CHAPTER 3: EXISTING BIOLOGICAL AND HYDROLOGIC/ GEOMORPHIC SETTING

This Chapter describes the biological setting of the approximately 131,600-acre Southern NCCP/MSAA/HCP study area, including portions of the CNF (*Figure 3-M*). Within the study area, the approximately 91,660 acres of non-federal land defines the planning area for the NCCP/MSAA/HCP. Management of resources in the CNF is the responsibility of the USFS. Therefore, the description of the biological and hydrologic/geomorphic setting includes a general description of the CNF, but the main focus of this section is the 91,660-acre planning area. The 91,660-acre planning area is further subdivided into the four Subarea Plan areas described in *Chapter 1* (*Figure 3-M*). The Subareas total approximately 86,339 acres. The remaining 5,321 acres are comprised on the cities of Lake Forest and Dana Point, and internal areas that are "not a part" of the Subareas, such as Ladera Ranch, Las Flores, the wastewater treatment plant in lower Chiquita, Tesoro High School, FTC-North, and the Nichols Institute bounded by Caspers Wilderness Park.

To describe the biological setting of the NCCP/MSAA/HCP planning area, this Chapter includes the following sections:

Section 3.1 Database development methods;

Section 3.2 Vegetation communities that make up the planning area and the key wildlife species that are typical of, or indicate, high quality vegetation communities;

Section 3.3 Existing geomorphic and hydrologic conditions and processes;

Section 3.4 Sensitive wildlife and plant species distribution in the planning area and subarea plan areas; and

Section 3.5 Regional and subregional wildlife habitat linkages.

SECTION 3.1 DATABASE DEVELOPMENT METHODS

The information used to prepare this biological setting discussion is derived from various databases to support the NCCP/MSAA/HCP. The initial database consisted of a vegetation map and sensitive species information compiled into a GIS coverage by the County of Orange for the Southern NCCP/MSAA/HCP study area. This database was provided to the NCCP/MSAA/HCP consultant, Dudek & Associates, Inc. (Dudek), by the County in 1993 and has been subsequently updated with remapping of the vegetation communities in specific areas of the RMV, as described below and with additional species surveys between 1993 and 2003, as listed below in *Section 3.1.2*. The database also includes data and information presented in the *Baseline Geomorphic and Hydrologic Conditions* report prepared by RMV consultants (PCR *et al.* 2002). The methods used to prepare and update the study area databases are briefly described below, and are described in more depth in appropriate sections of this chapter.

3.1.1 Vegetation Communities

The vegetation layer of the database is in part based on vegetation community mapping originally performed by Dames and Moore, circa 1992. The mapping was based primarily on color aerial photo (circa 1990) interpretation. The vegetation layer was modified in-house by Dudek in response to changing biological conditions in the study area, primarily where grading for various large-scale developments has removed vegetation (*e.g.,* Ladera Ranch, Talega). The most recent revision to the vegetation database by Dudek was made in 2004. In addition, the vegetation communities within planned development areas on RMV, as defined for the GPA/ZC EIR, were refined by Glenn Lukos Associates (GLA) in 2005 because of some mapping discrepancies between the landscape-level riparian and wetland communities in the original NCCP database and the project-level wetland delineation conducted by GLA, as described below. These discrepancies necessitated refinements of both the riparian/wetland communities and the adjacent upland communities (*e.g.,* areas where the NCCP database had coast live oak riparian forest that was actually upland oak woodland or chaparral). The 2005 vegetation database is used for acreages reported in this Chapter.

The original mapping and the Dudek and GLA updated mapping used the Orange County Land Cover/Habitat Classification System (Gray and Bramlet 1992), which is a hierarchical system that identifies separate vegetation associations and subassociations. The classification system facilitates data analysis and reserve design while maintaining the level of detail required to accurately identify vegetation community areas of high biological and/or strategic value.

A separate mapping effort of native grasslands was conducted by Dudek within the RMV boundary in order to quantify the both conservation and impacts to native grasslands. A coarse-grained native grassland mapping effort was conducted by St. John in 1989. This mapping effort was limited in Cristianitos Canyon, a major grassland area in the San Mateo Creek Watershed, due to lack of access to the Ford Aerospace lease area, resulting is some very generalized mapping. Dudek conducted a refined native grassland survey on about 4,800 acres in 2001 based on the areas identified by St. John, the presence of clay soils and the existing NCCP vegetation map. The Dudek survey effort included the following native grassland quality ratings:

1. High quality grasslands (> 30 percent native grassland species)
2. Moderate quality grasslands (5-30 percent native grassland species
3. Low quality grasslands (< 5 percent native grasslands)

Because of the large survey area, the minimum mapping unit for a native grassland area generally was 5 acres, with smaller areas mapped as incidentally encountered.

A separate watershed-level delineation for the portion of the study area within the San Juan Creek and San Mateo Creek watersheds in support of the Special Area Management Plan (SAMP) was completed by the USACE Waterways Experiment Station (WES) in 2000. In addition, a "Functional Assessment" prepared by the USACE Cold Regions Research and Engineering Laboratory (CRREL) that addresses the extent and quality of wetlands and other waters of the U.S. located within two watersheds. Because the WES watershed-scale delineation and the NCCP wetland/riparian mapping were both performed at a landscape level, and because of the technical difficulties of combining the two databases the existing setting description presented in this chapter relies on the NCCP database.[1] The SAMP will utilize the WES delineation and CRREL Functional Assessment, as was their intended use.

In addition to the NCCP and WES watershed-level mapping of riparian and wetland vegetation communities, beginning in 2002 wetland specialists from Glenn Lukos Associates (GLA) conducted a "project-level" jurisdictional delineation for the proposed development project alternatives pursuant to Section 404 of the Clean Water Act and the California Department of Fish and Game (CDFG) pursuant to Section 1600 of the Fish and Game Code, including areas of riparian vegetation (GLA 2006). The jurisdictional delineation for CDFG (designating CDFG Jurisdictional Areas) focused on a functional definition of vegetation communities providing "riparian habitat" and thus defined riparian areas which would be subject to evaluation under CEQA. During the performance of the project-level delineation, it became apparent that many features identified by WES/CRREL as Waters of the United States (WoUS) did not meet the criteria set forth in 33 CFR 328.3 due to a lack of characteristics consistent with the presence of an Ordinary High Water Mark (OHWM) or jurisdictional wetlands in accordance with the 1987 Wetland Manual. It was also noted that areas identified as riparian by WES/CRREL and/or the NCCP databases sometimes overestimated the extent of riparian vegetation, and in some instances mapped upland areas as riparian vegetation because of the inherent generalization based on aerial photo interpretation compared to specific

[1] A comparison of the original aquatic habitats in the Southern NCCP/MSAA/HCP vegetation database and the new mapping by WES showed overlapping, but somewhat different mapping results. While discrete vegetation polygons were similar in shape and size, the vegetation communities attributed to the polygons were sometimes different from the original database. This result would be expected because of actual changes in the habitat over the past decade (*e.g.,* from succession or natural disturbances), technical advances in the aerial photography (*i.e.,* geo-referenced photos) and different field workers, methodologies and mapping decision rules. For example, the labeling of vegetation polygons may be different to reflect current conditions and polygon shapes and positions may be different as a result of some distortion in the original aerial photographs, causing difficulties in edge-matching between different vegetation polygons. For these reasons, the data layers cannot be simply combined to produce a seamless vegetation map (*i.e.,* simply inserting the new aquatic habitats in replacement of the original mapping).

characterization of vegetation at the project-level delineation. Generally the WES/CRREL and NCCP databases were accurate for the mainstem creeks and associated riparian vegetation and were less accurate on smaller tributaries extending into upland vegetation communities. As noted above, as a result of the discrepancies between the landscape-level NCCP vegetation map and the wetland delineation, GLA refined the vegetation mapping within the GPA/ZC EIR-defined development areas. These refinements were incorporated into an updated 2004 NCCP vegetation database.

