should be placed at least 10 feet out from the woodland edge, and signing erected requesting that visitors stay out of this area due to its botanical fragility. Even greater protection for the habitat would be afforded in this alternative if the "Dead Cow" cove campsites were available for use only during the drought season, when woodland edge flora was dormant and gone to seed and the soil dried out, reducing its compaction potential.

With the implementation of the second alternative, there should be ongoing monitoring to assess the area and density of cover of woodland edge species. This may fluctuate due to prolonged drought or extended years of ample rain, as well as from human use. Therefore, quadrats, transects or visual qualitative inspection of diversity combined with measurement of zone width at several points (5 or more) should be utilized in concert with point penetrometer measurements (see before). The latter would assess compaction during periods of soil field capacity. An increase of compaction plus a decrease in cover density and width of the mesic edge floral zone would give indication of human impact which should trigger management intervention (closure, rest/rotation, increased supervision).

5. Rare and Regional Limited-Distribution Flora

This critical habitat category includes the sites of plant species which are recognized by the Federal or State government and/or private conservation organizations to be of limited distribution, rare, threatened or endangered throughout their ranges. In addition, it encompasses the habitats of locally rare species not so recognized. The following regionally or locally rare plant species have been found to date in Caspers Park East:

- Many-stemmed dudleya (Dudleya multicaulis)
  Federal candidate (Category 2) for threatened/endangered listing

  CNPS rare and endangered-listed

- Coulter's matilija poppy (Romneya coulteri)
  CNPS limited distribution-listed

- Engelmann oak (Quercus engelmannii)
  Rare in Orange County

- Venegasia (Venegasia carpesioides)
  Rare in Orange County

- Alaska rein orchid (Habenaria unalascensis)
  Rare in Orange County

a. Monitoring Technique

While the specifics of management of rare plant species differs according to the ecological requirements and potential impacts on each taxon, the mechanics of monitoring rare plants in California has been refined and standardized and today utilizes the California Native Plant Field Survey Form, reproduced on the following page. CNPS and CNDDB (California Natural Diversity

CALIFORNIA NATIVE PLANT FIELD SURVEY FORM

Transmittal form for field data collected on populations of California native plants submitted to the California Natural Diversity Data Base, endorsed by the California Native Plant Society and Southern California Botanists, approved by the California Native Plant Advisory Committee and the California Department of Fish and Game

OFFICE USE ONLY

Document Code _____ Taxon Code _____
Index Code _____ Occurrence # _____
Quad Code _____

IN ORDER FOR US TO HANDLE THIS FORM, PLEASE COMPLETE ALL ENTRIES IN THE BASIC DATA SECTION ABOVE THE HEAVY LINE. IF YOU HAVE TIME, WE WOULD APPRECIATE YOUR ENTERING ALL INFORMATION NOW AVAILABLE TO YOU WITHIN THE DETAILED SECTION BELOW THE HEAVY LINE. YOU DO NOT HAVE TO COMPLETE ALL ENTRIES IN THE DETAILED SECTION. YOU MAY USE THE BACK FOR COMMENTS.

BASIC DATA

Scientific Name (no codes): _____

Date of Field Work: ____ - ____ - 19____ (day / mo / yr) County: _____ Collection: ___ Yes ___ No (# _____)

Location: _____

Reporter: _____ Phone: ( ) _____

Address: _____

DETAILED INFORMATION

1. LOCATION

A. Is this a new location record? ___ Yes ___ No ___ Unknown Is this a subsequent visit? ___ Yes ___ No

B. Plant found? ___ Yes ___ No If not, reason:

C. Quad Name: _____ T_____ R_____ ___ ¼ of ___ ¼ Sec_____

___ 7½' ___ 15' T_____ R_____ ___ ¼ of ___ ¼ Sec_____

D. Owner (Name/Address/Phone): _____

E. Attach, or sketch on back, a map indicating the exact site, scale, and proximity to a prominent feature on quad sheet.

2. SPECIES BIOLOGY (Check one or more, and fill in percentages)

A. Phenology	B. Number of Plants	C. Population Area	D. Age Class
___ In leaf	___ 1–10	___ < 1 m² (= yd²)	___ % Seedlings
___ In bud	___ 11–50	___ 1–5 m²	___ % Immature
___ In flower	___ 51–100	___ 5–10 m²	___ % 1st yr
___ In fruit	___ 101–1000	___ 10–100 m²	___ % Mature
___ Fall regreen	___ 1001–10,000	___ 100m²–1 ha	___ % Senescent
___ Dormant	___ 10,001 +	___ 1 ha + (= 2½ac)	___ %_____

E. Compared to your last visit to this site: Number of Plants ___ more ___ same ___ fewer; Population Area ___ larger ___ same ___ smaller; Age Classes ___ same ___ different

F. Give reasons for changes

3. HABITAT (Describe site and check one or more, or fill in blanks)

A. Description

B. Aspect	C. Slope	D. Topographic Position	E. Light	F. Moisture
___ N	___ Slight, 0°–20°	___ Crest	___ Open	___ Inundated
___ E	___ Moderate, 20°–45°	___ Upper Slope	___ Filtered	___ Saturated
___ S	___ Extreme, 45° +	___ Mid-Slope	___ Shade	___ Moist
___ W	___ Vertical	___ Lower Slope		___ Dry
___ Flat		___ Bottom		

G. Elevation: _____ ft(m) to _____ ft(m). H. Microhabitat Relief: ___ ___ ___ ___ ___

I. Substrate/Soils:

J. Plant Communities/Associated Species/Taxa of Same Genus:

K. Disturbances/Visible Threats:

4. DETERMINATION (Check one or more, fill in blanks)

A. How was plant identified?

___ Keyed in a Flora (title _____)
___ Compared with Specimen
___ Compared with Photo/Drawing (source _____)
___ By another person (name _____)
___ Other (_____)

B. If collection was made, give collector's name and number, and repository for each specimen.

5. PHOTOGRAPHS (Check one or more)

A. Subject	B. Type
___ Plant	___ Sli
___ Habitat	___ Pr
___ Diagnostic Feature	
___ Other	

C. May we obtain duplicates, at our cost? ___ Yes ___ No

6. OTHER KNOWLEDGEABLE INDIVIDUALS (Name/Address/Phone)

Data Base) listed taxa are monitored following the format of the Field Survey Form, and this update information is incorporated into the CNDDB computerized file at the State Department of Fish and Game in Sacramento. For species of local concern which are not tracked by the Data Base, it is recommended that two archival repositories be utilized.

- The notebook sighting log maintained at Caspers Wilderness Park.

- The Museum of Systematic Biology at University of California Irvine (UCI-MSB) and/or Dr. Peter Bowler, Dept. of Ecology and Evolutionary Biology, UCI.

If in the future the County establishes a scientifically credible and properly curated natural history museum (of the quality of the Los Angeles or San Diego Natural History Museums), then the herbarium of this institution would be the logical local archive for monitoring data of county-wide significance.

The elements of the Field Survey Form include the following:

- Basic Data

  This includes the plant name, date of field work, location of population, and the person doing the monitoring work.

- Specific Location of Population

  For park use, this information is depicted on the critical habitats map. New locations may be found. These should be added to the map set. For Data Base or UCI-MSB use, the populations should be reported according to their U.S.G.S. Quadrangle locations. Caspers Park is depicted on the Canada Gobernadora, CA 7 1/2 minute Quadrangle map. Caspers Park East is located within Township 7 South, Range 6 West, and portions of Sections 7, 8, 16, 17, 18, 19 and 20. Under the Field Survey Form Section 1, "Location", quad name = quadrangle map name, T = Township, R = Range. To determine the quarter section (1/4) of the quarter Section (1/4), (the 1/16 Section) divide the Section in which the plant was found in half from north to south and in half again from east to west. Do the same with the quarter Section that the population actually occurs in. Please note that the grid lines on the critical habitat map are not equivalent to Section, 1/4 Section or 1/16 Section. County base mapping utilizes California Coordinates rather than degrees of latitude and longitude. However, by correlating lines of topography and distance from

landforms and physical improvements between the large County map set (1" = 200') and the small USGS sheet (1" = 2000'), an accurate location on the latter reference map can be made.

- Species Biology

Section 2 of the Field Survey Form is titled "Species Biology". Phenology, the development stage of the plant, is self-explanatory. Subsection B requests an estimate of the number of plants present. This can be an actual plant count if the numbers are small, or an approximation if the numbers are large, as they may be in some many-stemmed dudleya populations. A fairly accurate approximation can be derived by measuring the area of total cover and conducting a plant count in several representative quadrats (whose sizes are known) within the area of total cover. For instance, if the population area is 50 square meters (50 m) and within a representative quadrat frame sample of 1 square meter, 25 plants were counted, it would be safe to assume that there were around 1250 plants in the population. When sampling, sites within the population which are neither unusually dense or sparse but just average (based on qualitative scrutiny) shoud be selected.

Subsection "age class" is quite important for many-stemmed dudleya, as this species waxes and wanes according to cyclic high and low precipitation periods, each lasting several years. The species sets ample seed, but is not tolerant of prolonged drought, and populations may disappear entirely at that time (see below).

- Habitat Description

Section 3, "Habitat Description" is fairly self-explanatory. Aspect means which direction the population is facing. Degree of slope of 20 degrees is about 1 foot vertical to 2 feet horizontal, while 45 degrees is 1 to 1. Microhabitat relief is topography right around the population. Is it on a knoll, in a dip, on rolling land, on the flat or on a steep bank? For instance, the Rancho Carrillo Road stands of many-stemmed dudleya are near the crest of Lucas Peak, but their microhabitats would be the steep cuts along the road.

Soil formation can be determined by examining the aerial photo Soils Map #16 within Wachtell, 1978, Soil Survey of Orange County and Western Part of Riverside County, CA (USDA Soil Conservation Service), and reading the soils description in the

text which accompanies the map set.

Plant community type is depicted on the Caspers Park Phase III GDP Vegetation Map, on the same aerial/ topo base as the Critical Habitats Map.

Why monitor rare plant populations in areas of Caspers Park East which are only rarely visited? For one thing, by doing so, the data base of knowledge for the species in question is increased. Much is not known about the rare plant species in the Park. For instance, will many-stemmed dudleya reappear in areas where drought has killed all plants? How long can the fine seed rest in the soil before it looses viability? What are the effects of natural or deliberately set burns on the study area's various rare plant species? As native grassland continues to recover in the high saddle near Lucas Peak, will the number of Alaska rein orchid plants be reduced? Is the Engelmann oak in Lucas Canyon setting viable acorns, or are the young shoots underneath just root suckers? What is learned from expansion of the data base can often be applied directly to species management in the Park. If the species is intolerant of fire, burning of its habitat would be proscribed. If, on the other hand, fire acts as a stimulus, controlled burns would be desirable. If the species disappears entirely with prolonged drought, former population areas should be replanted with seed gathered from surviving groups during a subsequent rainy period, to reestablish lost stands.

b. Species Populations and Management

- Many-Stemmed Dudleya

  - Location and General Description

    Groupings of this CNPS rare and endangered species located by Marsh and Roberts, 1984 are depicted on the Critical Habitats map set. They include a stand on the upper margin of the lateral ravine which drains into Lucas Canyon from the north, stands along the backbone ridge divide between Lucas and the upper part of the unnamed canyon, and beyond its head, Verdugo Canyon, road cuts along Rancho Carrillo Road near Lucas Peak and along the small barranca between the upper level Northern and Central Terrace.

    Many-stemmed dudleya is a vernally evident succulent with a root corm. Above-ground parts wither and dessicate with the advent of summer drought, but reappear during the winter rainy season. The species normally flowers in May or early June. Blossoms are yellow. Many-stemmed dudleya is a

component of the xeric "barrens" floral association and also occurs in shallow clay soils within native grassland. It is unable to compete successfully with overshadowing shrubs, forbs or tall grasses such as wild oats or ripgut brome. Despite its proclivity for arid habitats, and shallow soils within more mesic ones, many-stemmed dudleya cannot tolerate prolonged periods of drought extending over several years, relieved by only scanty winter rains. The corm-bearing succulent is a short-lived perennial which survives two or three years. Extended drought kills established plants, and seeds either fail to germinate or tender seedlings die soon after sprouting (Kei Nekai, pers. comm.).

Most of the many-stemmed dudleya stands were not. resurveyed during the current field reconnaissance All but the terrace and Rancho Carrillo Road stands are within the proposed wilderness area or other locales where direct human impact is not expected. The terrace population site was resurveyed by Marsh and Krucki, and no individuals of the species could be found there. The current status of the Rancho Carrillo road cut stands is not known.

- Management of Habitats Outside of Potential Impact Areas

As discussed in Section 4b, preceding, the effects of controlled burning on xeric habitat flora is not known, to the knowledge of the HCP team. The same is true of many-stemmed dudleya. The monitoring recommendations and management of controlled burns specified for the entire xeric flora association also applies to this component species.

It is also recommended that a knowledgeable volunteer or volunteer/park employee team resurvey as many as possible of the many-stemmed dudleya sites mapped by Marsh and Abbott (reproduced on the HCP Critical Habitats map) to:

- Verify the continued existence of the species within each population;

-or-

- Ascertain that the species has disappeared from particular previously identified localities.

- Conduct a plant count (see a, above) and measurement of each extant grouping.

- Complete field survey forms for each extant grouping.

A followup to this initial resurvey should be conducted several years later, when the substained drought has broken and the region has returned to a sequence of higher than normal rainfall years. The focus of the second survey should be on trying to relocate the dudleya in sites where it has disappeared previously, and assessing comparative population sizes and plant counts between drought and rainy cycles. At that time, if plants failed to show up in HCP mapped sites where the species had subsequently disappeared, an effort should be made to revegetate these locales with seed gathered from extant stands in the Park, and nursery-grown first year plants also propagated from locally collected seed.

- Management of Habitats Within Potential Impact Areas

  The recommendations enumerated above also apply to localities of many-stemmed dudleya on the high terrace and along Rancho Carrillo Road. Additional management of these more vulnerable sites is also required. The discussion contained in 4b, Management Plan for Xeric Habitats (interagency communication) also applies to the many-stemmed dudleya groups within the roadcut habitats along Rancho Carrillo Road. The terrace population site should be remonitored next year, and reseeded as soon as the drought cycle breaks if extant plants cannot be found there. If the population survives or can be reestablished, it should be safeguarded from equestrian and undue pedestrian ingress by placement of a barrier (such as split rail fence) along the south side of the Northern Terrace branch of the hiking trail as it crosses the high terrace nearby.

  The terrace locality, if it survives, is ideally situated for conducted interpretive walks. The Caspers Park interpretive naturalists should select a short, informal spur path alignment to move groups from the Northern Terrace branch trail to the population, and use the same path each time, to minimize pedestrian impact on this feature and its surroundings.

- Engelmann Oak

  - Location and Description

    A single large Engelmann oak was discovered during an HCP late April reconnaissance by Marsh and Hanes, on the floor of Lucas Canyon a short distance south of the Ortega Rock Haul Road in the

eastern portion of the park. Its approximate location is depicted on the critical habitats map.

This specimen was not measured but equalled in size the large coast live oaks nearby. Since this is one of only a very few close to genetically pure Engelmann oaks in Orange County and is located within a County park, it qualifies as a County Heritage Tree.

A number of young Engelmann oak saplings are growing beneath the canopy of the mature individual. It is unknown whether these are seedlings or root suckers. No old acorns could be found beneath the oak. However, the substained drought may be inhibiting acorn set.

- Local Significance

Genetically pure individuals of Engelmann oak are very rare in Orange County, although they are fairly common across the crest of the Santa Ana Mountains on the Santa Rosa Plateau and extending further south into the inland hills of San Diego County. To the north, the species is found scattered along the base of the San Gabriel Mountains between Pasadena and San Dimas.

Engelmann oak is the southern California ecological replacement of blue oak (Quercus douglasii), the conspicuous deciduous oak of the foothill woodland surrounding California's Great Central Valley (Griffin and Critchfield, 1972). It is found in woodland-savannah habitat and is drought deciduous, but not as drought tolerant as coast live oak. Acorns can rest in the soil over a dry winter, sprouting the second year, an adaptive measure which coast live oak lacks (Snow, 1973). Engelmann oak was probably more widespread in southern California and Orange County in the past. The trend toward a drier climate in southern California has favored chaparral species, and some former stands of oak woodland have disappeared (Benson, 1962; Tucker, 1979).

Engelmann oak and scrub oak (Quercus dumosa), both members of the white oak subgenus, hybridize freely where they grow together. While pure Engelmann oaks have nearly disappeared from the County, evidence that they were more widespread in the past can be seen from the numbers of Englemann-scrub oak hybrids still present. The main concentrations of these are in the San Joaquin Hills and the south County Santa Ana Mountains foothill area which includes Caspers

Wilderness Park. Some hybrids will attain small tree stature; several of these can be seen along the Ortega Highway including 3, first observed by Park ranger Richard Dyer on the Nichols Institute site.

Other than the tree in Lucas Canyon, the only fairly "clean" Englemann specimens known from the County are a medium sized tree near the Caspers Park Visitors Center discovered by Dyer, a tree in Gabino Canyon observed by HCP team member Bloom, a tree on Starr Ranch found by Dave Bontraiger, and a specimen reported from Shady Canyon on the Irvine Ranch (Boughey, 1968), within the San Joaquin Hills.

Because of their relative isolation from the population north and southeast, the remaining Engelmann oaks along with the Q. engelmannii gene pool now swamped by Q. dumosa may be subtlely different from the Santa Rosa Plateau and San Gabriel Mountains stock.

- Management

Utilization of Specimen for Propagative Material

Also appropriately called mesa oak, Engelmann oak would be a desirable addition to the landscaping plant palette for screening and shade vegetation for some of the terrace campsites (as well as the Nichols Institute grounds). Because of the potential of genetic uniqueness of the remaining Orange County Q. engelmannii stock, landscape specimens should be propagated from local individuals. If the specimen in Lucas Canyon or near the Visitor's Center set viable acorns, these would be an important resource for seedling propagation. It could not be determined through a literature search and interviews with knowledgeable taxonomists whether or not Engelmann oak is self fertile. To be self fertile, male catkins would have to mature at the same time as the inconspicuous female flowers which develop into acorns. Walter Wisura of Rancho Santa Ana Botanical Gardens stated that, as a rule, wind pollinated plants (such as oaks) are self fertile. However, if this particular species is self sterile, then its acorns here would most likely produce individuals that were Q.engelmannii x dumosa hybrids, because of the abundance of the latter species within the vicinity. (Engelmann oak does not hybridize with coast live oak because the latter is within the less closely related black oak subgenus.) As described above, young Q. engelmannii individuals were seen beneath the parent tree in Lucas Canyon. These could,

however, be root suckers rather than seedlings. Sucker production is stimulated by fire. The old Lucas Canyon tree undoubtedly has been through one or several burns, though it presently shows no fire damage.

The alternative to propagation by acorns is by taking cuttings and treating these with root growth hormone. This technique works best on cuttings taken from young individuals, according to Wisura. Even then, many cuttings need to be taken, for only a few of those treated will produce viable plants. The stock of undergrowth saplings beneath the Lucas Canyon tree is rather small.

Seedlings and cuttings should be propagated and established in containers by a native plant nursery for later outplanting.

Basic Care; Recognition

The Engelmann oak in upper Lucas Canyon appears to be in good health. However, because this is such a special tree, it would be wise to have it inspected by a plant pathologist/arborist to pinpoint health and potential structural problems, so these can be corrected before serious injury occurs.

The oak is located on a flood plain island and appears relatively secure from flood impact. Some reinforcement of the upstream portion of the island might be desirable to divert flood waters around the tree's habitat.

This Engelmann oak qualifies as an Orange County Heritage Tree. It should be so identified and marked.

Since the specimen is located in an area of the Park not serviced by trails, future direct human impact on it is not expected. However, the tree should be inspected periodically, to assess natural and man-caused impacts, and correct those where feasible.

- Venegasia

  - Location and General Description

    The Marsh and Roberts 1984 survey located one or two stands of this locally rare suffrutescent herb in upper Lucas Canyon. During a resurvey of selected portions of Lucas Canyon by Marsh and Krucki, additional groupings were found. The

canyon was not exhaustively inspected; still other colonies probably remain undetected.

The bright yellow daisy-like flowers of venegasia were spotted in early April about the margins of oak groves on the foot of the north-facing slope, and offsite near the impoundment.

Venegasia is a ±3 foot tall leafy branching perennial herb with a woody base and deltoid semi-heart shaped leaves. The aforementioned flowers resemble superficially those of native sunflowers and encelias except that the yellow rays are uneven in size, giving the composite blooms a somewhat scraggly appearance.

Venegasia is a species of "rocky canyon walls, shaded slopes and moist stream banks, not far from the coast" (Munz, 1974).

- Local Significance

While venegasia's range extends from northern Baja California to central California, in Orange County, it is very rare. The only other recently documented population center besides Lucas Canyon is Niguel Hill along the coast between Laguna Beach and South Laguna. Several stands occur on the hill and its north-facing slope, which constitutes the south side of Aliso Canyon gorge. Fred Roberts, Jr. also reports seeing a population in a canyon behind Dana Hills High School, but has not inspected that stand for a number of years.

- Management

The precise number of stands of venegasia in Lucas Canyon should be determined and their locations mapped. This would be an excellent project for a Caspers Park volunteer or park naturalist/volunteer team. A field survey form should be completed for each stand.

Venegasia may or may not be tolerant of fire. Any proposed controlled burn on the Lucas Canyon slope should be preceeded by a focused survey for the species. Followup surveys should also include searches for newly established colonies.

Since venegasia grows in an area not serviced by trails, direct human impact on its habitats is not expected. The venegasia stand near the offsite impoundment was probably impacted when Ortega Rock recently reworked the pond banks. In informal cooperative discussions between Parks and

Recreation and Ortega Rock, the sensitive plant location should be relayed to this company. However, beyond such information relay, the County has no power to enforce protection of the offsite stand.

- Coulter's Matilija Poppy

  - Location and Description

    Stands of Coulter's matilija poppies grow in the North Cove. These groupings are distributed in brushy habitats across the savannah in the north half of the cove.

    Coulter's matilija poppy is a large bushy perennial with stems from 3 to 8 feet in height. It forms robust patches via creeping underground rootstalks from original seedling individuals. Large, spectacular yellow centered, frilly white petalled blossoms give raise to the nickname "fried egg flower". The species is popular in the nursery trade as an easy-care xerophyte.

    There is quite a bit of variation in Romneya coulteri through its cismontane range, from Ventura County to Baja California. Therefore, nursery-propagated stock planted near native populations may give raise to propagates different from plants evolved locally, in a form of genetic contamination.

    The variation of Coulter's matilija poppy is so great that it was formerly separated into two species by taxonomists, R. coulteri (endemic to the Santa Ana Mountains and nearby San Diego County) and R. trichocalyx (occurring everywhere else).

    Ecologically, Coulter's matilija poppy, at least in Orange County is mainly an alluvial scrub and stream bench woodland-savannah plant. It occurs in a number of other localities in the County, including Featherly Regional Park in Santa Ana Canyon, Coal Canyon, Santiago, Silverado and Black Star Canyons, and O'Neill Regional Park and Trabuco Flats in Trabuco Canyon. Within Caspers Wilderness Park, there are also a number of stands west of Ortega Highway. Some of these are near the old corral, in the E loop area, along the nature trail in Bell Canyon Wash and near the Juaneno Trail (Bruce Buckman).

    Coulter's matilija poppy is listed by the California Native Plant Society as a limited-distribution species. The designation applies to stands

assigned the taxonomic status of R. coulteri, including all those in Orange County. It is unclear whether, now that R. trichocalyx and R. coulteri are considered synonymous, CNPS will retain the "limited distribution" listing in future editions of its Inventory.

- Management

During weed eradication or wetlands establishment activities in the North Cove, care must be taken to not disturb the Coulter's matilija poppy stands there, or allow herbicide drift to reach them. The stands should be flagged during such times when human activity could inadvertently harm them.

Because the local stands are genetically different from some "off the shelf" stock available through the nursery trade, any individuals used in landscaping, habitat enhancement or for campsite screening must be grown from locally gathered seed or runners. County Parks and Recreation should also urge Nichols Institute to use locally gathered material for Coulter's matilija poppies used in its landscape palette. It is the opinion of the HCP team that, in the interest of protecting the genetic integrity of the San Juan Canyon population, it would be appropriate for Nichols Institute to obtain seed and root-runner cuttings from the more prolific colonies in Caspers Wilderness Park, perhaps including the North Cove.

It is not expectd that human activities other than those described above will result in impact to the North Cove population, provided the barbed wire fence is kept in good repair to keep out flower pickers. Some stands close to the highway may be temporarily harmed by cars spinning out of control off of the road.

Fire break weed abatement discing along the highway inside the fence (if any) should avoid stands, if possible. If this is not feasible, such colonies should be salvaged for propagative material.

The wetlands establishment project, if implemented, should be restricted to the south end of the cove. Though growing in proximity to streams and rivers, Coulter's matilija poppy is not a phreatophyte and is probably intolerant of perennially moist soil (though nursery-grown plants can be watered, if desired).

- Alaska Rein Orchid

In a saddle between two ridges at the very top of the unnamed canyon watershed, about 375 feet north of Rancho Carrillo Road is a pristine native perennial grassland through which are scattered Alaska rein orchids. The orchid also grows in the wooded cove between the north and south segments of the Central Terrace Group Camp.

The Alaska rein orchid is a perennial herb with broad, tongue-like basal leaves and a 1/2 - 1 foot tall flowering spike developing in late spring. The individual flowers on the spike are tiny and greenish-colored, but on close inspection, they do look like orchids.

Ecologically, the Alaska rein orchid is a plant of mesic places such as springy meadows and cool, sheltered north-facing slopes in the shade of oaks or big-cone Douglas firs (Pseudotsuga macrocarpa).

- Local Significance

  While the Alaska rein orchid is widely distributed from Baja California to Alaska and the Pacific Coast to the Rocky Mountains, in Orange County and probably throughout much of the rest of its range, it is of sparing occurrence. This is true of most United States orchids; plants which are vulnerable to exploitation because of their natural rarity and beauty, and habitat loss because of their specialized environmental requirements. There are two orchids which occur in Orange County; the Alaska rein orchid is the more widespread of the two. The other is the stream orchis (Epipactis gigantea), known only from two spring-fed sites in upper San Juan Canyon. The stream orchis is a handsome plant with stalks clad with lily-like leaves and spikes of rose colored blossoms.

  Other known localities of Alaska rein orchid in Orange County include Niguel Hill, Pine Canyon and upper Trabuco Canyon where it grows in the shade of Douglas firs and oaks, Chiquita Basin in spring-laced native grassland and the mouth of the Viejo Canyon tributary of upper San Juan Canyon (also a stream orchis site). (Localities reported by Fred Roberts, Jr., Dave Bramlet, HCP author Marsh.)

- Management

  Controlled Burns

  The tolerance of Alaska rein orchid to fire is not known, to the knowledge of the HCP team. Because

this species throughout the bulk of its range and habitat occupies sites which are quite mesic and not excessively prone to burning, it is suspected that fire tolerance may not be one of its adaptations. Most damaging would be a spring burn, when the plants were actively growing and in flower or approaching anthesis. For native grassland management, as discussed previously, spring burning is recommended. However, the saddle grassland should be left as is and not subject to such management.

Monitoring

As the saddle grassland is not within an area of the Park serviced by trails, direct human impact on it is not expected. However, to expand the data base for sensitive resources within Caspers Park East, it is recommended that the rein orchid plants in the saddle grassland be counted, and their approximate locations mapped, if possible. This, again, could be a Caspers Park volunteer group project. Data gathered may be summarized on a field survey form described before. Followup surveys are recommended.

The cove population is somewhat vulnerable to human impact because of its proximity to the Central Terrace Group Camp. The plants here should be checked periodically. Informal foot traffic areas potentially harming them should be closed off or realigned. Because the flowers of this species are not brightly colored, they are probably not vulnerable to picking (though rodents find them tasty).

6. Old Growth Chaparral

- Location and Ecology

The chaparral vegetation in Caspers Park East occupies the north-facing slopes of Lucas Canyon below Rancho Carrillo Road and upper San Juan Canyon. It forms dense stands of many-stemmed, evergreen shrubs 5 - 10 feet high. The stiff, woody branches intertwine, making the vegetation almost impenetrable.

The dense, unyielding character of chaparral makes it a durable, non-sensitive vegetation type compared to grasslands and coastal sage scrub. Large birds, mammals, and humans find it inhospitable except where the stands thin out on rocky ridges or where fingers of other vegetation types reach into otherwise formidable stands. Many reptiles, small birds, and rodents

find the dense chaparral an ideal protective cover and food source, and are permanent residents.

Chaparral is also well-known as a fire type vegetation in that it is prone to burning and is uniquely adapted to fire. The summer drought and presence of volatile compounds in the leaves render the chaparral one of the most fire susceptible vegetations in the world. Yet many of the chaparral shrubs resprout from rootcrown burls after the tops have been consumed or killed by fire. Others, such as ceanothus, produce seeds that need to be scarified by fire before they will germinate. Also, many of the chaparral shrubs decline with age. The result is a stand with an increasing proportion of dead wood compared to live tissues. These older stands provide limited resources for their wildlife residents.

When fire occurs in the chaparral, the entire natural community of plants and animals is rejuvenated. The added nutrients from the incinerated dead branches and the increased available light lead to the genesis of many herbaceous flowering plants not found in mature chaparral stands. At the same time, seedlings of the shrub species and the highly nutritious rootcrown sprouts provide attractive, enhanced forage for many wildlife forms.

As a consequence of this natural partnership between chaparral and fire, we now view fire as a management tool in chaparral rather than a factor to be excluded. In fact, the old concept of fire exclusion in chaparral has lead to uncontrollable holocausts that killed off many resprouters and dormant seeds, leaving denuded slopes exposed to severe erosion from winter storms.

The chaparral management strategy that has evolved in recent years involves control burns of small stands of chaparral. The various stands in an area are burned on a 10 to 20 year rotating basis. The outcome of this program is a mosaic of chaparral of different age classes. If a wildfire occurs, it is more easily contained, or it runs out of heavy fuel stands and dies out. Such an age class mosaic would not only reduce the threat and property loss of fire, but it would increase the foraging value of the vegetation for many wildlife species.

- Chaparral Management Plan

  (1) Select manageable watersheds and put on control burn schedule.

  Selection by park maintenance personnel in consultation with Orange County Fire Department and the U.S. Forest Service, Cleveland National Forest.

(2) Designated watershed(s) burned when presecribed conditions of fuel volume and environmental factors are met.

Burning by Park maintenance personnel in cooperation with and under the supervision of County and Federal fire personnel.

(3) Set up interpretive signs and a nature interpretive program on the role of fire in chaparral.

To be executed by Park interpretive personnel.

(4) Set up a regrowth (chaparral succession) monitoring program to determine re-growth rate and fuel volume of previously burned stands.

Monitoring program carried out by maintenance personnel in cooperation with County and Federal fire personnel.

(5) Adjust control burn schedule according to monitoring information. Modification carried out by Park maintenance personnel.

APPENDIX D

Zoological Sensitive Habitats

1. Avifauna

a. Raptors

- Methods

Field work was conducted by HCP author Bloom over several days spread out during March, April, and May. All suitable nest trees were examined on site as were many trees within the existing Park on the north side of the Ortega Highway. Nest trees were climbed to determine reproductive success and band the young. Important nesting and hunting habitats were also noted.