The *Baseline Geomorphic and Hydrologic Conditions* report (PCR *et al.* 2002) provides mapping and descriptions of the physical processes and the underlying geomorphology that contribute to the ecologic conditions of the riparian systems in the study area. This work was intended to supplement and complement the information gathered by the USACE WES and CRREL, but provides value information for describing important abiotic processes in the planning area. This mapping effort covered the large majority of the NCCP/MSAA/HCP study area, but did not include the northernmost portion of the CNF or the San Clemente Hydrological Unit in the southern portion of the study area (*Figure 7-M*).

As noted above, the broad existing setting description presented in this chapter relies on the landscape-level NCCP vegetation database; however, with the incorporation of the more refined mapping within the RMV development areas. The project-level delineation will be used in other chapters of this NCCP/MSAA/HCP to analyze potential impacts to jurisdictional areas within proposed project development areas.

It is important to understand that the spatial and temporal distribution of vegetation communities in NCCP study area is dynamic and variable. As described above, the original NCCP vegetation database dates back to pre-1993, with several updates since that time to incorporate landscape changes and refinements within the RMV development planning areas. The latter demonstrated some changes in the vegetation communities that probably are due to a combination of natural processes (*e.g.*, floods, fire, precipitation cycles) and differences in mapping technologies, the level of field-truthing, *etc*. The vegetation community descriptions, in terms of acreage and distributions, provided in this Chapter therefore are intended to provide a general overview of the existing biotic conditions in the study area. As described in *Chapter 7*, an important component of the Habitat Reserve Management Program (HRMP) will be periodic updates and monitoring of the major vegetation communities in the Habitat Reserve.

3.1.2 Sensitive Wildlife and Plant Species

The database for sensitive wildlife and plant species in the study area is compiled from the cumulative results of a number of general and focused biological survey efforts and existing databases, including the following:

- Coastal California gnatcatcher surveys conducted by Michael Brandman Associates (MBA) on various private lands in 1990 and 1991 and for the proposed Foothill Transportation Corridor in 1994-1996.
- General biological surveys conducted by Ed Almanza & Associates on Forster Ranch in 1992.
- Bird surveys conducted by Sweetwater Environmental Biologists on County parkland in 1993.
- Focused surveys for the orange-throated whiptail conducted by Lilburn Corporation on portions of RMV in 1994.
- Focused surveys conducted by Bontrager for the coastal California gnatcatcher (1989), coastal cactus wren (1989-1990), and tricolored blackbird (1989) on RMV.
- A general survey of the distributions of sensitive biological resources and wildlife corridors on RMV (Bontrager 1990).
- Focused bird surveys conducted by Dudek & Associates, Inc. (Dudek 1994) in three areas: Coto de Caza/Dove Canyon, Northrop Grumman/Ford Aerospace, and Reservoir Canyon.
- A wildlife corridor study conducted by Dudek throughout the Southern NCCP/MSAA/HCP in 1994.
- A cumulative database on historic raptor nest sites in the study area compiled by P. Bloom between approximately 1990 and 2000 with review and update in 2006.
- Pitfall trap data for Audubon Starr Ranch Sanctuary provided by P. DiSimone.
- Focused surveys conducted in 1998 by Dudek and Harmsworth Associates throughout RMV for riparian birds.
- Focused surveys conducted in 1998 by Glenn Lukos Associates (GLA) throughout RMV for sensitive and rare plants.
- Focused surveys conducted in 1998 by P. Bloom throughout the study area for arroyo toad and western spadefoot toad.
- Focused surveys by Dudek for least Bell's vireo, southwestern willow flycatcher, coastal California gnatcatcher, and arroyo toad in lower Arroyo Trabuco in 1997-2000 (Dudek 2001a).
- Focused survey for rare and sensitive plants by GLA in lower Arroyo Trabuco in 2000 (found in Dudek 2001a).
- Focused surveys for sensitive wildlife and plants by Dudek in middle Chiquita Canyon in 1998 (Dudek 1998).
- Focused survey by Dudek for coastal California gnatcatcher and other sensitive wildlife species on the Donna O'Neill Land Conservancy at Rancho Mission Viejo in 2003 (Dudek 2003).
- Vernal pool and fairy shrimp surveys conducted in 2001 on RMV jointly by Dudek and PCR (Dudek 2001b; PCR 2003b).

- Various biological surveys conducted by BonTerra on the Prima Deshecha Landfill (BonTerra Consulting 2004a,b; 2005).
- The California Natural Diversity Database (CNDDB).
- A cumulative database for sensitive and rare plants compiled by botanist F. Roberts (formerly with the USFWS) received circa 1994.
- WES/CRREL and PCR *et al.* (2002) studies of riverine and non-riverine wetlands, geomorphology and hydrology conducted in 2000-2002 in support of the SAMP and NCCP/MSAA/HCP.
- Various other studies and anecdotal records of species from the Science Advisors and other biologists for the study area and specific projects (*e.g.,* Beier and Barrett 1993; Padley 1992; Harmsworth Associates 1997, 1998a, 2000, 2001, 2003, 2004).
- Updates to the listed species database from the USFWS in 2002 incorporating surveys conducted under federal permits from 1999 to 2002.
- Updates to sensitive plant database for RMV provided by GLA in 2002 and 2003.
- Update to sensitive plant database for the Donna O'Neill Land Conservancy at Rancho Mission Viejo (Roberts and Bramlet 2004).

These various survey efforts have resulted in a cumulative database that provides a strong portrayal of the abundance, richness and distribution of biological resources in the study area.

As noted above, the sensitive species database has been updated periodically to incorporate new data and provide the best available data for planning purposes. In the updates, new location data include several areas that have been surveyed more than once; *e.g.,* the SOCTIIP (formerly FTC-S) study area has been surveyed several times in the past decade. Because the California gnatcatcher and cactus wren are non-migratory species that tend to use the same home range/territories over their life span, simply adding the new locations would erroneously inflate the number of occupied locations. Alternatively, simply deleting the old data and "plugging in" the new data would result in a "snapshot" of occupied habitat. For example, if the most recent survey were following a poor breeding season, suitable habitat would be underestimated. To control for the "double-counting" problem and to prevent the loss of "old" species locations, new locations of gnatcatchers and wrens were incorporated into the existing database using a method that results in a composite species location map showing "occupied" habitat; *i.e.,* any location documented to have supported the California gnatcatcher or cactus wren since the database was originally created. The virtue of creating a cumulative database is that it helps identify vegetation communities providing suitable habitat and recognizes the variability of the distribution and density of populations over any given year.

New data for the California gnatcatcher were incorporated on four separate occasions: 1994-1996 Dudek and FTC/SOCTIIP data; 1998 USFWS data; 2001 SOCTIIP data, and 2002 USFWS data.

An 11-acre circular buffer (400-foot radius from the data insertion point) was plotted around each existing gnatcatcher location. (The 11-acre buffer area was selected on the basis of an estimated average non-breeding home range of 11.6 acres [standard deviation of 4.5 acres] for 12 California gnatcatcher pairs in Chiquita Canyon by Bontrager [1991].) Since this original estimate was used in 1996, more data on home ranges have been collected indicating smaller home ranges and higher densities in coastal areas (*e.g.*, Atwood *et al.* 1998a). However, the 11-acre estimate was based on site-specific observations by Bontrager and furthermore provides a conservative estimate of the typical density and carrying capacity in the subregion.) Any single new points that fell within the buffer were deleted. If two new points fell within the same buffer, only one was deleted because the two points within the buffer for the same survey year demonstrated a higher population density than assumed by the 11-acre buffer area.