- Findings

Raptorial species observed on or near the project site during the 1987 breeding season included the turkey vulture (*Cathartes aura*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), Cooper's hawk (*Accipiter cooperi*), American kestrel (*Falco sparverius*), black-shouldered kite (*Elanus caeruleus*), great horned owl (*Bubo virginianus*), western screech-owl (*Otus kennicottii*), and common barn-owl (*Tyto alba*). One common raven (*Corvus corax*) nest was also found.

Of the above species, both the black-shouldered kite and golden eagle are State-listed Fully Protected Species.

Two red-tailed hawk nests were found containing 3 young each, and one red-shouldered hawk nest contained 2 young. One red-tail nest was located in a sycamore while the other was found in a coast live oak. The red-shouldered hawk nest was found in a sycamore.

The nest of the 1 pair of black-shouldered kites was not located due to its failure in the early spring but probably is in the oaks in the small canyon to the northeast of the proposed Northern Terrace Campground. One red-tailed hawk nest is located in Lucas Canyon approximately 1/2 mile east of the Ortega Highway while the other nest and its alternate are in the unnamed canyon at the water trough. The red-shouldered hawk and raven nest are located adjacent to the Ortega Highway in the cove directly north of the southerly segment of the Central Terrace Group Camp.

If the proposed park plan is implemented as designed, Bloom predicts the following would occur to the nesting raptors. The pair of Fully Protected black-shouldered kites would cease to nest at this location. The pair of red-shouldered hawks would probably also cease to nest at this location, although they might ultimately return after several years +. The pair of red-tailed hawks in Lucas Canyon would continue to nest, but the pair in the unnamed canyon would cease to nest. The common ravens would continue to nest successfully. Other, difficult-to-detect nesting species such as the western screech-owl would probably continue to nest successfully.

b. Cavity-Nesting Avifauna

These are birds which nest in cavities originally excavated in tree trunks by woodpeckers. They include secondary cavity nesters such as kestrels, certain owls, swallows, bluebirds, flycatchers, wrens and starlings, as well as the woodpeckers which are the primary cavity nesters. On site, cavity nesting species observed were kestrels, barn owls, screech owls, northern flickers (Colaptes auratus), Nuttall's woodpeckers (Picoides nuttallii), acorn woodpeckers (Melanerpes formicivorous), ash-throated flycatcher (Myiarchus cinerascens), house wrens (Troglodytes aedon) and European starlings (Sturnus vulgaris). The latter, an introduced species, may in some areas dominate these niche habitats, forcing out native birds. In Caspers Park East, however, a good diversity of native cavity nesting avifauna is still present.

Principal cavity nesting habitats in Caspers Park East are locales containing sycamore trees. Sycamore trees grow in the unnamed canyon, Lucas Canyon, the North Cove and the cove between the northern and southern segments of the Central Terrace Group Camp. The main area of potential conflict between nest cavity habitat and human use is in the unnamed canyon.

c. Coastal Race of Cactus Wren

Dr. Amadeo Rea of the San Diego Natural History Museum has determined that the San Diego County coastal populations of the cactus wren are of a different race than the desert species of southern California, Campylorhynchus brunneicapillus couesi. Although the race is not listed by CFG NDDB, 1986 or Remsen, 1978, because Rea's research is still ongoing, Department of Fish and Game includes it informally with their species of special concern (John Gustafson, personal communication).

In San Diego County, the range of this race is similar to that of the coastal race of the black-tailed gnatcatcher, and both have suffered substantially from loss of coastal sage scrub habitat because of urbanization. Judging from breeding records (Unitt, 1984), the latter species population is in better condition than that of the cactus wren. Coastal breeding sites occur all the way to the Orange County line; however, Rea has not ascertained the distribution of the race beyond the southwest corner of San Diego County. If the northern coastal San Diego County birds prove to belong to the new race, then it is logical to assume that populations in coastal cismontane Orange County are also members. In Orange County, Sexton and Hunt, 1979 described the cactus wren as a "fairly common resident around cactus and sage scrub throughout the lowlands".

However, subsequent development has caused a decline in available habitat and presumably, numbers of birds present. If the coastal race of the cactus wren extends into southwestern Orange County, its distribution probably stops here because of inappropriate habitat north of Newport bay, lowlands now urbanized and historically areas of sloughs and swamplands. The next upland landfalls which could have contained appropriate habitat are the Palos Verdes Peninsula and the Santa Monica Mountains. The species is basically sedentary and would not be expected to disperse out of its locallized southwest California habitat. The range of the desert cactus wren, which is not a species of concern, extends west into inland Los Angeles County in sites such as the San Jose Hills in West Covina (Marsh, 1986).

Orange County Breeding Bird Census data reveals two areas of concentrations in summer sightings and nest records. The first is centered about the Santa Ana River and its watershed. These may be the common desert race birds. The second concentration is in the south County, extending from the coast inland to the Santa Ana Mountains, and Newport Bay to the San Deigo County line. These could be coastal race birds. Nesting is confirmed in 9 3 mile x 3 mile census blocks in the south County, including the block containing Caspers Park.

The cactus wren is appropriately named, as it lives and rears its young in cactus patches. Local birds appear to prefer coastal cholla (Opuntia prolifera) stands to other cactus species, but also nest in patches of platy opuntias (O. littoralis, O. occidentalis, O. oricola).

Cactus wrens live in coastal sage scrub with cactus stand inclusions on the south-facing slope of Lucas Canyon and probably also along the ridgeline between Lucas and the unnamed canyon.

d. Grasshopper Sparrow (Ammodramus savannarum)

Grasshopper sparrows occur in native perennial grassland in Caspers Park East. HCP author Bloom verified their presence in the proposed Northern Terrace Group Camp area. The sensitive species is one of several birds unique to grasslands; others observed during the current early April survey were water pipits, horned larks, meadowlarks and savannah sparrows.

The grasshopper sparrow is blue-listed by the National Audubon Society (Tate, 1986). Blue-listed species are experiencing a non-cyclic population decline through all or a portion of their range.

In Orange County, the species is a "rare, local summer resident in grasslands of low foothills. Even when the County was sparsely settled, the species was generally considered uncommon and very local. Modification, perturbation and loss of native grasslands have almost certainly made the species even rarer and more local" (Sexton and Hunt, 1979). Unitt states that San Diego birds may be resident rather than migratory, but are so secretive in winter that they are rarely seen.

Grasshopper sparrows prefer dense, tall grassland (Unitt, 1984). They are occasionally detected in adventive grassland but prefer dense native Stipa prairie, where they nest hiden away in the needlegrass clumps (Jeff Froke, personal communication).

e. Avifauna Management and Monitoring Plan

- Raptors

  - Protection of Existing Breeding Territories and Nest Sites

    Continued nesting of the black-shouldered kite on this property will require the implementation of one of the following alternative plans:

    1. Elimination of the proposed Northern Terrace Group Campground, or

    2. A time restriction on the use of this campground, prohibiting use from January 15 through June 15 of each year. Examination of the site on May 1 of each year might allow earlier use of the facility.

    Continued nesting of the red-shouldered hawk on this property will require the implementation of one of the following alternative plans:

1. Elimination of the lower half of the northerly segment of the Central Terrace Group Campground, or

2. A time restriction on the use of this campground, prohibiting use from January 15 through May 15 of each year.

Continued nesting of the pair of red-tailed hawks in the unnamed canyon would require the implementation of one of the following alternative plans:

1. Adjustment of the rim trailhead overlooking the unnamed canyon to a position 50+ yards north, and

2. Elimination of the entire south segment of the Central Terrace Group Campground, or

3. The recommended rim trailhead adjustment and a time restriction on the use of the hike-in camping facility, and bottom of the canyon trail, prohibiting use from January 15 through June 1 of each year.

The above recommended alternatives will not guarantee these pairs will continue to nest, but they do strike a compromise whereby the Park can have its desired improvements and the birds of prey at least have a chance of retaining their breeding territories. Since the black-shouldered kite is a State Fully Protected Species that is rapidly declining in Orange County, it is strongly suggested that recommendations for this species be heeded in entirety. The pair of golden eagles in this region will not be affected significantly by the Park proposal since most of the hunting habitat will remain undisturbed, and they nest in the National Forest.

To evaluate the success of the proposed alternatives, it is recommended that an experienced raptor biologist examine existing nests during late April and/or May during the first 3 years of Park facilities use. New nest sites, as they are found, should be added to the HCP critical habitat map and the ongoing monitoring study.

- Enhancement

Nest Boxes

As a mitigation for the lost habitat resulting from the campgrounds, it is suggested that 4 barn owl and 4 screech owl/kestrel nest boxes be installed.

North Cove Understory Habitat Improvement

Improvement of understory habitat in the North Cove, discussed before, will make this site more attractive to raptors. A pair of black-shouldered kites was found in the cove during the 1984 biological reconnaissance. No raptors were discovered here by Bloom during the ongoing HCP survey, though he found the remnants of an old buteo nest.

Cardoon Control

Cardoon eradication improvement of grassland habitat on the ridgetop "bald" in the proposed wilderness area north of Lucas Canyon will result in enhanced raptor foraging land. Recommended grassland improvement here consists of eradication of cardoon (artichoke thistle) stands. There appear to be about 78 acres of cardoon-infested grassland on these hghlands and slopes, as determined by evaluation of aerial photographs flown in 1984. Cardoon density seems to be reduced in portions of the stands from its 1984 condition. In 1987, the most dense areas remaining are in drainage swales on some of the lower slopes on the northwest side of the bald. A line transect was run by Marsh and Dimeo to determine percentage of cover of cardoon on the upper west slope of the bald. This transect was 5170 cm (170.6 feet) in length and was run uphill in a northeast direction to the ridge crest, which is free of cardoon. Cardoon occupies 54% of total cover and other grassland components, 46% of total cover within the transect. Frequency of occurrence intervals of cardoon dominance was 49%, compared to 51% frequency of other components. Many cardoon plants were quite small. Other grassland components inventoried include common wild oats and ripgut brome, both adventive annual grassland climax species, and minor amounts of coastal goldenbush and purple needlegrass.

Cardoon is an aggressive Mediterranean weed well established in overgrazed range in the region.

"Artichoke thistle is a stout perennial with a large, fleshy taproot. The plant forms a basal rosette of leaves, commencing growth in the fall, and culminating in production of a flowering stalk in late spring. After seed set, which is usually in early to mid-summer, the leaves die back until new growth is initiated in the fall from the root crown. Because artichoke thistle is a perennial species reproducing primarily by seed, an effective control program must address several

problems: 1) adult plants must be eliminated; 2) seed source must be reduced or eliminated; 3) other more desirable vegetation (preferably native) must be established to reduce thistle seedling establishment" (Hilliard, 1986).

Considerable research on cardoon control has been conducted, especially in Australia where the species is a serious rangeland pest. In Orange County, control methods by private and public landowners have concentrated on the employment of herbicides, due to the very extensive areas of cover requiring treatment. 2, 4D and 2, 4, 5T were herbicides used in earlier years by County ranchers. These were applied by helicoptor or airplane, and herbicide drift into watershed-protecting brushland sometimes resulted, in some cases promoting rather extensive streambank erosion.

Today, preferred herbicides are Banvel (dicamba), a broad-leaf selective which unfortunately remains soil-active for a long period and can move down into sensitive watershed habitat, and Round-up, which has low soil activity but unfortunately is a nonselective, killing grass as well as cardoon. Banvel has been used with significant success in Crystal Cove State Park, reducing cardoon in two years time to 18% of its former extent of cover, with grass filling in, occupying 720% of its former cover in treated areas. Banvel is also used on some of the country's ranches. Round-up is now used on County-owned lands. Bill Tidwell reports that this herbicide is very effective in controlling cardoon on areas the "weedbuster" team has treated. While Tidwell's data is not quantitative, he states that stands like those on the slopes of the Arroyo Trabuco which were solid thistle the first year are reduced to open thistle the second and scattered dispersed plants the third. Tidwell would like to overseed treated areas with grassland species but has not been funded by EMA to do this. Because Round-up is nonselective, timing of application is critical. Round-up is applied after annual grasses have set mature seed, in April to May. Tidwell states that the chemical does not penetrate the seed coats, and the folowing spring there is good annual grass germination except in areas where cardoon grew in solid stands. These would be appropriate for overseeding.

Round-up is hand applied by the "weedbuster" crew. The herbicide is gravity fed through hose downhill from a tanker truck and applied via hose nozzle.

Hand application reduces accidental spraying of desirable plants and probably also cuts down on the amount of herbicide used.

In statistical analyses comparing the effectiveness of Banvel versus Round-up at Crystal Cove State Park, Hilliard found that Banvel reduced thistle cover in dense stands to 18% of former cover and in grass/thistle stands, 5% of former cover. Round-up reduced thistle cover to 28% of former extent in dense stands, but only 41% in grass/thistle mosaic. This was not substantially better results than in the control plot, where nothing was done. In addition, "the use of Round-up did not result in any corresponding increase in grass cover, while the use of Banvel resulted in an increase" (Hilliard, 1986).

Because the wilderness area infestation is on a high promontory, a long distance from drainages, and exists for most part in a grass/thistle mosaic containing some native perennial needlegrass which could be harmed by a nonselective herbicide, the use of Banvel may be warranted over that of Round-up. Statistical followup monitoring should be conducted to determine the effectiveness of either herbicide or non-chemical control method selected, as is now done at Crystal Cove State Park.

Non-chemical control methods used at Crystal Cove State Park for artichoke thistle include mowing with a brush cutter, grubbing with a pulaski tool, and burning. Mowing and grubbing are done before the species flowers, with a repeated mowing also done three months later. Burning is done after annual grasses have dropped their seeds but before the thistle comes into flower in early summer.

Burning is also done in the fall, after the cardoon plants have begun to grow vegetatively again after their reproductive cycle. Burned areas are overseeded with foxtail fescue and soft chess, because the fire consumes most of the existing seed on the ground.

Hilliard does not give the results of burning. For grubbing and mowing in dense stands, reduction is insignificant, about the same as in the control stands. However, in dispersed grass/thistle cover, control is moderately successful, reducing thistle to 34% of former cover, as compared with a "do nothing" reduction of 53% in the control plots. Mechanical means of thistle control are not economically feasible in large stands because labor costs.

The "do nothing" approach of beneign neglect management may be adequate in portions of the stand where the artichoke thistle cover is thinning out since the removal of cattle from the Park property. In more dense stands remaining on the lower slopes, herbicide application is recommended. The final decision of type selected should be Tidwell's. It is recommended that treated stands be subject to statistical (line transect) analysis pre and post application, rather than simple qualitative evaluation.

Turkey Vulture Clean Feeding Stations

Though a scavenger, the turkey vulture is considered a raptor. While migrant and wintering turkey vultures are commonly seen flying over the County's rangelands, few nest sites are documented. These are mostly in rugged cliff areas in remote canyons.