A similar exercise was conducted for cactus wrens using a 4.5-acre buffer (250-foot radius). This buffer was selected based on 4.8-acre average territories (range 2.9-6.9 acres) observed in Arizona (Anderson and Anderson 1973).

3.1.3 Geomorphic and Hydrologic Conditions

The geomorphic and terrains and hydrologic conditions studies were evaluated at two spatial scales: **(1)** the landscape level that encompasses the entire San Juan Creek and San Mateo Creek watersheds from the headwaters to the coast; and **(2)** the scale of the property boundary for the RMV. Included in these studies were analyses of sediment yield and transport, water quality and groundwater. The methods used in the studies are briefly summarized below. The reader is directed to the *Baseline Geomorphic and Hydrologic Conditions* report by PCR *et al.* (2002) for the detailed descriptions of these studies.

The geomorphology and terrains study primarily was a descriptive analysis of the watersheds using existing data on geology, soils, and past and present uses. Historic data and aerial photos also were used to investigate the effects of both natural and anthropogenic land use changes over time. Based on these analyses, GIS maps were prepared to show terrain types, and runoff and recharge characteristics associated with various substrate types.

The hydrology study examined the available information on magnitudes, frequencies, and patterns of surface flows through uplands and stream channels in relation to the distribution and integrity of wetlands and riparian vegetation communities. This study included a review of the scientific literature regarding hydrologic impacts associated with urbanization, including both empirical studies and computational models. Specific analyses within the watersheds were conducted of the stream network, rainfall-runoff, and dry season flow.

The sediment yield and transport study examined entrainment, transport and deposition characteristics of the watersheds. The estimate of sediment yields was based on a review of a variety of data sources from southern California coastal watersheds, including data for sediment discharge, locally derived sediment rating curves, observed rates of debris accumulation in debris basins, reservoirs and gravel pits, calculated yields based on the Los Angeles District method and Modified Universal Soil Loss Equation, and comparisons with adjoining watersheds having similar sediment-generating influences such as slope, geology and soils. Storm event-based sediment transport rates and yields were estimated on a reach basis using SAM, a USACE channel design package, which includes both hydraulic and sediment parameters.

The water quality study consisted of review, summary and analysis of five substantial water quality data sets collected within the study area, including data collected by the Orange County Public Facilities and Resources Department. The water quality data were supplemented by field surveys that assessed the potential role of various geomorphic and biological features that may be involved in the mobilization and cycling of key nutrients and constituents of concern such as nitrogen, phosphorus, metals and sediment. In addition, 11 monitoring stations have been established in the study area for the ongoing collection of organic and inorganic water quality constituents.

A comprehensive groundwater study was beyond the scope of the SAMP baseline studies program because extensive modeling of groundwater movement (*i.e.,* subsurface hydrodynamics) is a long, complex and costly endeavor that is generally limited to major drinking aquifers. Additionally, groundwater appears to be a much more significant influence in the Chiquita and Gobernadora sub-basins than in the other sub-basins. Consequently, groundwater flow directions and locations of key recharge areas were inferred from: **(1)** the results of the terrains analysis, the hydrogeologic conditions, the surface hydrology modeling, and the groundwater analysis; and **(2)** existing well data and bore logs, earlier technical reports on groundwater conditions in the watershed, detailed investigations from the 1960s by the California Department of Water Resources and local water districts, and portions of the San Diego RWQCB Basin Plan.

3.1.4 Role of the NCCP Science Advisors

As part of the Southern NCCP/MSAA/HCP planning process, a panel of scientists with conservation biology, species, and regional and local expertise was brought together by The Nature Conservancy. This panel, known as the Southern Orange County NCCP Science Advisors (Science Advisors), prepared a document titled "Principles of Reserve Design and Species Conservation for the Southern Orange County NCCP" (*Appendix B*). The Science Advisors were brought together to provide scientific information and experience to assist the conservation planning process for the Southern NCCP/HCP. They were tasked to develop three products: **(1)** principles of reserve design; **(2)** principles for conservation of species and vegetation communities providing habitat for such species; and **(3)** principles and goals for an adaptive management program. Under the second task, the Science Advisors developed a list of species to be addressed as part of the conservation planning process. This list of species was not confined to those primarily associated with coastal sage scrub, but included species using all types of wildlands in the Southern NCCP/MSAA/HCP planning area.

SECTION 3.2 VEGETATION COMMUNITIES/LAND COVERS AND ASSOCIATED SPECIES

The vegetation community/land cover descriptions provided in this section are organized under the following aggregated headings:

- Coastal sage scrub
- Chaparral
- Grasslands
- Woodland and Forests
- Riparian
- Other Wildland Habitats
- Non-natural Land Covers

For coastal sage scrub and chaparral in Orange County Gray and Bramlet (1992) define numerous "types" (*e.g*, Venturan-Diegan Sage Scrub, Southern Cactus Scrub, Scrub-Chaparral Ecotone/Sere) and "subassociations" within types (*e.g.,* sagebrush-buckwheat scrub, chamise chaparral). Because of the numerous types and subassociations of coastal sage scrub and chaparral, for ease of discussion in this Chapter and the general vegetation analyses presented throughout this NCCP/MSAA/HCP, coastal sage scrub and chaparral types and subassociations are presented as aggregates, except in instances where they provide unique and important habitat information for a particular Covered Species (for example, see the *Chapter 13* Covered Species analyses). The grassland discussion distinguishes between annual (non-native) and native grassland because native grassland is a sensitive vegetation community that is very distinct from annual grassland. Woodland and forest are aggregated because the vast majority of the community in the planning area is comprised of coast live oak (*Quercus agrifolia*) and coast live oak woodland and forest are distinguished primarily by the percent of canopy cover. The various riparian communities (*e.g.,* southern willow scrub, coast live oak riparian forest) are discussed separately because they are unique communities that have diverse functions and values. "Other Wildland Habitats" are diverse biotic vegetation communities/land covers that are distinct from the major vegetation communities discussed above. They are comprised upland cliff and rock, vernal pools, freshwater marsh, slope wetlands, alkali meadow, open water and water courses. Non-natural land covers include agriculture, disturbed areas, and development.

3.2.1 Coastal Sage Scrub

a. General Description

Coastal sage scrub is represented by several major associations that occur discontinuously from the San Francisco Bay area south to El Rosario in Baja California, Mexico. Some classification systems are based on dominant species (*e.g.*, Holland 1986; Sawyer and Keeler-Wolf 1995; White and Padley 1997), while others are based on geographic location *(e.g.,* Axelrod 1978; Westman 1982). The most commonly cited geographic-based associations include those of Axelrod (Fransiscan, Diablan, Lucian, Venturan, Diegan, and Riversidean) and Westman (Diablan, Venturan, Riversidean, Diegan, Martirian, and Vizcainan). Coastal sage scrub is found most extensively at lower elevations of coastal southern California, but occurs up to about 4,200 feet in elevation in the Coast Ranges. It transitions into Mojave Desert vegetation to the east and to Sonoran vegetation in Baja California, Mexico (Axelrod 1978; Westman 1981a).

Coastal sage scrub is dominated by a characteristic suite of low-statured, aromatic, drought-deciduous shrubs and subshrub species. Composition varies substantially depending on physical circumstances and the successional status of the vegetation community. Characteristic species include California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), laurel sumac (*Malosma laurina*), California encelia (*Encelia californica*), and several species of sage (*e.g., Salvia mellifera, Salvia apiana*) (Holland 1986; Sawyer and Keeler-Wolf 1995). Other common species include brittlebush (*Encelia farinosa*), lemonadeberry (*Rhus integrifolia*), sugarbush (*Rhus ovata*), yellow bush penstemon (*Keckiella antirrhinoides*), Mexican elderberry (*Sambucus mexicana*), sweetbush (*Bebbia juncea*), boxthorn (*Lycium* spp.), prickly-pear (*Opuntia littoralis*), coastal cholla (*Opuntia prolifera*), tall prickly-pear (*Opuntia oricola*), and several species of *Dudleya*. Sage scrub often is patchily distributed throughout its range (O’Leary 1990a). Over a scale of several miles, it can be found in diverse mosaics with other plant communities, particularly grassland and chaparral, and oak/riparian woodland in more mesic areas. Coastal sage scrub may convert to chaparral or grassland, depending on slope, aspect, climate, fire history, and other physical factors and biological phenomena. Conversely, chaparral or grassland areas may convert to coastal sage scrub (Axelrod 1978; White 1995; O’Leary 1995; Allen *et al.* 1999).