As cattle range is converted to urban uses (and parkland), former "clean foods" of the turkey vulture, stillborne calves and cattle which succumb to injury, affliction or old age, are gradually disappearing. The other available food sources are ground squirrels poisoned or shot during rangeland erosion control or bubonic plague eradication measures, and game shot but not retrieved by hunters. In a small way, the turkey vulture is subject to the same hazards of lead and other toxics uptake as the nearly extinct California condor. Establishment of a clean feeding station could help to offset these for birds within San Juan Canyon. The station would also be a rather remarkable interpretive amenity, allowing conducted groups to see these birds at relatively close range. "Stale-dated" packaged meat for the feeding station might be obtained free of charge from grocery stores; there would be the labor costs of store pick up and unwrapping the packages. A second source might be "canner and cutter" grade cattle (old breeder cows) available at low cost from a nearby ranch. A third source would be road-killed animals. If it is determined that such a feeding station is a desired interpretive and resource-enhancing feature, it should be located in a vehicle-accessible site well away from the trails and campgrounds. (Such feeding stations may also attract predators such as coyotes, and are a source of odor.) One site which might be feasible would be the ridgetop bald discussed in the cardoon control portion of the Raptor Habitat Enhancement Section, above. As noted before, there is a farm road trace from

Nichols Institute to the bald. Tidwell stated that the road would be bladed prior to artichoke thistle control activities. Representatives of Nichols Institute stated that access could be provided for County maintenance activities. Discussed in Section 4.2.1 and in the Management Plan for Wetland Habitats, Section 4.2.2 #3, a complex of public-private funded interpretive activities might center about the Nichols facility, if its management was a willing participant in the program. One such activity could be turkey vulture observation on the bald. As discussed in the foregoing section, a second feature of the area is an excellent exposure of fossil reef material containing close packed clam and oyster shells. This was discovered by Park's groundperson Randy Dimeo during site reconnaissances for the HCP. These fossils are apparently from either the Holtz or Baker Canyon member of the Upper Cretaceous Ladd Formation.

- Cavity-Nesting Avifauna

Continuous, ongoing human activity in the vicinity of nest trees will probably contribute to nest abandonment by at least some cavity-nesting species. Deletion of the campsite near the water trough in the unnamed canyon, recommended above, before and after, will also benefit cavity-nesters using the two sycamore tree clumps there. However, occupants of other trees in the lower part of the unnamed canyon will probably not continue to maintain breeding territories here in the future. The only way this loss of undisturbed habitat could be prevented (short of deleting all campsites in the lower canyon) would be to restrict the use of some or all sites during the breeding/nesting season months, April through June. If feasible, this action is recommended.

Establishment of sycamores in the upper canyon will, in time produce new natural habitat away from the actively used area of the unnamed canyon. This action is recommended before (Sec. 4.2.2, #2d).

Natural cavity habitats in tree trunks can be expanded and supplemented by erecting bird houses. A variety of aperatures should be provided, to accommodate different-sized birds. The house design should include a hinged bottom or side for maintenance cleanup after the nesting season. Sea and Sage Audubon Society members erected nest boxes at Green River Golf Course in Santa Ana Canyon, resulting in increased breeding success of western bluebirds there. Like many of the other activities and

monitoring programs suggested in the Habitat Conservation Plan, this would be an excellent project for the Caspers volunteers.

Cavity-nesting avifauna habitats in the two coves and in Lucas Canyon should not be impacted by development of recreation facilities, since none are planned for these areas (with the exception of the emergency access road and Juaneno trail linkup in lower Lucas Canyon.

- Cactus Wren

A precise mapping of the extent of cactus wren habitat in Lucas Canyon has not been conducted. This should be done, especially if controlled burns are to be conducted within or near the habitat. As the species is sedentary, burning of its habitat is not recommended, and must be particularly avoided during the breeding season, April through June.

It would be desirable to determine the precise status of local birds. The key characters differentiating the coastal race from desert birds are apparently subtle. It is hoped that Dr. Rea or another knowledgeable ornithologist can be encouraged to study the south Orange County birds.

As the cactus wrens in Caspers Park East are in locales remote from recreational facilities, direct human impact on them is not expected.

- Grasshopper Sparrow

Recommended management to reduce adventive grasses and forbs in the terrace grasslands includes spring burning and mowing. The nesting season for the species in San Diego County is April and May; males maintain territory from late March through mid July. This conflicts with the mid to late spring burning or mowing recommendations of Goode.

It is therefore specified that prior to implementation of burning or mowing of grassland during the breeding season of the grasshopper sparrow, that the proposed management sites be carefully surveyed by a biologist or ornithologist familiar with the species and its teritorial song. Those areas containing grasshopper sparrow territories shall be deleted from spring mowing or burning management. The grasslands management specialist should select several alternative burn/mowing sites so that a program for a given year can cover adequate ground and still avoid grasshopper sparrow nesting sites. Swirsky's recommendation of late summer/early fall

for burning (not mowing) would avoid this conflict entirely, though as discussed above, the secretive birds may still remain. However, not maintaining breeding territories, they would be more inclined to move away from sources of threat, including fire. A late summer/early fall fire fits the normal burn pattern within southern California's Mediterranean climate belt.

Grasshopper sparrows now occupy habitat which is planned for camping uses. Recommendations given before regarding deletion of the Northern Terrace Group Camp and rearrangement of certain sites elsewhere on the terrace are intended to preserve significant grassland resources on the lower terrace between Lucas and the unnamed canyon. This in turn will protect grasshopper sparrow habitat. The habitat can also be protected during the breeding season by closing the camp between March 15 and July 15 (or between January 15 and July 15 to also protect nearby nesting black-shouldered kites).

2. Mammalian Wildlife Critical Habitats

"Critical habitats" for mammals are those habitats that are critical to continued functioning of the plant and animal communities of the Park in a natural or near natural fashion. In addition, habitats important to the enjoyment and safe use of the Park by the public are also included as critical habitats.

Caspers Park is very productive and diverse habitat for mammals. At least 36 species were predicted to occur by Marsh and Roberts in their 1984 biological inventory prepared for the County. Due to its location and relationship to other undeveloped land, Caspers Park is the most diverse and natural park in the system for mammals. Its tie to hundreds of thousands of acres of undeveloped public land make it unique in providing for the needs of mammals. All plant and animal species on the site are important and linked ecologically.

a. Emphasis Species

A habitat conservation plan for mammals in the Park must focus on the most critical habitats and species to determine direction and gain public and administrative support. Species with regional or local viability concerns must receive priority treatment to insure long-term survival. Loss of any species will reduce the quality of the wilderness resource.

In addition to species of concern due to potential viability problems, species of special public interest will be used to drive and monitor habitat management

objectives. The habitat conservation program will be designed to maintain viable populations of all mammals and enhance or maintain habitat for special interest species.

- Cottontail Rabbits (Sylvilagus spp.) and California Ground Squirrel (Spermophilus beecheyi)

  These species are of special interest due to their value as prey species for the predators of the Park and their value for public observation. They are the most frequently observed native mammals in the Park and provide a significant amount of public enjoyment. They are a primary food source of many of the predators in the Park and are extremely tolerant of human activity. They are most frequently observed in openings and shrub/grass edges.

- Coyote (Canis latrans)

  The coyote is an emphasis species due to its large size and observability, ecological importance as a predator and significant public interest. Coyotes are viewed frequently in both Caspers West and East. Sign and observations of coyotes were concentrated in the washes and riparian areas, on ridgetop trails, and on the edges of openings. Dirt roads, firebreaks and trails in Caspers East are heavily utilized by coyotes for movement. With large home ranges required to meet the needs of the coyote, easy access and the ability to hunt over large areas is important. Coyotes requre drinking water and are fairly tolerant of humans when not harassed. They are omnivorous opportunists, eating birds, reptiles and amphibians, small and medium sized mammals, carrion, insects, fruit, berries, and other items.

- Mountain Lion (Felis concolor)

  Mountain lions utilize Caspers East for feeding and long distance movement in search of prey. Lions and their sign have been observed in the unnamed canyon at the Rancho Carrillo Road underpass, on the firebreak along the Ortega Highway, on the Lucas Canyon Haul Road, in the canyon cove between Lucas Canyon and the unnamed Canyon, and in Verdugo Canyon. This is a species of concern due to recent human attacks in Caspers West, large body size, large home ranges, population vulnerability due to development, and predatory nature. Recent proposals to open southern California to lion hunting brought out significant public concern over the long-term survival of the species in the region. As a result, the Department of Fish and Game removed this portion of the State from the proposed lion hunt.

Mountain lions are carnivorous, with mule deer making up 60-80 percent of the diet in most areas. Other mammals, such as rabbits, rodents and domestic livestock and pets are regularly eaten along with reptiles, amphibians and birds. They need drinking water, and prefer to hunt in areas with relatively dense cover. Shrub and tree edges with grasslands and riparian areas are used heavily for hunting. They den in natural cavities, caves, rock shelters, or bush thickets.

Due to rapid urbanization taking place in southern California and the legal protection of this species from human harassment, there is an increasing number of lion-human contacts. This unusual amount of contact is expected to continue for many years as the region develops at a rapid pace. Long-term viability of mountain lions in the Santa Ana Mountains depends largely on the ability of public lands to support large enough populations of lions and their prey. Insuring long-term survival will require agency and public emphasis on providing adequate habitat and reducing human conflicts.

- Bobcat (*Lynx rufus*)

Bobcats are fairly common in Caspers East and their sign was observed on the dirt roads. They are frequently observed near the entry gate of Caspers West. They feed mostly on rabbits and small rodents near dense cover. They den in natural cavities in logs, rock outcrops, caves, and dense brush. They require drinking water, and they are an emphasis species due to the amount of public interest in their well being. Large, wild cats are extremely popular with the public throughout the world, and bobcats are no exception.

- Mule Deer (*Odocoileus hemionus*)

Mule deer are the largest and the most frequently observed large mammals on the site. Due to their protection from hunting and human harassment in the Park, they have become fairly tolerant of human activities. They are a popular species with the public due to their large size. They are important to survival and health of the regional mountain lion population. They were most frequently observed in the unnamed canyon, Lucas Canyon, and other smaller canyons in Caspers East, especially near food, water and cover. They also use roads and trails to move throughout Caspers East. The largest grassland openings in Caspers East are used by deer at night, with the majority of daytime use near shrub cover. They feed on grasses, forbs, and shrubs depending on

the food value of the plants at varying times of year. Succulent, early successional forage is preferred for feeding when it occurs in proximity to cover.

- Badger (Taxidea taxus)

  The badger is a State Species of Special Concern. Badgers have been observed adjacent to the site, and what was believed to be a badger den was observed by Marsh and Roberts in their 1984 inventory. Badgers feed primarily on burrowing rodents, and their principal habitat requirements are sufficient food production, friable soils for digging, and large areas of relatively open, uncultivated ground.

- Snag-Dependent Species

  Many mammal species use snags for denning, nesting and feeding. Woodlands capable of producing large snags are limited on Caspers East, making them all the more important.

- Species Dependent on Dead and Down Woody Material

  Numerous species make use of large woody material on the ground for denning and feeding. This material is also very critical to long term soil productivity in forest and woodland habitats.

- Riparian-Dependent Species

  Riparian areas are used by the majority of wildlife species. Some species such as raccoons (Procyon lotor), are dependent upon riparian areas. Other species such as deer can make it without riparian areas if water is made available in the uplands, but do much better with quality riparian areas in their home range.

b. Critical Mammal Habitats

- Watering Sites

  Due to the importance of water to many of the mammal species, watering locations are considered critical habitats. Perennial water in Caspers East is limited to several old livestock water developments in the North Cove, lower Lucas Canyon and in the unnamed canyon. Important perennial water exists on private land within or adjacent to the Park in Verdugo Canyon and in ponds created from natural springs in upper Lucas Canyon. All water sources investigated are heavily used by wildlife and important to the productivity of wildlife populations in the Park.

- Canyon Movement Corridors

  Due to the large home ranges of the large mammals, movement coridors are very important. Canyon bottoms are heavily used corridors. This is probably due in part to the abundance of prey, water, cover, and relatively gentle topography. Heavily used trails leading from the adjacent uplands to the canyons are common, an indication of the value of the canyons for movement. Trails in the larger canyons such as Lucas and the unnamed canyon are the heaviest used by large mammals. Vegetative cover of sufficient height and density to hide large mammals, yet open enough to allow for easy movement appears to be important to large mammal use of canyons as movement corridors.

- Ridgetop Trail Movement Corridors

  Many of the major ridges have trails that are used by large mammals for movement within and through Caspers Park East. This is largely due to the gentle topography, open shrub stands and views of surrounding areas. Many of these trails were probably developed and kept open through past cattle grazing. With the removal of cattle from the Park, some of these trails will probably disappear, but major trails will be kept open by large native mammals, horses and public use.

- Riparian Areas

  Riparian areas are very important to mammals in Caspers Park East. These areas are important as water sources in the wet season. They have a wide diversity of vegetation and are more productive than drier sites. Vegetation in riparian areas tends to stay green and continue growth later into the dry season. This is important to the herbivores tht are stressed in the late summer dry period. The largest riparian areas have a woodland overstory which makes them much cooler than surrounding habitats in summer. These riparian woodlands, which are primarily sycamore and oak, have very important snags and down woody material for shelter and feeding areas for mammals.

- Oak Woodlands

  Oak woodlands are critical habitats for many mammal species due to the mast production, coolness during the summer months, and snags and down woody material for denning and feeding.

- Dense Cover

  Numerous species are dependent upon dense cover for hiding, avoiding predators, stalking prey without being detected, and for temperature regulation. In addition to being important for many mammals, they are areas of public safety concern due to recent lion attacks.

c. Habitats With Significant Human Safety Conflict

In light of recent mountain lion attacks in Caspers Park West, along with the increasing number of lion/human conflicts in the region, concern for human safety is warranted in Caspers Park East. Deer appear to utilize the entire Park, and mountain lions probably do as well. Lions and other large mammals on the Park East appear, from a reconnaissance level survey, to use certain areas and habitats for movement to a greater extent. Heaviest use areas seem to be canyons with good cover and water present.

Large areas of sparse cover are avoided to some extent by deer and probably the large cats especially in daylight hours. In northern Arizona, mule deer have apparently chosen open areas over many years to winter in to avoid mountain lion predation (Shaw, personal communication). The preference for cats to hunt near heavy cover where they can quickly spring on prey has implications to location of human use facilities in Caspers Park East.

d. Management of Critical Habitats

- Design Modifications

  - Adjust Placement of Facilities

    Concentrate Human Activities in Openings

    From a safety standpoint, it would be preferable to locate human activity areas in grassland openings. This would be most important where youth camping is proposed. It is also the best place to locate concentrated human use for most mammals.

    The large youth group camping area and associated facilities on the Southern Terrace should be located as much as possible in the existing openings and avoid shrub and tree edges for human safety and animal well being. Trails from this group area to other portions of the Park should also be located in openings to the greatest possible extent.

Other group camping facilities on the Central and Northern Terrace Grasslands should also be located in the openings to the greatest possible extent. If use is restricted to adults, this may not be as critical as if children are permitted. Where it is possible, permanent facilities should be concentrated in the grassland habitat to reduce destruction of the habitat as a whole.

Unnamed Canyon Facilities Modifications

The unnamed canyon presents a real challenge to the biologist and recreatonal planner due to the desirability of this area for camping and as quality habitat for mammals. It will be impossible to locate the proposed camping facilities in the unnamed canyon without having an effect on mammal use. More sign and observations of large mammal use were noted here than anywhere else in Caspers East.

Camping sites should be located immediately adjacent to the road in the canyon bottom to concentrate development and leave as wide a corridor as possible for large mammal movement. The campsites in the Canyon Campground should be moved closer together to provide more open space at the underpass and at the water trough. A natural buffer of two to three hundred feet would give large mammals a greater feeling of security at these critical locations. A similar buffer should be left undeveloped on the spillway side of the underpass between the underpass and trailhead parking lot.

The individual campsites should be located away from the old sycamores due to the dead and dying portions of the trees that will be a safety hazard. If the campsites are located under the old sycamores, the dead and dying portions of the trees would need to be removed. This would have an adverse effect on species dependent on snags. Planting sycamore saplings as soon as possible in areas between old sycamores will provide shade and cover in a few years. These young healthy trees should provide good locations for campsites in the near future if planted soon.

The hike-in camping area is heavily utilized by deer and probably mountain lion, although no lions or sign were observed. The main tributary, "Dead Cow" was also heavily utilized by deer. It would be desirable to place campsites at least 200 feet up this side canyon to avoid the confluence with the main canyon. This would reduce the impact of the camping area on large mammal movement considerably.