Coastal sage scrub typically is found on xeric sites, notably steep, south-facing slopes with thin and/or rocky soils. It also is found on exposed sea bluffs, coastal and river terraces composed of coarse alluvial outwash, and coastal dunes (Axelrod 1978). The more open nature of the canopy permits persistence of a diverse herbaceous component of forbs, grasses, and succulents in mature stands than usually is associated with chaparral. It often is mixed with chaparral and grassland communities and the distinct boundaries between each can sometimes be difficult to delineate.

b. Coastal Sage Scrub Communities in the Study area

Gray and Bramlet (1992) proposed a complex and highly detailed classification system, modified from Holland (1986), for use in mapping vegetation types in Orange County, California. Within "scrub" communities, Gray and Bramlet (1992) identified eight major subtypes: **(1)** southern coastal bluff scrub; **(2)** maritime succulent scrub; **(3)** Venturan-Diegan transitional coastal sage scrub; **(4)** southern cactus scrub; **(5)** Riversidean coastal sage scrub; **(6)** floodplain sage scrub; **(7)** chenopod scrub; and **(8)** sage scrub-grassland ecotone. Within the Venturan-Diegan transitional coastal sage scrub subtype, 12 distinct subassociations were identified based on the dominant species. Within the sage scrub-grassland ecotone subtype, five distinct subassociations were identified based on the same criterion.

"Scrub" as defined for this study area, roughly corresponds to Holland's (1986) descriptions of Venturan-Diegan coastal sage scrub (a transitional community containing elements of two major types described by Holland), southern cactus scrub, and Riversidean coastal sage scrub. In the study area, scrub is a more or less open community composed of low, drought deciduous shrubs, with a sparse understory of annual and perennial grasses and forbs.

1. <u>Venturan-Diegan Sage Scrub</u>

This variable scrub community occurs on rocky, well-drained slopes away from the immediate coast (where it is replaced by the "coastal bluff scrub" community). This community is defined by the presence of one or more shrub species characteristic of coastal sage scrub, such as California sagebrush, California buckwheat, bluff monkeyflower (*Mimulus longiflorus*), goldenbush (*Isocoma* spp.) and prickly-pear. The understory is variable, and frequently includes annual and perennial grasses; in spring, annual wildflowers may occupy open ground in relatively undisturbed scrub.

2. <u>Southern Cactus Scrub</u>

Southern cactus scrub generally contains greater than 20 percent cactus (*Opuntia* spp.), with the remainder of the community consisting of other typical Venturan-Diegan sage scrub species. This community occurs primarily on south-facing slopes on low foothills away from the immediate coast. This community generally is of particular value to the coastal populations of the cactus wren.

3. <u>Coastal Bluff Scrub</u>

Coastal bluff scrub consists of low scrub vegetation on exposed bluffs and cliffs, usually immediately adjacent to the ocean.

4. Brittlebush/Buckwheat Scrub (Riversidean Coastal Sage Scrub)

Brittlebush/buckwheat scrub fits within Holland's (1986) description of Riversidean sage scrub. It is typically found on shallow, rocky soils (Kirkpatrick and Hutchinson 1980).

5. Other Scrub Types and Ecotones

Scalebroom scrub is associated primarily with broad floodplains and alluvial fans of interior Orange County, and is characterized by the presence of scalebroom (*Lepidospartum squamatum*). **Saltbush scrub** is defined by the presence of Brewer's saltbush (*Atriplex lentiformis* spp. *breweri*) as a dominant. In Orange County, this community typically occurs in low, saline places near the coast. California gnatcatchers have been known to nest in pure stands of saltbush scrub, at least in coastal areas where gnatcatcher density is relatively high. **Scrub/ grassland ecotones** are defined as an open scrub/grassland with shrub cover of 5-20 percent. **Scrub/eucalyptus** is an ecotone occurring where eucalyptus trees have been planted within extant scrub. Until the eucalyptus trees become dominant to the point that the scrub is excluded from this community, scrub/eucalyptus may provide valuable wildlife habitat, including sensitive species such as California gnatcatcher and orange-throated whiptail (*Aspidoscelis hyperythra [Cnemidophorus hyperythrus] beldingi*).

c. Distribution of Coastal Sage Scrub in the Study area

A total of 25,687 acres of coastal sage scrub is present in the study area, of which 20,856 acres (81 percent) are in the planning area and 4,831 acres are in the CNF (*Table 3-1*). *Figure 10-R* shows the distribution of coastal sage scrub in the study area. Coastal sage scrub is well distributed throughout the study area. At the lower elevations in the western portion of the study area it occurs in a mosaic with grasslands, while in the eastern and northern parts of the study area it is more interspersed with chaparral. Including the CNF, coastal sage scrub comprises about 28 percent of the natural vegetation communities in the study area. Among the five major upland vegetation communities (*i.e.*, coastal sage scrub, chaparral, grassland, woodland, and forest) totaling 84,935 acres in the study area, coastal sage scrub accounts for approximately 30 percent of the total. Within the planning area, the 20,856 acres of coastal sage scrub accounts for 44 percent of the 47,318 acres of major upland vegetation communities.

d. Distribution of Coastal Sage Scrub in Subareas

The large majority of coastal sage scrub in the planning area is located in Subarea 1 (80 percent), followed by Subarea 4 (9 percent), Subarea 2 (6 percent) and Subarea 3 (4 percent) (*Table 3-1*). With the exception of Subarea 4, which is the most urbanized Subarea, coastal sage scrub is well represented in the Subareas Plan areas. Proportionally, coastal sage scrub accounts for 43 percent of the natural vegetation communities/land covers in Subarea 1, 38 percent in Subarea 2, 54 percent in Subarea 3 and 22 percent in Subarea 4.

TABLE 3-1
VEGETATION COMMUNITIES/LAND COVER ACREAGES IN THE SOUTHERN SUBREGION STUDY AREA

Vegetation Community/Land Cover	Subregion Total	Planning Area[1]	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Cleveland National Forest	Other[1]
Coastal Sage Scrub	25,687	20,856	16,710	1,300	753	1,854	4,831	239
Chaparral	37,962	8,513	6,611	1,156	54	627	29,449	65
Grassland	15,449	15,329	9,430	367	292	4,995	120	245
Woodland	1,845	1,640	1,391	168	49	31	205	1
Forest	3,992	980	940	8	0	32	3,012	0
Riparian[2]	7,356	5,125	3,876	419	233	521	2,231	76
Open Water	388	387	113	0	24	240	1	10
Freshwater Marsh	33	33	19	1	0	13	0	0
Slope Wetland	2.4	2.4	2.2	0	0	0.2	0	0
Watercourses	75	75	25	8	0	35	0	7
Alkali Meadow	42	38	38	0	0	0	0	4
Cliff and Rock	72	10	10	0	0	0	62	0
Marine	131	131	0	0	0	98	0	33
Subtotal	***93,034***	***53,119***	***39,165***	***3,427***	***1,405***	***8,450***	***39,911***	***680***
Developed	32,743	32,678	945	235	2,380	24,391	65	4,727
Disturbed	1,816	1,792	1,037	39	70	562	24	84
Agriculture	4,044	4,043	3,485	175	171	146	1	66
Subtotal	***38,603***	***38,513***	***5,467***	***449***	***2,621***	***25,099***	***90***	***4,877***
TOTAL[3]	**131,637**	**91,632**	**44,632**	**3,876**	**4,026**	**33,549**	**40,001**	**5,557**

Source: County of Orange NCCP Vegetation Database, 1993, as last modified in 2005

1 The "Other" category includes the cities of Lake Forest and Dana Point, an "Existing Use" Girl Scout Camp, and other areas that are in the study area but are "Not a Part" of the Subareas.