The group camping area immediately above the unnamed canyon on the Central Terrace should be placed at least 100 feet from the edge of the canyon and screened to provide a larger area for large mammal movement up and down the canyon. Large mammals should still be able to move through the canyon at night if a large enough corridor of undeveloped area exist.

- Creation of Additional Watering Sites

  - Unnamed Canyon Water

    A new water development should be installed in the unnamed canyon several hundred yards past the confluence of the hike-in camping area ("Dead Cow" lateral). With the proposed water tank on the ridgetop, it would be easy to install a gravity fed pipeline and drinker. This would significantly reduce impacts of the camping in the canyon since the existing water source will be near human use areas.

  - Central/Northern Terrace Canyon

    An additional watering site should be developed from the new storage tank and located in the canyon that separates the Central Terrace Grassland from the Northern Terrace Grassland. This will also reduce the impacts of development in the unnamed canyon.

  - Maintenance and Improvement of Existng Waters

    All existing water sources are heavily utilized by larger mammals and other wildlife. The cattle troughs in the unnamed canyon and lower Lucas Canyon are apparently fed from springs in upper Lucas Canyon. These water developments appear to be working satisfactorily at the present time, but research should be conducted to find out the particulars on the water conveyance system prior to any problems developing. This would be a good job for an interested volunteer. Personnel involved with the previous grazing program should know the history and background of these waters, and their assistance would be invaluable.

    The well immediately north of the unnamed canyon underpass (Caspers Park West) should be developed if found to be capable of being reactivated. Placement of a windmill at this site would be in keeping with the historical use and be of interest to Park visitors. The well and trough at the Northern Cove should also be restored.

These three water troughs should be cleaned to remove aquatic vegetation several times a year, and each one should have an access and escape ramp installed for smaller animals to prevent drowning.

- Wildlife Enhancement Plantings

There does not appear to be a need to do much planting at this point in Caspers Park East. As human use increases in the expansion area, oak and sycamore woodlands should be monitored and planting should be done if it appears as though there is inadequate natural reproduction. Some sycamore should be planted at the present time in the unnamed canyon to provide for a younger, healthier stand of trees for campsite shading. Campsites and other developments should be screened as much as possible from the water and riparian area in the unnamed canyon to reduce human influence on animal use.

- Operational Directives

A significant amount of time was spent in Caspers West to get an idea of how management was affecting mammals. Current management appears to be excellent for most mammals. The same general management program should work well in Caspers East.

- Mowing

Mowing should be kept to the minimum needed for fire protection and prevention. This should help reduce the potential problems with lions in developed areas.

- Education

Teaching users about wildlife and the need to watch but not harass is very important in Caspers East. The animals here are not nearly as used to people as they are in Caspers West, and could be reduced by human harassment if visitors are not well behaved.

- Seasonal Adjustments in Human Use

Almost all of the mammals of Caspers East appear to be yearlong residents. The major seasonal difference in mammal use is the increased concentration on water sources in the summer months. Mule deer tend to fawn close to water where possible. It would be desirable to reduce human use of Lucas Canyon and upper unnamed canyon from April until the winter rains begin. The walk-in campsites should be rested during this portion of

the year. Trail use as planned should not eliminate the canyons as fawning habitat, although an initial reduction in deer use will probably occur. It would be best to encourage use of the ridge trails as much as possible during fawning season and critical summer months.

- Rodent Control Measures

If habitats are managed as naturally as possible, overabundant rodent populations and the problems associated with them should be minimal. In some cases around human use areas, California ground squirrels may become a problem. It woud be best to avoid the use of poisons if possible due to the dangers associated with this practice. Several species could be susceptible to secondary poisoning by eating poisoned rodents, or directly by eating poison. Since several of the species, such as badger and black-shouldered kite, are emphasis species, protecting them from rodent control efforts is worth the effort. Rodent control programs are probably the one of the biggest contributors to the current population status of the badger in California.

- Monitoring

Monitoring is very important to the continued well being of mammal populations in Caspers East. To be meaningful, mammal monitoring must be standardized and consistantly done. After talking with Park personnel, it appears as though spotlight counts may be the best way to monitor management effects on mammals. The Park is patrolled at night at the present time, and including a spotlight count would not require a great amount of additional time. One count a week or every other week should be an adequate sample. The count should be conducted on the same night each week by the same personnel as much as possible so it will become a routine that is not overlooked. Two people should be involved, and it would be good to have some training for new personnel before they are sent on the counts as a primary observer.

The spotlight count should yield good information on deer and other larger mammals. These species tend to be less tolerant of human use and can serve as indicators of the effect of park management. Small mammals should be impacted only slightly by planned management, so if the larger more secretive species do well, the smaller, more tolerant species should do fine.

- Mitigation for Unavoidable Impact to Critical Habitats

  - Habitat Improvement

    Water Developments

    The water developments discussed in the previous Design Modifications Section will significantly help to mitigate for impacts of development in Caspers East.

  - Prescribed Burning

    Prescribed burning should be conducted for mule deer, and other species preferring early successional vegetation and a diversity of size and age classes. This burning should be conducted in a mosaic pattern to maintain diversity. The highest priority areas to burn for deer are areas of dense, mature or decadent mixed chaparral. These areas can get so dense that deer and other large mammals cannot get through them. In these cases, only a small area on the edges receive any browsing.

    Fire appears to be natural in all of the habitats in Caspers East and a program of rotation burning throughout would be desirable. Care should be taken to not have extremely large fires, or too frequent fires. Riparian areas should be burned very lightly if deemed appropriate by plant ecologists. There are indications that in southern California chaparral and annual grassland habitats, human-caused fires are increasing at an alarming rate and threatening to type convert many acres to pure annual grassland. This should be carefully monitored in the Park and appropriate measures taken to prevent this from happening. Type conversion of shrub habitats in the Park would be very detrimental to the mammals.

    Prescribed burning and fire control programs should be carefully coordinated with the California Division of Forestry and the Forest Service. Cooperative programs can be worked out that will reduce the cost of the program to the County.

    (HCP ed. note: see, also, Sec. 4.2.2 #6.)

  - Contribution to Regional Wildlife Study Efforts

    By contributing labor and funding to assist in the various wildlife studies underway in the region, the County can partially mitigate for the impacts

of the Caspers East development. The County should continue to contribute to the study of mountain lions in the Santa Ana Mountains.

- Environmental Education

One of the biggest threats to southern California wildlife is an uneducated public. Maintaining healthy wildlife populations in southern California will require an informed public. The County contribution to environmental education will be very important in gaining public support for wildlife. The Caspers Park East area lends itself well to teaching respectful use of natural environments.

APPENDIX E

Potential Zoological Sensitive Habitats

1. Amphibians and Reptiles

Several regionally or locally sensitive amphibians and reptiles have been documented from Caspers Wilderness Park and are of potential occurrence in Caspers Park East. Locality records are published in Roberts, 1984, and additional sighting records are provided by Park employee Donna Krucki.

a. Arroyo Toad

(*Bufo microscaphus californicus*)

The Arroyo toad is a California Department of Fish and Game Species of Special Concern and a Category 2 Candidate for Federal Threatened/Endangered listing.

Arroyo toads have been found in three localities within the San Juan Canyon floodplain by Roberts and other herpetologists. Two of the three localities are immediately west of Caspers Park East. In all cases, these toads were found about the margins of (drying) pools along the streamcourse as it passes through a gravelly floodplain vegetated with alluvial scrub plants.

Similar habitat in Caspers Park East is found in the Lucas Canyon floodplain. Impoundment of the waters of Lucas Canyon by Ortega Rock lessens the likelihood of occurrence of this sensitive toad, however. In all cases, the species is found along intermittent, summer-dry creeks. However, there must be pooled water available during the spring-early summer breeding season for populations to survive in Lucas Canyon.

- California Red-legged Frog (*Rana aurora draytonii*)

  The red-legged frog is a Department of Fish and Game species of Special Concern and a Category 2 Candidate for Federal Threatened/Endangered listing.

  No records for this species were found in the vicinity of Caspers Park East. However, suitable habitat is present within the Ortega Rock lease along upper Lucas Canyon Wash and about the headwater springs.

  Besides loss of pond habitat, a major causative factor in the decline of the red-legged frog is competition with and juvenile predation by the introduced bullfrog (*Rana catesbeiana*).

- Pacific Pond Turtle (Clemmys marmorata pallida)

  Clemmys marmorata is a Department of Fish and Game Species of Special Concern and a Federal Category 2 Candidate for Threatened/Endangered listing. The status of the southern pallida subspecies is even more critical. This subspecies south of the Transverse Range is now limited to dispersed and isolated breeding colonies (Bayard Brattstrom, personal communication). In the Orange County area, it occurs in permanent streams in the Chino Hills, in the San Joaquin Marsh and San Diego Creek and some of its tributaries, in upper Santiago and Harding Canyons in the Cleveland National Forest and in the San Juan Creek watershed. Channelization and flood control maintenance activities are a threat to local populations in the urban area of the County. Channel dredging wiped out a large population in lower Salt Creek within recent years (Fred Roberts, Jr., personal communication).

  Krucki reports seeing Pacific pond turtles along San Juan Creek. The species requires permanent areas of ponded or sluggish water, with ample hydrophyte edge vegetation. Such habitat exists along the upstream portions of Lucas Canyon Wash within the Ortega Rock lease.

- San Diego Horned Lizard (Phrynosoma coronatum blainvillei)

  The San Diego horned lizard is a Department of Fish and Game Species of Special Concern and a Category 2 Candidate for Federal Threatened/Endangered listing. The cryptically-colored "horned toad" lives in arid sandy or gravelly habitats atop ridges (in xeric "barrens") and along intermittent streamcourses in alluvial scrub. Harvester ants are a preferred food. Scat can sometimes be identified as of this lizard because of ant exoskeleton content.

  Krucki reports rather substantial populations of this species in certain areas of Caspers Park West. Roberts cites records from several localities in the Bell Canyon floodplain and one in coastal sage scrub on the west-facing slope.

  Appropriate habitats in Caspers Park East include the floodplain in Lucas Canyon and ridgetop xeric barrens in uplands north and south. The proposed trail alignments pass along ridge crests which contain appropriate habitat. The proposed Juaneno - farm road trail linkup also passes through appropriate habitat, on the floor of Lucas Canyon.

Primary threats to the species in Caspers Park East are trampling by horses, crushing by vehicles and collection and removal from the site by Park visitors.

- Orange-throated Whiptail (Cnemidophorus hyperythrus beldingi)

  The orange-throated whiptail is a Department of Fish and Game species of Special Concern and a Federal Category 2 Candidate for Threatened/Endangered listing. Roberts cites 3 records for this whiptail in Caspers Park West: 2 in San Juan Canyon and 1 in Bell Canyon. One of the San Juan Canyon records is immediately west of Caspers Park East. Orange-throated whiptails were observed by Roberts and others in floodplain alluvial scrub and riparian vegetation. They can also occur in coastal sage scrub and chaparral. Termites are a preferred food; hence the species can be looked for in areas where there is significant dead and down wood.

  Potential habitats in Caspers Park East include alluvial scrub and riparian habitats in Lucas Canyon and the upstream portion of the unnamed canyon, and to a lesser degree, upland habitats vegetated by coastal sage scrub and chaparral.

- San Diego Mountain Kingsnake (Lampropeltis zonata pulchra)

  The San Diego Mountain kingsnake is a Department of Fish and Game Species of Special Concern and a Federal Category 2 Candidate for Threatened/Endangered listing. The colorful red-banded species has not been documented in Caspers Wilderness Park to date, but good potential habitat for it exists along San Juan Creek and in Hot Springs Canyon and Cold Springs Canyon in the vicinity of San Juan Hot Springs. This species inhabits montane riparian woodland and adjacent moist coniferous forest stands. Within the vicinity of Caspers Park East, the snake could occur in the riparian and oak woodlands of upper Lucas Canyon and on the north edge of the wilderness area in the north-facing slope woodlands overlooking San Juan Creek.

- Two-striped Gartersnake (Thamnophis hammondi)

  This is a species of local concern. "Housing and urban development have greatly reduced its range in southern California" (Stebbins, 1985). Two-striped gartersnakes are found about areas of permanent water: streams, springs, ponds. Krucki reports a population in a wetland habitat in Caspers Park

West. Appropriate locales in the vicinity of Caspers Park East are along the creek and about the springs and ponds in upper Lucas Canyon within the Ortega Rock lease.

b. Management and Monitoring

- Monitoring

  Focused searches should be conducted to determine presence or absence of the amphibian and reptile species discussed above in Caspers Park East. Localities where the species are sighted should be added to the HCP critical habitats map set. A fauna field survey form should be completed for each sighting, and in addition, sightings should be logged in the notebook maintained at the Park. A CNDDB fauna field survey form is reproduced on the following page; 1 copy of the completed form should be mailed to the Data Base, 1 copy to the Museum of Systematic Biology, U.C. Irvine and/or Dr. Peter Bowler, U.C.I (address on form) and 1 copy retained at the Park.

- Management

  - Protection of Identified Localities

    Areas where sightings are made of a sensitive fauna species will require increased surveillance to assess potential impact eminating from recreeational use or Operations Maintenance, and adjustment of such activities to reduce impacts. Contemplated kinds of impacts include collection of individuals of showy or interesting species (Pacific pond turtle, San Diego horned lizard, mountain kingsnake), horse or vehicle mashing (San Diego horned lizard), controlled burns (San Diego horned lizard, orange-throated whiptail) and channel grading for flood control or bank-stabilization purposes (Arroyo toad, San Diego horned lizard, orange-throated whiptail).

    The mesic wetland habitat species red-legged frog, Pacific pond turtle, San Diego mountain kingsnake and two-striped gartersnake all have potential habitat within the upstream reach of Lucas Canyon Wash in the Ortega Rock quarry lease, but only marginally within contiguous areas of parkland. Actions by Ortega Rock including the recent disruption of streamside and woodland habitat created when more impoundments were excavated there would adversely impact those species actually present. It is hoped that the Park can develop a good-neighbor relationship with Ortega Rock, and that

the quarry operators can be sensitized in a positive way to the fragility and value of wetland and forestland habitat in the lease. It would also be desirable for some water to be released downstream from the lower impoundment so that the Park's portion of Lucas Canyon could also contain a little wetland habitat. Department of Fish and Game requires the filing of a 1601/03 agreement prior to streambed alteration or streamside vegetation removal. Mitigation to restore habitat lost, in the form of site revegetation is often specified in the agreement process. It is not known whether Ortega Rock entered into such an agreement prior to its recent activities in upper Lucas Canyon Wash and Springs.

- Environmental Education

  If some of the species discussed above prove to be present in Caspers Park East, those likely to be noticed and sought after by Park visitors should be the subject of an education program highlighting their sensitivity and vulnerability, and State laws prohibiting collection. The Park's personnel should be alert to collecting activities and stop those occurring on its premises.

- Habitat Enhancement

  Creation of wetland habitats in the North Cove and lower terraces discussed before would enhance habitats for sensitive wetlands amphibians and reptiles. Individuals from other areas of the Park could be introduced into these created habitats of adequate size to support self-substaining populations.

2. Regionally Endangered Mammalian Species

   a. Bats

   Significant declines of many bat species have been noted in southern California and other parts of the west. Two species of bats are on the State's Species of Special Concern list as second priority species. Townsend's big-eared bats (*Plecotus townsendii*), occur throughout California, but have not been recorded in the Park. A marked decline in this species appears to have occurred in the past 40 years. Declines are believed to be the result of human disturbance. One human visit to caves, abandoned mines and buildings used for roosting can cause these bats to abandon a roost. Although this species was not specifically found on site, caves and cliffs should not be made easily accessible to the public. The public should be

urged to view these unique habitats from a distance. Numerous species make use of caves and potholes associated with cliffs. The importance and biological values of cliffs, caves, crevices, etc. should be interpreted to the public.

The California mastiff bat (Eumopsperotis californicus) is another State Species of Special Concern in the second priority. Incidental information suggests that this species has undergone significant declines in recent years. Reasons for population declines are unknown, but may be related to extensive loss of habitat due to urbanization of coastal basins, marsh drainage, and cultivation of major foraging areas. They favor rugged, rocky areas where suitable crevices are available for day-roosts. These generally open high on a cliff. These bats have great difficulty taking flight and must drop at least 2-3 meters for launching.

Avoiding cliffs, as described for Townsend's big-eared bat should provide protection for the species if present.

b. Pacific Pocket Mouse (Perognathus longimembris pacificus)

Pacific pocket mice are on the highest priority of the State's Species of Special Concern list. Very little is known of the habitat requirements of this species. This species has been recorded on the Starr Ranch by Charlie Collins in brushlands and xeric habitats. There is a good chance that this species occupies Caspers Park in alluvial scrub, and coastal sage scrub in relatively xeric sites. With the little amount of disturbance planned in the Caspers East portion of the Park, the effects on this species should be relatively minor. The continued management of Caspers Park and Starr Ranch to emphasize their natural characteristics should provide a refugium for this species as the rest of the coastal basins are developed.

All of these suspected species are so rare that the County would probably be best off keeping in contact with State biologists to see if more information is developed through studies being conducted elsewhere. Searching for the bats at roosts can result in the abandonment of the roosts. If bats or mice are found by the public or Park personnel, an attempt should be made to identify the species. If personnel cannot identify the specimens and they could potentially be one of these sensitive species, they should be frozen and looked at by experts. If one of these sensitive species is found in the Park, the Department of Fish and Game should be notified. The County and the

Department could then determine if any special management is needed.

It would be desirable if the County could work with local colleges and universities and their students to do intensive live-trapping in alluvial scrub and coastal sage scrub to see if Pacific pocket mice are present and determine habitat preference. If this species is found, management should be evaluated to see if any change is needed.

APPENDIX F

VISITOR SAFETY CONCERNS

MOUNTAIN LIONS

Two mountain lion attacks on children have taken place in Caspers Park in the recent past. These attacks are the only documented human attacks in the region, although attacks on domestic animals is becoming more commonplace. The fact that both of these human attacks have taken place in the Park is cause for concern. There is a growing consensus among biologists that lions in the state and southern California have lost some of their fear and respect for man due to years of full legal protection. In addition, the amount of natural prey and livestock on private lands in the County has been declining steadily due to development. This decrease in prey may be related to the increased incidence of lion/human encounters. Reductions in prey availability have been linked to increasing human attacks by cats in some areas.

Mountain lions are relatively long lived animals and will do whatever is necessary to secure food as long as they live. As deer herds and livestock numbers decrease, lions will be forced to turn to other prey or starve. Domestic animals such as dogs and cats are easy prey for lions, and in some cases are preferred prey of individual lions. Incidences of lions coming into people's yards and on to porches to take dogs have been recently documented in the region. Small children, when encountered by a lion alone in wildland situations where they are protected may be considered easy prey. In most of the west, lions are actively pursued and persecuted by man. In these cases, lions may have a healthy fear of man and attacks are at least somewhat reduced.

A literature review and series of interviews with biologists was conducted in regard to the mountain lion management situation. Based on this review of the southern California situation and a literature review on large cats throughout the world, it appears as though there is a real chance that additional children will be attacked in the future in the region. In various parts of the world, human attacks by cats are most common in park situations where animals are protected and far less common where they are persecuted. Attacks are more likely in areas of dense cover, and open areas seem to provide some level of protection.

Phase III GDP Implementation Recommendations

1. Restriction of Youth Camping

   Until evidence indicates that lions are becoming less of a threat to children in the Park, youth camping in Caspers East should be delayed. Current studies being conducted by the County and the Department of Fish and Game may give some insight on this problem. In addition, monitoring of reports of lion/human conflicts and contacts in the region with the Department will be helpful. If youth camping or general use is permitted, it must be carefully controlled, and children should not be allowed to stray from groups. With development trends and full protection of lions, the concern over children safety could last for many years.

2. Location of Camping Facilities

   Camping facilities planned for youth should be located in open areas to the greatest possible extent. Attacks would be less likely in open areas where the lions would be less able to surprise people and attack from cover.

3. Monitoring Lion Use and Harassing Bold Lions

   Park personnel should continue to follow up on lion reports and make an attempt to harass any lions that appear to be increasing activity or becoming more bold near developed portions of the Park. This could best be accomplished by getting houndsmen to run the lions and instill some element of fear. Lions need to be taught to fear man in the Park and to avoid contact.

4. Participation in Continuing Studies

   The County should continue to support and be involved in studies of mountain lion. If additional attacks take place, it seems that the County would be in a much more defensible position if studies are underway.

MISCELLANEOUS HAZARDS OF CASPERS PARK EAST WHICH CAN BE CONTROLLED

Poison Oak

Poison oak (*Toxicodendron diversilobum*) is a low shrub or shrubby vine of the sumac family which causes an allergic dermatitis reaction in many people. The species is especially toxic in spring when leaves are fresh, but sensitive individuals can experience a reaction after contact with the plant throughout the year, even in winter when it is bare of leaves.

Poison oak is a common, often abundant understory shrub in oak and sycamore riparian woodlands. In Caspers Park East, it is found along the unnamed canyon within oak and sycamore understory near campsites and along the brushy channel margin near the hiking trail. It is also found in cove understory habitat adjacent to the Central and Northern Terrace Group Camps.

To reduce probability of accidental contact by Park visitors, two actions are recommended:

- Public Education

  Exhibits illustrating poison oak in leaf and leafless condition should be posted in infested areas. These may advise appropriate action in event of exposure: thorough washing of contact area with soap within 20 minutes of the encounter.

- Removal of poison oak from the margins of the hiking trail and developed campsites. Removal at Featherly Park consists of keeping the nature trail edge well brushed back, without reliance on herbicides. This needs to be repeated regularly because brushing back will not kill poison oak plants. In addition to brushing back, spot treatment with a translocating herbicide may be required. Care should be taken not to use the herbicide applicator in such a way that nearby desirable plants are sprayed. It requires several weeks for the effects of a translocating herbicide to take effect; the chemical must move through the plant from leaves to roots before mortality results. The material is most effective when applied in the spring, when the leaves are fresh.

Honey Bee Hives

A certain proportion of the general population is highly allergic to honey bee (*Apis mellifera*) stings, and they are uncomfortable to all victims. Honey bee hives in the vicinity of campsites or trails should be removed. A bee-keeper may remove the hive and seal up the tree hollow site at a nominal charge ($75-$150) in exchange for the swarm.

One honey bee hive was observed in the vicinity of planned campsites in the unnamed canyon. The hive is in a hollow sycamore tree limb.

Cone-nose Bug

The cone-nose or kissing bug (*Triatoma protracta*) is an ectoparasite of wood rats and pack rats (*Neotoma* spp.). Wood rat nests are found in oak woodland and dense chaparral close to campsites in the unnamed canyon (especially the two sites in the "Dead Cow" lateral). There are also probably wood rat nests in the cove between the two segments of the Central Terrace Group Camp and the wooded lateral of Lucas Canyon adjacent to the Northern Terrace Group Camp.

Sensitivity to the bite of *Triatoma* is enhanced by repeated exposures. Most people do not react the first time bitten. An estimated 5-10% of the general population may develop allergic sensitivity to cone-nose bug bites after several bite events (Dr. Raymond Ryckmann, Loma Linda University, personal communication). These insects are active at night, and are attracted to light. However, lighted "bug-zappers" are an ineffective control mechanism because the flying insects drop to the ground and crawl, just outside the beam's aureole (Ryckmann). Cone-nose bugs can fly at least 1/4 mile to light from their home in a wood rat nest, and have been encountered as far as a mile from suitable wildland habitat (Ryckmann). The insects usually bite their victims while the latter are asleep; the initial bite is painless.

Bite reaction can be quite severe in sensitized individuals, and includes whole body dermatitis and hives, burning sensation, particularly about the genitals, and difficulty breathing. Victims sometimes loose consciousness. The latter reactions may be life-threatening. An antigen has now been developed for desensitizing hyperallergic individuals, many of which live in rural areas near chaparral and oak woodland habitats where repeated exposures are common.

Because of the long distance which these insects can fly, control is difficult in an outdoor recreation setting. Wood rat nests near camping facilities can be removed and their mammalian occupants relocated elsewhere. Ryckmann suggests a combination insecticidal dusting and bait box, where wood rats would have to pass through an initial chamber containing the dust to feed on the scratch or other grain used as bait. Bait boxes are useful for dispersing insecticide dust to many kinds of rodents within recreation areas, and have been utilized effectively in the San Jacinto Mountains to reduce plague-carrying fleas. In the case of the wood rat or pack rat, the dusted individual would return to its nest and groom itself there, spreading around the insecticide in its sleeping chamber, resulting in control of *Triatoma* as well as fleas and other ectoparasites. The dust selected should be a kind which is not toxic to small rodents, but only to insects.

Visitors should be warned that *Triatoma* is expected to occur in the Park, and that full control of the insect is not possible. Known reactors who intend to camp here should do so at their own risk, and be so advised before entering the Park.

Yellow Jackets

Yellow jackets (Vespula pensylvanica) are bright yellow and black-banded wasp relatives of the honey bee. Their bites are quite painful to most people, and cause allergic reactions in some. Yellow jackets nest in cavities in the ground such as abandoned gopher burrows. They are often encountered in grasslands and flail-mowed stubble around campsites. These wasps are attracted to meat, fruit and, apparently human body odor. Many victims are bitten on the feet when wearing thongs or other open sandals. Sometimes an individual is bitten as he walks over or on a nest, but apparently unprovoked attacks also occur in the vicinity of food-laden picnic tables or odoriferous trash cans. As stated accurately by Hogue, 1974, (the yellow jacket) "can become a great nuisance to picnickers and campers".

Part of regular maintenance in the group camping areas should be the eradication of yellow jacket nests. Several commercial preparations are effective, and are best applied at night when the insects are at rest in their nest. Beside the labelled preparations, a fogger normally used to kill fleas in a closed room is effective if opened and inserted top down into the nest opening, and the area covered with a plastic tarp. Even household ammonia can kill colonies when poured into the nest hole.

In addition to eliminating nests found, other measures for controlling yellow jackets include use of pheromone-baited traps. These must be located in a site inaccessible to recreational facilities and trails, since their purpose is to attract yellow jackets. Preventive measures include using garbage cans with tight-fitting lids and visitor education. The latter might suggest wearing close-toed footwear such as tennis shoes rather than sandals, and keeping foodstuffs covered.

Black-legged Tick (*Lxodes pacificus*)

The western black-legged tick is the vector of tick paralysis, spotted fever and Lyme disease. Orange County Vector Control District is monitoring the black-legged tick population in Caspers Park West for the latter disease, which has become prevalent in some portions of the United States (including northern California) but has not yet been encountered in tick populations in Orange County. The black-legged tick is smaller and less common than the western wood tick (*Dermacentor occidentalis*), American dog tick (*D. variabilis*) or brown dog tick (*Rhipicephalus sanguineus*). It has a dull reddish body, and is usually found on deer. Its bite is painful (Hogue).

The synthetic pyrethrum, Permethrin, is effective as a personal protective measure against all stages of the western black-legged tick. Permethrin is applied directly to clothing by pressurized spray. Permethrin is not yet registered in California for use against ticks, but has been registered in some other states (*Vector Ecology Newsletter*, June, 1987).

In event that Orange County Vector Control discovers Lyme disease or other pathogens in the local tick population, those areas of the Park containing concentrations of these insects should be considered for closure until the situation is corrected. Lyme disease is a serious, spirochete-caused disease which in advanced stages can attack the brain and other organs.

Precipitous Drop-offs Along High Country Trails

As discussed before, the southwest spur branch of the proposed hiking trail crosses a narrow, knifelike hogback ridge before joining with the northwest spur. The narrow ridge is a sensitive xeric flora area. As specified previously, there should be physical barriers preventing equestrian use of this spur. In addition, warning signs should be posted near the hazardous drop offs, and the trail brochure should also carry a warning, encouraging particular care when traversing this area.

The other hazardous area along the proposed hiking trail is where it drops down off the ridge into the upper reach of the unnamed canyon. The gradient at the drop off point is quite steep, and the trail will need to be zig-zagged to maintain a gentle drop. A zig-zagged alignment may pose difficulty for horseback riders using the trail. The trail alignment has been designed for hikers, not equestrian users. But, as noted before, enforcement of equestrian exclusion from Caspers Park East and from this particular trail may be difficult. Physical barriers could be installed, but these would probably hinder wildlife dispersion from the canyons to the highlands. The trail brochure and signs at the trailheads should inform Park visitors that, because of design and gradient, this trail is not suitable for horseback riding. Those who chose to ignore such signing use the trail at their own risk.

APPENDIX G

DESCRIPTION OF INTERIOR HIKING TRAIL

The resources of the trail as originally planned are described in Marsh and Roberts, 1984. The trail was subsequently redesigned to avoid many-stemmed dudleya stands, an Alaska rein orchid population within sensitive native grassland and potential trespass access onto Rancho Carrillo Road. The trail as now proposed consists of dual alignments from the Northern and Central Terraces north of the unnamed canyon which join atop the ridge above the canyon. The trail continues along the ridge to the upper part of the canyon, where it drops down the steep north slope and crosses the drainage course. From this point it continues westward along the canyon floor to the camping area near the Ortega Highway. Service roads than provide access back to trailheads.

The south branch of the modified trail alignment was inspected on April 2, 1987 by Karlin Marsh and Park employee Donna Krucki. A summary of findings is included below.

At the beginning of the Central Terrace branch, as it leaves the lower terrace, a dark phase Pacific rattlesnake was encountered in dense grassland. Rattlesnakes are relatively territorial and individuals tend to stay in the same area, as observed by Krucki.

A trace of an old roadway defines the proposed trail path from the lower to upper terrace. (The HCP proposes a more northerly alignment here, to avoid disturbing nesting red-tailed hawks nearby.) On the slope, on somewhat disturbed ground, several common xeric barrens plant species can be observed. These include matchweed (Gutierrezia bracteata), fluffweeds (Filago spp.) and amole or soap plant (Chlorogalum pomeridianum). The slope, however, is not a critical habitat for xeric flora, merely an interpretive locale to contrast flora in this thinly vegetated semidisturbed site ith the thick growth of native and adventive grasses on the broad mesa above and below.

The south branch trail continues along the margin of the high Central Terrace, providing expansive views of its grasslands.

At the base of the mountainside bordering the higher terrace, a connector will extend north to link up with the north trail branch which eminates from the Northern Terrace grassland, following along the north side of a laurel sumac-vegetated gully which separates the North and Central Terrace grasslands. The connector passes through grassland.

From the connector junction, the trail alignment follows existing, often ill-defined wildlife trails originally made of cattle and now maintained by mule deer and other indigenous fauna. The southerly branch climbs the toe of the ridge above the unnamed canyon, passing through grassland and coastal sage scrub. The hikers encountered numbers of ticks in this environment. Ticks are often abundant in habitat utilized by deer and

quail. There is ample evidence that numbers of each is present here (tracks, droppings of deer and sightings of large coveys of quail).

The crest of the ridge toe contains disturbed annual grassland of wild oats, mustards and cardoon. As noted before, Caspers Park East was within cattle range before it was acquired by the County. This ridgetop was probably a resting and grazing area, and received substantial impact.

As the ridgeline continues to climb, the trail alignment reenters coastal sage scrub of California buckwheat (Eriogonum fasciculatum), California sagebrush (Artemisia californica), and some prickly pear cacti and tufts of foothill needlegrass. Coyote droppings were observed on the dim wildlife trail.