2 See Table 3-2 for a breakdown of specific riparian communities.

3 Subtotals may not sum precisely due to rounding error.

e. Wildlife Associated with Coastal Sage Scrub

Coastal sage scrub supports a rich diversity of wildlife species, including birds, mammals, reptiles, and invertebrates. While many widely ranging species that occur throughout shrublands in California may be encountered in coastal sage scrub, some species are restricted almost exclusively to this vegetation community. The Science Advisors identified several species that are indicative of high quality coastal sage scrub and indicators of the potential presence of other species dependent on this vegetation community. These species include California gnatcatcher, cactus wren, wrentit (*Chamaea fasciata*), greater roadrunner (*Geococcyx californianus*), Dulzura kangaroo rat (*Dipodomys simulans*), Dulzura California pocket mouse (*Chaetodipus californicus femoralis*), northern red-diamond rattlesnake (*Crotalus ruber ruber*), orange-throated whiptail, coast horned lizard (*Phrynosoma coronatum* [blainvillei population), and spotted night snake (*Hypsiglena torquata*).

f. Human-Related Disturbances and Threats

Human-related disturbances have affected and continue to affect coastal sage scrub associations throughout the region. Of all human-related effects, livestock grazing and potentially increased fire frequency from fires intentionally set or otherwise caused by human activities have had the greatest and most pervasive effects on extant scrub in the region (Hobbs 1983; Monroe *et al.* 1992; Keeley and Keeley 1984; Westman 1976). Grazing by livestock has affected coastal sage scrub ecosystems for about 240 years since European settlement of California. Humans have potentially ignited wildfires in coastal scrub for several thousand years, and naturally-ignited fires have occurred both before and during that period.

1. <u>Grazing</u>

Grazing of livestock has, in many areas, impacted both the extent and quality of coastal sage scrub. The degree of impact on scrub vegetation from grazing often depends on whether or not a grazing management plan is prepared and grazing is conducted in accordance with the management plan. On Santa Cruz Island, 130 years of grazing by feral sheep reduced the coastal sage scrub cover to only six percent of the island (Brumbaugh and Leishman 1982). Westman (1987) observed that heavy sheep grazing has extensively impacted the understory of some stands of coastal sage scrub in Riverside County. Similar effects occur as a result of uncontrolled cattle grazing. Conversely, many researchers have found that removing intense grazing pressure from grasslands may encourage establishment of coastal sage scrub (Vogl 1976; Burcham 1957; Hobbs 1983; Kirkpatrick and Hutchinson 1980).

2. Fire

As one of the vegetation communities that have evolved in a Mediterranean climate, it generally is assumed, based upon studies conducted in chaparral, that coastal sage scrub is adapted to periodic wildfire disturbance. These inferences, however, should not be generalized to all coastal sage scrub associations because there are a number of characteristics of coastal sage scrub that differ from chaparral, which could affect fire ecology. Sage scrub's resilience to periodic wildfire is not completely understood, but seems to be a product of the reproductive strategies of the constituent species and the nature of the fire regime. Compared to chaparral, coastal sage scrub has lower shrub cover, higher volatile oil content, greater cover by herbaceous (or understory) species, shorter duration of nitrogen-fixing species, and more marked variation in post-fire sprouting patterns (Westman *et al.* 1981). Typically, coastal sage scrub has much less standing biomass and litter accumulation and constituent shrub species also are capable of continual reproduction by seed, unlike chaparral species.

There appears to be a difference in recovery strategy dependent upon the geographic locations of the coastal sage scrub and, perhaps, fire regimes (White 1995). In coastal areas, most sage scrub species resprout from underground root crowns, although there can be substantial seedling germination. This is not the case in inland areas, where there is little or no regeneration from sprouting and virtually all recovery is dependent upon seed germination. Sage scrub recovery in inland areas is low. This may be due to an adaptation to a fire interval that was longer than occurs today or that these species once were more effective in recolonizing from seed. Coastal sage scrub assemblages that regenerate primarily by seeding may be inherently more vulnerable to the effects of non-native species than stands that regenerate by sprouting (O'Leary 1990b; White 1995). The study area is coastal; therefore, sprouting from root crowns is expected to be of primary importance for the regeneration of coastal sage scrub in this area.

Wildfires and controlled burns have occurred with increasing frequency in southern California over the past century (Zedler *et al.* 1983). High fire frequency (*i.e.*, short intervals between fires) may permanently alter the floristic composition and structure of a site, including the extirpation of weak resprouting species such as California sagebrush (Malanson and O'Leary 1982). Fires at five- to 10-year intervals may result in type conversion from chaparral to coastal sage scrub (Keeley 1987; O'Leary *et al.*1992). Type conversion from coastal sage scrub or chaparral to grassland may result from repeated burning in successive or alternate years (Zedler *et al.* 1983).

3.2.2 Chaparral

a. General Description

Chaparral vegetation occurs at sea level along the Pacific Coast to the about 6,500 feet in the mountain foothills from southern Oregon to the San Pedro Martir Mountains in Baja California

(Detling 1961; Axelrod 1973). The distribution of chaparral mostly is within California where it is one of the most widespread vegetation types, encompassing an estimated 11,200 square miles or about seven percent of the total land area of the state (Davis *et al.* 1994). Species composition is varied within California where as many as 50 different subassociations of chaparral have been recognized (Sawyer and Keeler-Wolf 1995). Additional forms of chaparral are known from Arizona and northeastern Mexico, and the Rocky Mountain Region but these types are isolated by greater than 124 miles of desert, and are adapted to summer rainfall and a different fire regime (Keeley 2000).

Chaparral is a shrub-dominated vegetation community that is composed largely of evergreen, sclerophyllous species that range from 3 to 13 feet in height (Keeley 2000). Other growth forms, including soft-leaved subshrubs, perennial herbs, geophytes (bulbs and corms), and annual herbs, are less abundant in mature chaparral, but can be present in abundance in early and late successional stands (Keeley 2000). Sparse stands of trees can occur within chaparral, typically within transition areas with conifers at higher elevations and oaks on north-facing slopes or ravines (Hanes 1977; Keeley 2000). Depending on the species composition and underlying topography and soil, the structure of chaparral can range from low, monotonous, smooth-textured vegetation to more heterogeneous stands approaching the vertical structure of woodlands (Keeley 2000).

From inland and high elevations to coastal locations, chaparral occurs in both large continuous stands or within a patchwork of vegetation communities including coastal sage scrub, grasslands, oak woodlands, conifers, and several wetland types (Heady 1977; Hanes 1977; Calloway and Davis 1993). Chaparral near the coast tends to occur in disjunct patches occupying more mesic areas, whereas coastal sage scrub is distributed more extensively in drier areas (Kirkpatrick and Hutchinson 1980; Malanson and O'Leary 1995). Mountain foothill and high elevation stands of chaparral are larger and more continuous, with coastal sage scrub occurring in smaller patches generally restricted to steep and south-facing exposures (Keeley 2000). Oak woodlands border chaparral in more mesic areas (*e.g.*, ravines, north-facing slopes) that have developed deeper soils (Griffen 1977). Oak woodlands are thought to develop within late successional chaparral in areas with more developed soils (Cooper 1922; Wells 1962). The native grassland-chaparral interface is not well understood; however, research has shown cases of type conversion from chaparral to annual grasslands with frequent fire or mechanical disturbance (Zedler *et al.* 1983).

Chaparral generally is thought to be a fire-dependent system based on the many adaptations of its characteristic species, and its resilience in form and species composition to periodic burning (Keeley 1986, 1992a). Most of the characteristic shrub species in chaparral can be organized generally into three adaptive strategies related to fire: **(1)** shrubs that have stems that regenerate following fire from below ground burls (resprouters); **(2)** shrubs that produce large amounts of dormant seed that persist for long periods of time and germinate by heat or chemical processes initiated by fire (obligate seeders); and **(3)** plants that apply both strategies (Keeley 1977). Within chaparral vegetation, nonshrub plant growth forms may also employ these strategies or fire avoidance to persist within this fire prone system (*e.g.*, geophyte species whose bulbs or corms persist following fire, annual herb species with long seed dormancy and heavy annual seed production, and annuals with the ability to disperse seeds over long distances) (Keeley 1986).

The species composition of a particular chaparral stand is largely influenced by fire. Chaparral generally returns to pre-fire structure and composition within a normal fire regime (Keeley 1986); however, considerable research has documented various effects of fire regime on species mortality (Keeley 2000). Frequency of fire has been shown to affect chaparral species composition, where short fire intervals may eliminate obligate seeding species in favor of resprouters (Keeley 1986, 1992b). Additional research has shown that fire temperature or intensity also has a strong influence on post-fire species composition (Davis *et al.* 1989; Rice 1993; Tyler 1995). Stand age following fire is thought to influence the reproduction of species based on reproductive strategies. Research has shown that seedling recruitment is more common for resprouting species in old (>56 years) stands of chaparral whereas seedling recruitment for obligate seeding species was extremely uncommon (Keeley 1986, 1992b). This research has led to the conclusion that short-intervaled fires may adversely affect the presence of obligate resprouting species in favor of obligate seeders.

The floristic composition of chaparral varies depending on biogeography, local biotic and abiotic characteristics and fire history. Of the many growth forms present in chaparral, woody evergreen perennials are the dominant plants and, as such, exert the most influence on the community. The most common and widespread species within chaparral is chamise (*Adenostoma fasciculatum*) (Hanes 1971). This species occurs in most stands of chaparral and is the dominant plant in drier areas (Keeley 2000). The ubiquity of this species is likely explained by its many adaptations to drought, fire and disturbance (Hanes 1977). Other common shrub species include representatives from manzanita (*Arctostaphylos* spp.), wild-lilac (*Ceanothus* spp.), silk-tassel bush (*Garrya* spp.), oak (*Quercus* spp.), redberry (*Rhamnus* spp.), *Rhus* spp., laurel sumac (*Malosma laurina*), mountain-mahogany (*Cercocarpus betuloides*), toyon (*Heteromeles arbutifolia*), holly-leaf cherry (*Prunus ilicifolia*), and mission manzanita (*Xylococcus bicolor*) (Holland 1986). Soft-leaved subshrubs are less common in chaparral than in coastal sage scrub but occur within canopy gaps of mature stands, and may be more prevalent following fire (Holland 1986; Keeley 2000; Sawyer and Keeler-Wolf 1995). Common species include California buckwheat, sages (*Salvia* spp.), California sagebrush and monkeyflower (*Mimulus* spp.). Suffrutescent and perennial herbaceous species commonly include deerweed (*Lotus scoparius*), nightshade (*Solanum* spp.), Spanish bayonet (*Yucca whipplei*), rock-rose (*Helianthemum scoparium*), golden yarrow (*Eriophyllum confertiflorum*), *Bloomeria* spp., *Brodiaea* spp., onion (*Allium* spp.), sanicle (*Sanicula* spp.), *Lomatium* spp., soap plant (*Chlorogalum* spp.), and bunch grasses (*Nassella* spp. and *Melica* spp.) (Holland 1986; Sawyer and Keeler-Wolf 1995). Vines commonly present in chaparral include wild cucumber (*Marah* spp.), dodder (*Cuscuta* spp.), chaparral-pea (*Lathyrus* spp.), bedstraw (*Galium* spp.), poison-oak (*Toxicodendron diversilobum*), and honeysuckle (*Lonicera* spp.). Annual species persisting in mature chaparral or in the post-burn flora vary according to geographic location, but typically include lupine (*Lupinus* spp.), *Lotus* spp., California thread-stem (*Pterostegia drymarioides*), *Claytonia* spp., *Gnaphalium* spp., *Phacelia* spp., *Gilia* spp., whispering bells (*Emmenanthe pendulflora*), fiesta-flower (*Pholistoma* spp.), and many others (Holland 1986; Sawyer and Keeler-Wolf 1995).

b. Chaparral Communities in the Study Area

Gray and Bramlet (1992) identify several scrub-chaparral ecotone/sere and chaparral subassociations in the Orange County. These subassociations generally are self-descriptive by their titles. The scrub-chaparral ecotone/sere subassociations are characterized gradations between scrub and chaparral vegetation communities. Two scrub-chaparral ecotone/sere subassociations known from the study area are chamise-sage scrub and maritime chaparral-sagebrush, the former dominated by chamise and California sagebrush and the latter dominated by lemonadeberry, laurel sumac, and toyon. Chaparral subassociations known from the study area include southern mixed chaparral, chamise chaparral, scrub oak chaparral, toyon-sumac chaparral, snowball ceanothus chaparral, and manzanita chaparral.

c. Distribution of Chaparral in the Study Area

A total of 37,962 acres of chaparral is present within the study area, of which about 8,513 acres (22 percent) are in the planning area and 29,449 acres are in the CNF (*Table 3-1*). *Figure 11-R* shows the distribution of chaparral in the study area. Chaparral generally occurs in a mosaic with coastal sage scrub in the eastern and central portions of the study area in association with rugged topography and higher elevations in the CNF. Including the CNF, chaparral comprises approximately 45 percent of the upland vegetation in the Southern Subregion study area; however, it only accounts for about 18 percent of the upland vegetation communities in the planning area. Chaparral is by far the dominant vegetation community in the CNF, accounting for 74 percent of all natural vegetation. Within the study area, the 37,962 acres of chaparral account for 44 percent of the five major upland vegetation communities. Within the planning area, the 8,513 acres account for 18 percent of the 47,318 acres of major upland vegetation communities.

d. Distribution of Chaparral in Subarea Plan Areas

The majority of chaparral in the planning area is located in Subarea 1 (78 percent), followed by Subarea 2 (14 percent), Subarea 4 (7 percent) and Subarea 3 (1 percent) (*Table 3-1*). Chaparral has a relatively diverse representation in the Subareas that is related to both elevation and existing urbanization. Proportionally, chaparral accounts for 17 percent of the vegetation communities/land covers in Subarea 1, 34 percent in Subarea 2, 4 percent in Subarea 3 and 7 percent in Subarea 4. The relatively high proportion of chaparral in Subarea 2 reflects this Subarea's higher elevation and its proximity to the CNF, where chaparral is by far the dominant vegetation community.

e. Wildlife

The Science Advisors identified several wildlife species that are indicative of high quality chaparral and also indicate the presence of other chaparral species. The chaparral indicator species are wrentit (*Chamaea fasciata*), bushtit (*Psaltriparus minimus*), spotted towhee (*Pipilo erythrophthalmus*), California thrasher (*Toxostoma redivivum*), black-chinned sparrow (*Spizella atrogularis*), Dulzura kangaroo rat, Dulzura California pocket mouse, coastal rosy boa (*Lichanura trivirgata roseofusca*), coastal western whiptail (*Aspidoscelis tigris stejnegeri [=Cnemidophorus tigris multiscutatus]*), northern red-diamond rattlesnake, and lyre snake (*Trimorphodon biscutatus*).

f. Human-Related Disturbances and Threats

Because chaparral and many of its component species are widely distributed, there is no direct threat to chaparral as a vegetation type. In specific locations, chaparral, endemic sensitive species or unique chaparral associations, however, may be vulnerable to local extirpation. Large-scale changes in climate or pollution may affect the distribution of chaparral species, but research on the effects of potential changes is not well developed. Fire suppression has been described as a threat to chaparral but this also has not been demonstrated over large areas (see discussion above for fire and chaparral relationships).