From the ridgeline, excellent views are provided of the unnamed canyon, and the unusual geologic formations on the west side of San Juan Canyon. These are upper Cretaceous Williams Formation exposures which vary in color from red to buff.

A single laurel sumac along the trail provides a shaded resting place. Beyond, the amount of cactus within the brushland increases, posing a hazard along the poorly defined trail.

The pathway climbs to a higher ridge as it approaches the junction with the northerly spur. Here, species-diverse xeric barrens habitat is encountered. The cobbly ridge is quite narrow, with steeply pitched dropoffs on either side. Flora of this interesting environment include diminutive herbaceous and suffrutescent material on the narrow ridgecrest and robust yuccas, and cacti on the flanking slopes. Species inventoried include:

- spineflower (Chorizanthe) species seedlings
- annual muhlenbergia (Muhlenbergia microsperma)
- Parish's three-awn grass (Aristida parishii)
- loosely-flowered annual lupine (Lupinus sparsiflorus)
- white forgetmenot species (Cryptantha)
- crested stipa (Stipa coronata)
- beardgrass (Bothriochloa barbinodis)
- whipple yucca (Yucca whipplei)
- western prickly pear (Opuntia occidentalis)

This narrow ridge is classified as a Critical Habitat because of its botanical resources.

The north spur trail junction is beyond the critical habitat a short distance. It is located in a tiny, hidden native grassland patch splashed with a scattering of scarlet-flowered Indian paintbrush (Castilleja).

The north spur trail drops down a fairly steep but broad slope heavily vegetated in coastal sage scrub to the upper Northern Terrace grassland below, running along the north side of a small

drainageway. Here, before the trail enters the laurel sumac-wooded portion between the upper and lower Northern Terrace this alignment passes close to a previously identified Critical Habitat containing a population of many-stemmed dudleya. This locale, consisting of a semi-xeric gully bankside was carefully reexamined by Marsh and Krucki, and no evidence of the endangered succulent could be found. As discussed elsewhere in the HCP, the impact of substained drought on the area has probably resulted in a substantial decrease within its many-stemmed dudleya populations, as this short-lived perennial is intolerant of long term dessication.

East of the trail junction, the poorly defined ridge trail continues through dense coastal sage scrub and cactus. Views are provided here of Lucas Canyon, the Nichols Institute site, and the grassy ridge bald east, and the Santa Ana Mountains behind. At closer range, nests, some quite large, of desert pack rats (Neotoma lepida), deer browse effects on buckwheat and tiny grass areas strewn with ground pinks (Linanthus dianthiflorus) can be observed.

The drop off point into the unnamed canyon consists of a broad, moderately steep slope apron between two drainage courses. On its upper portions, the vegetation is dense, almost impenetrable black sage (Salvia mellifera), through which large cacti are distributed, hidden away from view but not from physical encounter. Eventually, as the slope gradient gentles out below, this thick brush is replaced by a mosaic of native perennial grassland (here dominated by foothill rather than purple needlegrass) and dispersed laurel sumac and sagebrush. This locale is a pleasant resting and picnic lunch area.

Further down the slope, the proposed trail alignment reenters dense coastal sage scrub, of black sage, cactus and lemonadeberry shrubs. There are some clay barrens openings below; these do not appear to harbor floristically unique plant species. The alignment finally drops into a brushy lateral of the unnamed canyon.

Features of the unnamed canyon are described in Marsh and Roberts, 1984.

The upper canyon has a few widely dispersed, fairly small sycamore trees and a stand of oaks at the head (beyond the trail entry point). Most of the upper bottom is brushy coastal sage scrub and chaparral. However, there are some grassy openings with attractive massed displays of blue-eyed grass (including albino individuals).

This rather arid setting gives way further down canyon to a narrow, broken woodland-savannah of ripgut brome and sycamore trees closely flanked by laurel sumac, chaparral and coastal sage scrub. Some large native grasslands are on the south slope; these were sprinkled with thousands of blue-eyed grass flowers in spring, 1987, and are identified as Critical Habitats. Mosaic settings nearby, at the canyon floor margin contain within close

proximity of each other very large specimens of each of the three bedstraw (Galium) species occurring in Orange County. Galiums were also observed growing vigorously in secondary succession post-burn sites along Rancho Carrillo Road south of the canyon.

The lower part of the unnamed canyon has also burned. Here, bush lupines (Lupinus excubitus), are dispersed across quite open post-burn slopes. As described in Marsh and Roberts, 1984 and elsewhere in the HCP, a tributary, the "Dead Cow" lateral, draining into the lower canyon at the upper end of the walk-in camping area, contains a small but dense oak woodland edged by lady's mantle, miners lettuce and other delicate forbs. This site is classified as a Critical Habitat.

Below, the woodland-savannah broadens out to fill the entire canyon bottom. Here are large sycamore clones within adventive grassland of ripgut brome. Beneath the canopies of these clumps are dense stands of noxious milk thistle, as described in the HCP.

Elements of the unnamed canyon, as discussed elsewhere qualify it for Critical Habitat status. These include its wildlife dispersion corridor, raptor nest sites and cavity-nesting avifaunal habitats.

A feature observed in the lower canyon near the bend in the road as it climbs up to the Central Terrace, north, is a cattle water trough. This is overflowing. The tank which feeds it from the slope above also appears to be leaking. The result is an unusual willow riparian and freshwater marsh habitat around the tank. The habitat is developing diversity and should become more and more complex if left undisturbed. Hydrophytes inventoried here include:

curly dock (Rumex crispus)
dallis grass (Paspalum dilatum)
spudweed (Veronica anagallis-aquatica)
weedy cudweed (Gnaphalium luteo-album)
tall flatsedge (Cyperus eragrostis)
prickly sow thistle (Sonchus asper)
watercress (Rorippa nasturtium-aquaticum)
Mexican rush (Juncus mexicanus)
clustered field sedge (Carex praegracilis)
cattail species (Typha)

Interpretive Opportunities on Trail

The interior hiking trail is appropriate for ranger conducted nature walks and self-guided hikes, using a booklet which highlights trail features. Some of the interpretive features of the trail are these:

- Native perennial and introduced annual grasslands: history of community conversion, environmental requirements, dependent fauna, restoration and management of native grasslands.

- Local geologic history, Santa Ana Mountains tectonies, river terrace formations along San Juan Canyon.
- Coastal sage scrub: characteristics and drought adaptations of the community, component flora species and dependent fauna.
- Flora of xeric barrens, miniature deserts in California's coastal zone.
- Riparian woodland-savannah: floral components, land use history and disturbance elements, raptors, cavity-nesting avifauna, wildlife habitat and dispersion corridor use.
- Burn cycle in brushland: benefits for wildlife; post burn flora species.
- Oak woodland and woodland margins: flora, fauna; management of oak trees in parks and in residential landscaping. Insect associates, value for insect-eating songbirds.
- Freshwater marsh and aquatic setting at cattle trough: hydrophyte flora, aquatic insects, fish; value for wildlife in an arid land.

APPENDIX H

"PRINCIPLES OF WEED CONTROL*

The methods used in controlling any weed must be related to its habits of growth and reproduction. Since these vary widely, as already indicated, control practices differ. The first problem, always, is to determine the mode of attack best suited to the weed and to the conditions in question. Sound judgment is needed for often success depends upon adapting the methods to the situation.

Annuals

Annual weeds live but one year; they produce seed but once and then die down entirely, root and all. Having no parts underground by means of which they can spread, they propagate themselves by seeds alone. Obviously, all methods of controlling them have one principal object - the prevention of seeding - which may be attained by mowing, cultivating, burning, or spraying. If seed production is consistently prevented over a series of years, and if the introduction of weed seeds from neighboring areas is largely eliminated, the annual weed population will gradually decrease. Of course, weed seeds of many annuals may live for years in the soil and may then be brought by cultural operations to the surface, where conditions for their growth are favorable. The germination of such seeds should be encouraged by irrigation or cultivation before or soon after the crop is planted, to insure killing of the young plants before they injure the crop. Annuals in the early stages are easily and cheaply destroyed by cultivation, plowing, or chemicals; and, once the top has been killed, the root has no power of rejuvenation.

Summer and winter annuals differ considerably in their habits. The seeds of summer annuals germinate in the spring; and the plants grow to maturity during the same season, develop a crop of seeds, and die during the winter. Shallow cultivation and sprays, either oil, or 2, 4-D or a preparation of sodium dinitro-cresol or dinitro-phenol,** afford

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* This section is taken from California Agricultural Extension Service Circular No. 97, Weed Control, by W.S. Ball, A.S. Crafts, R.N. Raynor and W.W. Robbins, (revised by R.N. Raynor).

** California Agricultural Extension Service Bulletin No. 634, A New Selective Spray for the Control of Certain Weeds, by W.A. Westgate and R.N. Raynor.

the best control. It is to check summer annuals that an intertilled summer crop is usually placed in a crop-rotation plan.

Winter annuals usually start in the fall or early winter when soil-moisture conditions are favorable. The young plants live throughout the winter in a vegetative condition, often forming a rosette-like growth. In the spring they grow rapidly, flower, and produce seed. Such plants are more difficult to control in California. The seeds usually germinate throughout the winter; and shallow cultivation, to be effective, would have to be repeated several times - a procedure often impossible during the rainy season. Two effective methods, however, are available.

The first method is plowing. If plowed under fairly early in the spring, these weeds are effectively controlled, leaving the land free for crops. Plowing which is done primarily for the control of annual weeds should be shallow, in order that seeds be kept in the surface layers of soil where they will germinate readily. Spring plowing is common practice in California, both in cereal production and in preparing the land for later summer crops. In cereal production a good job of plowing often means the difference between a clean, heavy crop and a weedy unprofitable one.

The second means of checking winter annuals, principally used in growing cereals, is a selective spray such as 2, 4-D. This method will be described in detail in the next section.

Annuals often grow luxuriantly during the mild winters in California and are sometimes used for pasturage. In this case they are usually plowed under in the spring, and they serve the two-fold purpose of providing green feed for cattle or sheep and a soiling crop for the land. They should be turned under before seed is produced, and the plowing should be clean and thorough. Some annuals are similarly used in orchards, providing a valuable covercrop at minimum cost. Where used in this way, they are perpetuated by allowing the seeds to ripen before plowing. This practice always presents the hazard of severe competition for moisture if irrigation water is not available and it also may menace surrounding fields if seeds scatter. Where such a program is followed, the orchardist should be extremely careful that troublesome annuals or noxious perennials do not invade his land and spread undetected. Great caution should also be exercised in the planting of screenings for covercrop production.

Although mowing will prevent some annual weeds from seeding, certain species, such as wild lettuce, wild radish and yellow star thistle, will send up new shoots from buds in the axils of the lower leaves and may produce a second crop of flowers and seed. Such operations as mowing and spraying must be done at the proper time; delay may mean failure. The easiest way to dispose of annual weeds is to kill them in their early stages.

Common California annuals are mustards, wild radish, tumbleweed, pigweeds, wild oats, shepherd's purse, barnyard grass, chess or cheat, lamb's-quarters, Russian thistle, puncture vine, dodder, spiny sow thistle, yellow star thistle, sunflower, cocklebur, and crabgrass.

Biennials

A biennial weed lives for two years, passing through the first year in a low rosette form and producing seed the second summer. In California the biennials do not form a distinct or important group. Many weeds that are annuals in regions of freezing winters have a biennial habit in this State. True biennials are few, examples being purple star thistle and burdock. They are controlled like annuals, the treatment being made during the first year.

Perennials

The most troublesome weeds are perennials, which require special methods and systematic, painstaking endeavor for control. Plants in this group, as contrasted with annuals and biennials, live three years or more and spread not only by seed but also by underground roots or stems.

Perennials fall into three classes, according to their methods of reproduction:

The simple perennials have either a large taproot, like the dandelion, or a fibrous root system, like certain bunch grasses; in either case there is a well-developed perennial crown. Under natural conditions these perennials propagate only be seed; but if the roots of such plants as the dandelion, or the crowns of the bunch grasses, are broken into pieces, each piece is capable of rejuvenating the plant.

The creeping perennials are the most difficult type to control because they reproduce by creeping underground stems (rootstocks or rhizomes) as well as by seed. Among the most common are Johnson grass, hoary cress, morning-glory, Canada thistle, and

Russian knapweed. These not only spread horizontally for appreciable distances underground but have deeply penetrating roots. Morning-glory roots have been found over 20 feet deep in the soil.

Bulbous perennials reproduce by bulbs or nut-like structures and by seeds as well. Their reproductive organs are often but weakly attached to the mother plant and are easily dragged loose and scattered through the soil during plowing and cultivation. Some common bulbous perennials of California are wild onion, and the nutgrasses." (End of C.A.E.S. Circular No. 97.)

In the following discussion, mechanical and chemical methods for weed control are discussed. In any case where use of chemicals (herbicides) is deemed the appropriate course of action, their application should be conducted under the direction of EMA's weed control specialist, Bill Tidwell (Chief, Public Facilities Operations - the "weedbuster" team). Concentrations and application rates are critical in situations where desirable vegetation (trees, shrubs, native grasses) grow close by. An herbicide safe to use at low concentration may be deadly to overstory woodland resources at a higher concentration.

The key weeds and grasses desirable for control within the site's woodland-savannahs include winter annuals black mustard, poison hemlock and in some cases, ripgut brome, summer annual Italian thistle, winter annual or biennial milk thistle and perennial cardoon or artichoke thistle.

General directives regarding weed and adventive grass control in Caspers Wilderness Park's Addition Parcel include attempting to eradicate undesired vegetation by non-chemical means first, and resorting to the use of herbicides only if other methods fail and control is considered to be of greater benefit for elements of the environment (including recreational use) than leaving the situation as is.

Rationale for attempting to control weed infestations in the north cove includes improvement of savannah habitat for foraging raptors as part of a comprehensive program to improve wildlife carrying capacity in this now-degraded wilderness area site. Improving the biotic setting here will help to offset unavoidable recreation use impacts to woodland-savannah carrying capacity in the lower portion of the unnamed canyon.

Rationale for weed control and savannah grassland rehabilitation in the unnamed canyon is improvement of site aesthetics and visitor comfort, restoration of now rare natural riparian woodland-savannah understory grassland and improvement of raptor foraging habitat.

Specific recommended methods of ruderal/adventive grass control are these:

Black mustard, Brassica nigra
Poison hemlock, Conium maculatum

Where feasible, these elements should either be hoed in the seedling stage (January-February), or mowed just before flowering, when the species have committed energy to producing a flowering culm. Mowing too early may result in the production of new flowers issuing from the basal unmowed stubs. Mowing too late will result in dispersal of at least some viable seed on the ground. Mustard is a major problem in the north cove; poison hemlock is not, at this time.

It may be necessary to use weed whips rather than power equipment in the north cove. A gasoline-powered nylon cord trimmer and brush cutter would be labor cost effective if such equipment is on hand at the park.

Hoeing or mowing will have to be conducted over several years time, as some seeds rest in the soil for a long period before germinating.

In a number of instances, mustard (and poison hemlock) grow in melange habitat thickets of prickly pear cactus, sagebrush and other elements. Here, control would be very difficult and is probably not feasible. The seeding mechanism of mustard is such that controlled areas probably would not be reinfested by those remaining, unless they were in close proximity. It is particularly important to take care when attempting to eradicate mustard growing together with the sensitive, CNPS listed Coulter's matilija poppy. The only stands of this showy flowered shrub found in Caspers Park East grow in the North Cove.

Cut mustard plants should be removed from the cove and, if possible, burned. Black mustard is reputed to contain allelopathic chemicals which inhibit the germintion and growth of competing vegetation. Some highly disturbed cattle range areas, as in the vicinity of San Dimas are now pure stands of black mustard. Even such aggressive adventive grasses as

brome species have been completely eliminated. Mustard fields are often burned to remove the volatile allelopaths. Burning is not feaible in the mosaic woodland-brush-grass setting of the North Cove, however.