3.2.3 Grasslands

a. General Description

California grasslands are described as two grassland associations: **(1)** non-native, annual grassland; and **(2)** native perennial grassland (Heady 1977; Keeley 1990; Sims and Risser 2000). There is a basic disagreement about the historic distribution of native grasses in California before the introduction of non-natives. Some have suggested that the extant perennial grasslands represent relictual stands of “pristine” native grasslands (Heady 1977; Keeley 1990; Sims and Risser 2000). In a critical review of past research on native grasslands in California; however, Hamilton (1997) argued that most of the current distribution of annual grasslands in central and southern California historically was not extensively perennial grasslands, but rather shrublands, woodlands or desert scrub vegetation. Although there is debate about the distribution and pristine nature of native grasslands, it is known that areas supporting native grasses in southern California currently are uncommon and support a high diversity of native, and often sensitive, plant species.

1. <u>Annual Grasslands</u>

Annual grasslands primarily are composed of annual grass species introduced from the Mediterranean basin and other Mediterranean-climate regions, with variable presence of non-native and native herbaceous species (Baker 1989; Mack 1989). Species composition of annual grasslands may vary over time and place based on grazing or fire regimes, soil disturbance, and annual precipitation patterns (McNaughton 1968; Heady 1977; Keeley 1990). Annual grasslands are likely to be dominated by several species of grasses that have evolved to persist in concert with human agricultural practices (Jackson 1985; cited in Sims and Risser 2000): slender oat (*Avena barbata*), wild oat (*Avena fatua)*, foxtail chess (*Bromus madritensis*), soft chess (*Bromus hordeaceus*), ripgut grass (*Bromus diandrus*), barleys (*Hordeum* spp.), Italian ryegrass (*Lolium multiflorum*), perennial ryegrass (*Lolium perenne*), rat-tail fescue (*Vulpia myuros*), and Mediterranean schismus (*Schismus barbatus*). Annual grasslands also typically support an array of annual forbs from the Mediterranean-climate regions such as red-stemmed filaree (*Erodium cicutarium*), broad-lobed filaree (*Erodium botrys*), mustards [(*Brassica* spp.), short-podded mustard (*Hirschfeldia incana*), wild radish (*Raphanus sativus*)], tocalote (*Centaurea melitensis*), Italian thistle (*Carduus pycnocephalus*), artichoke thistle or cardoon (*Cynara cardunculus*), common catchfly (*Silene gallica*), burclover (*Medicago* spp.) and cat's-ear *(Hypochaeris* spp.) (Keeley 1990). Low abundances of native species are sometimes present within annual grasslands. These native species usually include disturbance specialists with several different growth forms: subshrubs (*e.g.*, *Lotus* spp., *Eriogonum* spp., *Lessingia* spp., *Isocoma* spp., *Ericameria* spp.); succulents (*Opuntia* spp.); perennial geophytes (*e.g.*, blue dicks [*Dichelostemma capitata*]); and herbaceous annuals (*e.g.*, doveweed [*Eremocarpus setigerus*], vinegar weed [*Trichostemma lanceolatum*], and tarweed [*Centromadia, Deinandra, Hemizonia*]) (Holland 1986; Sawyer and Keeler-Wolf 1995; Keeley 1990).

Most annual grasslands likely have developed as a result of past agricultural or urban development-related activities, including discing, brushing, grading, or overgrazing of native vegetation communities. Because annual grasslands generally are associated with these disturbances, abiotic factors (excluding fire) probably play a diminished role in determining their distribution. Some large-scale physical environmental factors (*e.g.*, climates with summer drought) may facilitate development of annual grassland within native vegetation communities (Sims 1988; Keeley 1990). However, it is doubtful that annual grasslands would develop in most areas in the absence of fire, grazing, or other form of disturbance. Species composition varies from one site to another but several annual grass species appear to show site preferences based on annual rainfall (Janes 1969). This research described grassland species along a rainfall gradient with soft chess and broad-lobed filaree on the mesic end (>8 inches annual rainfall) and foxtail chess and red-stemmed filaree in more xeric conditions (<8 inches) (Janes 1969). Abiotic factors are thought to influence the species composition of annual grasslands on a local scale. Seasonal variation in temperature, rainfall, and physical microsite differences have been shown to influence annual grassland species composition (Evans and Young 1989).

It is clear that annual grasslands have expanded into the former ranges of native grasslands (*sensu*. Clements 1920), coastal sage scrub (O'Leary and Westman 1988; Minnich and Dezzani 1998), chaparral (Zedler *et al*. 1983) and oak woodlands (Calloway and Davis 1993). The scientific literature on type conversion of native systems generally has shown that altered fire frequencies, grazing pressure or other physical disturbance, combined with competitive exclusion by non-native species, have caused the expansion of annual grasslands into native vegetation communities previously occupied by perennial species. Minnich and Dezzani (1998), for example, documented changes in the distribution of coastal sage scrub and annual grassland within a portion of western Riverside County. Annual grasslands in this region currently are expanding into areas formerly supporting coastal sage scrub.

Some authors have noted that annual grasslands have remained stable over time and it has been proposed that annual grassland species should be accepted as "new natives" and managed as though they were native systems (Heady 1977). Acceptance of the current distribution of annual grasslands may be shortsighted, however, because recent research in the coastal sage scrub/annual grassland interface has shown that the stability of annual grasslands may be related to permanent changes in soil nutrient and moisture regimes caused by the presence of exotic species (Heunneke and Mooney 1989) and air pollution (Allen *et al.* 1996; Padgett *et al.* 1999; Minnich and Dezzani 1998).

2. Valley and Foothill Native Grasslands

Native grasslands have been described as occurring in many topographic locations within California (Sawyer and Keeler-Wolf 1995), with affinities toward more mesic north and east slope-aspects within a limited region (Keeley 1990, 1993). It is more likely, however, that native grasslands usually are associated with soil characteristics particular to a local area. Statewide, native grasslands occur on a large variety of soil series; however, most of these support oak woodlands and other vegetation types (Barry 1972; Heady 1977). The current distribution of valley and foothill grasslands within southern California is limited to areas supporting deep clayey soils that have not been heavily disturbed by mechanical disturbance (Keeley 1993). Most research has provided descriptive accounts of the soil conditions supporting perennial grasslands as deep, brown, fertile and having high clay content (Adams 1964; Heady 1977; Keeley 1990; Sims and Risser 2000). For example, soil affinities for valley and foothill grasslands have been established within southeastern Ventura County where soil depth and percentage clay particles were positively related, and percentage rock was negatively related to percentage cover of native perennial grasses (Keeley 1993). Few soil chemical studies have been conducted within valley and foothill grasslands and no strong relationship has been established between native grasses and soil nutrients (nitrogen, potassium or phosphate) (Keeley 1993). Another consistent theme is that native grasslands occur on soils that remain saturated during the winter and become completely dry during summer months (Keeley 1990; Holland 1986).