The method of tilling seedling mustard and poison hemlock plants during the winter would certainly eliminate much of the standing crop, if it was done several times during the rainy season. However, hoeing will disturb the soil further. This releases otherwise locked-in soil nutrients, ideal for the perpetuation of other weed species which depend on the flush of these compounds on disturbed sites. This is in contrast to advanced seral and climax species of mature habitats, which get along with minimal amounts, assisted in nutrient gathering by soil fungus mycorriza extensions upon their root hairs (St. John, 1986, 87).

Dr. Jim McHenry, U.C. Davis, in consultation with Orange County Agricultural Extension recommends after the first year's hoeing or mowing, revegetating the area with native perennial grasses, and applying the following subsequent springs 2, 4-D in amine form to new seedlings coming up through the grass cover. 2, 4-D amine is a contact broad-leaf herbicide which will not harm grasses and is considered safe to use under established trees (at recommended application strength and rate). Long seed dormancy and resting seed viability in this species and milk thistle, discussed later, account for often discouraging initial control results. The first flush of germination may be successfully knocked down and its seed source eliminated. But other seeds wait, sometimes for several years before producing plants. So the key, whether using only mechanical methods or integrating these with herbicide application, is persistence and patience. These successful weeds will not succumb to a single assault.

Italian Thistle, <u>Carduus pycnocephalus</u> and/or <u>C. tenuiflorus</u>

Dr. McHenry in consultation with Mark Nester of the Orange County U.C. Agricultural Extension Office recommends hand hoeing 1/2 to 1" beneath the soil to cut the young Italian thistle roots in situations like the mulefat undertory of the North Cove where herbicide application is not desired. This, however, disturbs the soil, making it attractive for other weeds. Application of a thick mat of mulch (such as decomposed chipper refuse) following tilling may help to ameliorate this problem. A

preemergent herbicide which kills seedlings but not mature plants may be safe to use here.

The Extension Office also recommended introduction of the thistle seed predator weevil, Rhinocyllus conicus. Promising results have been detected following introduction of this southern European insect to infestation sites of Italian thistle and milk thistle in southern California (Goeden and Ricker, 1974, 1977). However, the weevil also attacks desirable native species of Cirsium thistles which are components of coastal sage scrub brushland habitats in Casper Park. Therefore, introduction of the insect here is not recommended by the HCP team.

It is probably impossible to fully control the Italian thistle infestation in the North Cove mule-fat scrub, because of overstory vegetation density here. Airborne "parachute" pappus fruit will drift from uncontrolled stands to cleared areas where the soil has been disturbed, especially if a thick mulch bed is not applied subsequent to hoeing.

Milk thistle, Silybum marianum

Excerpts of a synopsis of the biology and control of milk thistle by Caitlin Bean for the California Field Office of the Nature Conservancy are included on the following pages. Editorial comments by the HCP team are inserted where appropriate. As can be deduced from Bean's discussion, there are no simple and easy solutions for the control of this noxious species once it has become established in the habitats altered by cattle trampling and fertilized by accumulation of their fesces, usually under shade trees in the vicinity of drinking water. Herbicide application has been employed in the Arroyo Trabuco addition of O'Neill Park, which harbored a very extensive population. However, there was only a single application, because of a change in Arroyo operations management policy precluding further herbicide use on the floor of the canyon. Because populations in Caspers Park East are fairly limited and circumscribed, the HCP stresses utilizing nonchemical control, without its associated risks of sycamore tree uptake and unknown environmental hazards, on at least a trial basis.

In Bean's paper, below, the use of the Rhinocyllus conicus weevil for milk thistle control is discussed and its hazards to native Cirsium thistles pointed out. In addition, HCP author Marsh had the opportunity to inspect a Rhinocyllus conicus introduction area in the San Jose Hills in the City of Walnut, CA (Marsh, 1986). Many thousands of beetles were

observed in the extensive milk thistle stands. But the fact that those stands were still prolific after 13 years (the weevil was introduced in 1973) raised her doubts about the effectiveness of Rhinocyllus conicus to significantly reduce rather than live in sympatric harmony with milk thistle stands.

Selected portions of Bean's paper follow. References cited are included in the Section 6 Reference Appendix.

"Silybum marianum is an erect, annual (or biennial in California) herb growing from one to two meters tall. The root can be classified as a taproot. The leaves are large, deeply divided with undulate margins and stem-clasping. They are shiny with sparse hairs on the upper surface and more dull and hairy on the lower surface. Leaves have a variegated appearance on the upper surface because of white veins and white patches. They have sharp 1-2 cm long spines along the margin.

The large purple flower heads are 2.5-5 cm across, terminal, solitary and nodding. They are surrounded by large stiff reflexed bracts ending in sharp spines 1-2 cm long. The flowers are produced from May to July.

The seeds are black or brown, mottled, smooth, 1/4 inch long, somewhat flattened with a pappus of numerous barbed bristles 3/4 inch long.

Silybum can be distinguished from other California thistles by its distinctive white-mottled leaves. There is only one species of Silybum established in California. 'The seed leaves (cotyledons) are large from 1/2 to 3/4 inch wide and 3/4 to 1 inch long, rather thick, succulent and light green. The first leaves are very conspicuously white-netted along the veins and have short yellowish prickles' (A.H. Lange et al., 1983).

The plant is mainly confined to high fertility soils. It frequently establishes on river flats, sheep camps, around stock yards and any other area of higher than normal soil nitrogen levels, especially if the area has been disturbed.

Silybum marianum has long been familiar to man. It commonly appears in European herbals after 1590. Formerly it was cultivated for 'its oil bearing seed and as an ornamental plant in Europe and east Asia, and still finds limited use, e.g. in Italy, as a salad green or vegetable' (Goeden 1976).

The origins of S. marianum lie in the region of Southern Europe, the Mediterranean and Northern Africa. Its current distribution includes most temperate areas of the world. It is common in the Western U.S. as a weed afflicting pastures, wastelands and irrigation banks (Parsons 1973). It is believed to have been introduced in cattle feed.

S. marianum spread through both the southern and northern Central Valley of California during the 1940s demonstrating a remarkable adaptation for colonizing. 'The agricultural environment that was invaded had been dominated by alien weeds for 180 years. For a species without vegetative propagation to invade a community of annuals underscores the competitive advantage of its germination characteristics' (Young et al. 1978). It is now common in both the coastal and inland valleys as well."

Ecology of Milk Thistle

"'Each terminal head of the plant produces approximately 100 seeds; 10 to 50 heads are produced per plant (Young et al. 1978). Seed weight is approximately 22 mg' (Wheatley 1971). 'From this we can calculate 10-50 grams of seed produced per plant. With a conservative average density of 2 plants/square meter theoretical seed production reaches 500 kg/ha' (Young et al. 1978).

Seed dispersal is the only means by which the milk thistle spreads. The seeds are equipped with a large pappus which allows effective spread by wind (Parsons 1973). Spread can also be attributed to their presence in grain and fodder (Wheatley 1971). Other means of dispersal include water, mud, agricultural produce, vehicles, machinery and animals (Parsons 1973)."

(HCP Ed. Note - because of seed weight, seeds usually become disconnected from the pappus bristles after only a short aerial drift, and drop to the ground.)

"The seeds of Silybum marianum germinate in the fall after the first rains. 'Plants develop slowly through the seedling stage, becoming flat rosettes by late autumn/early winter. Growth is rapid in late winter and early spring producing large cabbage-like plants up to 3 feet in diameter from which center stems develop in spring. Flowering commences in late spring and continues into early summer' (Parsons 1973).

The seedlings prefer disturbed soils which provide suitable bare areas for litter-free germination. Therefore, sheep camps, rabbit warrens, cultivated fire breaks, roadsides, overgrazed pastures and the like are ideal propagation sites. Seedlings do not establish in perennial pastures if the soil is well covered with vegetation during late summer and autumn. Litter is apparently a highly important inhibitive factor in the germination ecology of milk thistle seed. Because its germination is reduced by accumulations of grass litter, milk thistle is not adapted as a landscape dominant in areas where there is a continuous ground cover provided by existing vegetation. This can also hold true for annual rangelands considering they are managed properly (Young et al. 1978). However, if there is an absence of pasture or litter cover in late summer and early fall, infestations of thistle may develop. This occurs especially in periods of drought which reduce the persistence of many pasture species (Michael 1968).

Silybum seed has the potential to remain viable in the soil for up to 9 years. The percentage of germination varies from year to year and can be less than 50% (Parsons 1973). In an article on germination requirements of this species, written in 1978 by Young et al., the following results were recorded.

'One month after harvest, milk thistle seeds had afterripening requirements related to germination temperature that limited germination to 10-20 C degrees. The time required to satisfy afterripening requirements was dependent on germination temperature. Generally the higher the incubation temperature during germination, the longer the afterripening requirement (up to a maximum of 5 months). Once afterripening requirements were satisfied, milk thistle seeds germinated over a temperature range of from 0-30 C degrees. Optimum germination occurred with 16 hour cold periods of 2-15 C degrees alternating with 8 hour warm periods of 10-30 C degrees. Emergence of milk thistle seedlings decreased with increased burial depth, but substantial emergence occurred from a depth of 8 cm. Germination on the surface of the soil or litter was greatly reduced compared to that with slight soil or litter coverage.'

Once Silybum has found a niche it is a competitive thistle, and it tends to establish in tall dense patches that eliminate other plant species either by shading or by competition for moisture and nutrients.

In areas of continual disturbance, eradication of Silybum is virtually impossible until the factors which cause the disturbance are removed. Silybum will stay localized in these areas unless disturbance becomes more widespread. Overgrazing and fire are two factors which encourage the spread of Silybum in large areas."

Current Monitoring

"Qualitative observations of the changes in a thistle complex which occurs on the Marin headlands are in progress by Terri Thomas, a plant ecologist working for the Golden Gate National Recreation Area (GGNRA).

Rob Hansen, preserve manager for Kaweah Oaks in California, has been monitoring Silybum growth patterns in an area from which cattle have been removed. In the spring of 1984 he set out six transect lines, 100 meters each. From the data he gathered he was able to compare the radius of the existing growth to the radius of the growth from 1983. This data expressed a marked decrease in the Silybum population over time. The average decrease ranged from 20-80 percent. Follow-up data will be gathered in the spring of 1985. Three intercept lines will be set out on original transect corridors."

Research Needs

"The following are specific questions that need study to improve conservation or control efforts:

1. Could mowing, followed by covering the area with a thick layer of mulch, be an effective control for S. marianum?

2. Could burning be considered an effective method of control for this weed?

3. Is S. marianum germination enhanced by the disturbance created by mechanical removal to an extent that would render this method unacceptable?

4. Is grazing exclusion an acceptable method of control?"

Control Methods on Current Use

"Cultivation can be a useful method controlling [milk thistle] seedlings as a preliminary measure to sowing competitive perennial species.

APPENDIX I

GLOSSARY OF TERMS

adventive	-	Plant or animal not native to region; introduced, as by man.
aestivate (estivate)	-	To pass the summer in a torpor.
annual (plant)	-	Complete life cycle within a single year.
anthesis	-	Flowering.
association (ecological)	-	An assemblage of plants that has one or more dominant species from which it derives a definite aspect. In the HCP, "association" is used to denote such assemblages which are subcomponents of a community, e.g.: flowerfield association of Valley grassland community.
base level (hydrology)	-	The level below which a land surface cannot be reduced by running water.
biennial (plant)	-	A plant which completes its life cycle over two years time.
biotic	-	Plants and animals
caliche	-	A crust or subsurface layer of calcium carbonate or other chemically deposited material.
clay	-	Mineral soil material that is plastic when wet, consisting essentially of hydrated silicates of aluminum. The minute individual particles are capable of water adsorption and long water retention.
climax (ecological)	-	Culminating stage in natural plant community succession. The community does not change unless there is a change in climate or disturbance factors are introduced.
cobble	-	Alluvial material of rounded rocks sized midway between gravel and boulders.

community (ecological)	-	An identifiable assemblage of plants and animals living in a common home under similar conditions of climate, water availability, soil, exposure and elevation.
cove	-	A small sheltered inlet, as a small valley in the side of a mountain.
cover (ecological)	-	Percent of ground surface covered (by specific species or species group) as determined by projection of above ground parts.
Cryptically colored or patterned	-	Colored or patterned in such a way that the individual is disguised or hidden, tending to appear as part of the background.
culm	-	The jointed stem of a grass, as flowering culm (which bears the flowers at its summit).
drip line	-	The outer margin of a tree canopy projected onto the ground.
ecosystem	-	Any area of nature that includes living organisms and nonliving substances interacting to produce an exchange of materials between the living and nonliving parts.
endangered	-	Threatened with extinction.
Federal Category 2 Candidate for Threatened/ Endangered listing	-	Taxa for which information now in possession of FWS indicates that listing is possibly appropriate but for which conclusive data on biological vulnerability and threat are not currently available to support listing.
feeder root zone	-	The extent of spread of shallow roots from the above-ground portions of a plant. Example: the feeder root zone of an oak treee extends about three feet beyond its drip zone.
field capacity	-	The quantity of water that can be permanently retained in the soil in opposition to the downward pull of gravity; saturation.

flood plain	-	A strip of lowland bordering a stream built of sediment carried by the stream and dropped in the slack water beyond the influence of the swiftest current in times of flood. The area of floodtime inundation.
forb	-	Broad-leaf (dicot) herb.
frequency (ecological)	-	Percent of sample plot or transect in which the species occurs.
friable	-	Easily crumbled or pulverized (soil).
Holocene	-	Approximately 10,000 years before present to the present time. Aka recent epoch.
humun	-	Organic portion of soil, formed by partial decomposition of vegetable or animal matter.
line intercept transect	-	One-demensional measurement of vegetative cover and frequency, using a tape measure subdivided into predetermined intervals. Plant species are recorded within each interval and their total linear area of cover measured.
loam	-	A soil consisting of friable material of varying proportions of clay, sand and organic matter.
mesic	-	Moist but not saturated habitat away from stream edge. Often a function of (north-facing) exposure.
nonselective (herbicide)	-	chemical material lethal to all plants.
palustrine	-	nontidal wetlands dominated by trees, shrubs, persistent emergent or nonaquatic mosses or lichens.
pappus	-	Modified calyx-limb in Aster Family, consisting of a crown of bristles on the summit of the akine (seed). Functions like parachute to aid in aerially dispersing seeds.

soil activity (herbicide)	-	Movement of a (toxic) chemical through the soil from the place it was applied. Correlated to the rate at which the toxic chemical decomposes into component compounds which are not harmful to the environment.
stream bench	-	Gently sloping elevated surface which represents old floodplain level. As used in HCP, the bench is the first terrae level above the existing floodplain.
succession (ecological)	-	The process of replacement of one sere or plant community stage with another until climax is reached. Each step changes the physical environment setting, eventually hindering the sere which brought it about and favoring a new one which is more advanced.
suffrutescent	-	A shrubby sized plant which is woody mainly near the base. Eg: California sagebrush.
summer annual	-	Plant which sprouts from seen in the spring, and grows to maturity and sets seed before the following winter, when it dries.
taxon	-	Any taxonomic unit, as an order, genus, species, variety or race.
tectonic	-	pertaining to the forces and processes of earth movement: uplift, faulting, folding, etc.
terrace	-	A level piece of land beside a stream, representing a former floodplain.
threatened	-	Any species which is likely to become endangered throughout all or a significant portion of its range in the foreseeable future.
winter annual	-	Plant which sprouts from seed in fall or early winter, lives throughout winter in vegetative condition, and blooms and produces seed during the following spring.
xeric	-	Arid environmental condition.

Xylem	-	Tubular plant tissue which conducts water from roots to leaves. In trees, as new tissue develops beneath the bark, old xylem gradually looses it water-transmitting capability and becomes wood.