No conclusive evidence has emerged concerning the relationship between valley and foothill grasslands and other shrubland or woodland communities within the same landscape. Research on the role of fire in the distribution and maintenance of valley and foothill grasslands has offered few conclusive facts. Some research suggests that the distribution of native grasslands was related to a long history of burning by Native Americans (Sampson 1944; Bean and Lawton 1973; Timbrook *et al.* 1982). Others dismiss burning by Native Americans as not playing a significant role in the distribution of native grasslands, suggesting alternatively that lightning-caused fires were more likely in the process maintaining grassland ecology (Heady 1977). Evidence supporting this assertion includes the finding that more common native grassland dominants (*Nassella pulchra*, *N. lepida*) are adapted to fire by resprouting and producing greater volumes of seed following fire (Ahmed 1983; Keeley and Keeley 1984). Several field studies have reported an increased cover of *Nassella* spp. after burn treatments (Hatch *et al.* 1991; Dyer *et al.* 1996), while other studies have shown mixed effects of burning on species abundance (Hatch *et al.* 1999). Though research has demonstrated increased abundance of native grasses following fire, there is little research describing the role of fire on maintaining other native species within valley and foothill grassland vegetation.

The effects of grazing on valley and foothill grasslands also remain unclear. In spite of the fact that a long history of intensive grazing in California has been cited as one of the primary reasons for the demise of native grasslands (Burcham 1957; Dasmann 1966; Keeley 1990; Bartolome and Gemmill 1981), most research has found that some intensity of grazing is beneficial to, or at least does not negatively affect, native grasses (Huntsinger *et al.* 1996). Several researchers have documented cases where native grasses have not increased in abundance on sites that have been excluded from grazing over 20- to 40-year periods (White 1967; Bartolome and Gemmill 1981; Goode 1981). Heady (1968, 1977) suggested that large native herbivores present prior to European colonization may have been an important factor in grassland formation and ecology. This assertion supports findings that some form of managed grazing may be useful as part of efforts to maintain or restore native grasses. Menke (1996) considers “Prescribed grazing to constitute the primary component of the first phase of a perennial grass restoration program.” (p. 23).

b. Grasslands in the Study area

1. <u>Annual Grasslands</u>

Annual grasslands in the study area are dominated by bromes (*Bromus madritensis*, *Bromus diandrus*, *Bromus hordaceous*), wild oats (*Avena barbata*, *Avena fatua*), rat-tail fescue, barleys (*Hordeum* spp.) and Italian ryegrass (*e.g.*, Gray and Bramlet 1992; MBA 1996; Dudek 2001c). Annual forbs common to non-native grasslands in the study area include Indian milkweed (*Asclepias eriocarpa*), tocalote, common fiddleneck (*Amsinckia menziesii*), popcornflower (*Plagiobothrys* spp.), black mustard (*Brassica nigra*), field mustard (*Brassica rapa*), common catchfly, stickwort (*Spergularia arvensis*), miniature lupine (*Lupinus bicolor*), white-whorl lupine (*Lupinus densiflorus* var. *austocollium*), burclover (*Medicago polymorpha*), bristled clover (*Trifolium hirtum*), red-stemmed filaree, white-stemmed filaree (*Erodium moschatum*), and fluellin (*Kickia spurria*) (MBA 1996). Tarweeds and doveweed become dominant in later summer and fall (MBA 1996). Large portions of the grasslands in the study area also are dominated by dense stands of cardoon.

Gray and Bramlet (1992) also describe a ruderal grassland that consists of early successional grassland dominated by pioneering herbaceous species of several genera such as *Centaurea, Brassica, Malva, Salsola, Eremocarpus, Amaranthus* and *Atriplex*.

2. Native Grasslands

Native grasslands in the study area are designated as valley needlegrass grassland (called southern coastal needlegrass grassland by Gray and Bramlet). Gray and Bramlet define needlegrass grassland as a grassland with more than 10 percent cover of purple needlegrass (*Nassella pulchra*). It is associated with the annual grasses listed above, leafy bentgrass (*Agrostis pallens*), junegrass (*Koeleria macrantha*), cane bluestem (*Bothriochloa barbiodis*), coast range melic (*Melica imperfecta*) and annual forbs such as common goldenstar (*Bloomeria crocea*), blue dicks, Cleveland's goldenstar (*Dodecatheon clevelandii*), smooth cat's-ear (*Hypocharis glabra*), lilac mariposa lily (*Calochortus splendens*), many-stemmed dudleya (*Dudleya multicaulis*), blue-eyed grass (*Sisyrinchium bellum*) and rosin weed (*Calycadenia truncata*) (Gray and Bramlet 1992; Dudek 2001c; MBA 1996).

c. Distribution of Grasslands in the Study Area

A total of 15,449 acres of grassland is mapped in the study area, of which 15,329 acres are in the planning area and only 120 acres are in the CNF (*Table 3-1*). As shown in *Figure 12-R*, grasslands are scattered throughout the lower elevations of the study area, with the largest, contiguous concentration in the southern portion. The distribution of native grasslands is shown in *Figure 13-M*. Other areas supporting large patches of grassland include Chiquita Ridge, Ladera Open Space, Thomas F. Riley Regional Park, Cristianitos Canyon, the Northrop Grumman lease area, and upper Gabino Canyon. Overall grassland accounts for approximately 18 percent of the five major upland vegetation communities in the study area, but they comprise 32 percent of these vegetation communities in the planning area.

Generalized mapping of native grasslands was done on RMV by St. John in 1989 (St. John 1990) and later more refined mapping in specific areas was completed by Dudek (1997, 2001c) and MBA (1996). As noted in the *Section 3.1.1* methods description, Dudek used a minimum mapping unit of about 5 acres, except where smaller discrete patches were encountered during field work.

Generally, native grasslands are patchy north of Highway 74, with patches occurring in Ladera Open Space east of Arroyo Trabuco (Dudek 2001c) and Chiquita Canyon (St. John 1990; Dudek 1997; MBA 1996). Much of the native grassland in the study area is located in the San Mateo Watershed portion of the planning area in upper Gabino Canyon (St. John 1990; Dudek 2001c), Verdugo Canyon (St. John 1990), and Cristianitos Canyon (St. John 1990; MBA 1996; Dudek 2001c). St. John made a preliminary estimate of approximately 3,300 to 4,000 acres of native grassland on RMV property, but based on the Dudek's 2001 refined mapping of native grasslands, the total appears to be closer to 1,100 acres (see *Figure 13-M*). This difference between the St. John estimate and the Dudek survey results does not appear to be due to any significant land use changes such as new agriculture in the San Mateo Watershed. As noted above, St. John had to roughly estimate the distribution of native grasslands in areas that could not be accessed, such as the extensive Ford Aerospace leasehold in Cristianitos Canyon, whereas Dudek had access to all areas except the Northrop Grumman facility and was able to conduct more precise mapping. Also, St. John noted large areas where native grasses were mixed with brush (presumably sage scrub) and that the native grasses "were losing ground against the brush" (St. John 1990, p. 1), so some of the difference may be accounted for by type conversion from native grassland to scrub over the past decade.

Major areas of native grassland include Cristianitos Canyon (~405 acres) and upper Gabino Canyon (276 acres), with smaller areas of native grassland in Blind Canyon (102 acres) and middle and lower Chiquita Canyon (76 acres). There are likely to be several smaller patches of unmapped native grassland scattered throughout the study area, but individual patches are unlikely to be more than a few 10s of acres in size. The cumulative total of these unmapped areas is likely to be no more than a few hundred acres.

d. Distribution of Grasslands in the Subareas

The vast majority of grassland in the planning area is located in Subareas 1 and 4, with Subarea 1 supporting 62 percent of the total and Subarea 4 supporting 33 percent of the total (*Table 3-1*), for a combined percentage of 95 percent of the total in the planning area. Proportionally, grassland accounts for 24 percent of the natural vegetation community/land covers in Subarea 1, 59 percent in Subarea 4, 21 percent in Subarea 3 and only 11 percent in Subarea 2. Virtually all of the documented native grassland in the planning area is in Subarea 1, but biological surveys in other Subareas likely would find additional stands of native grassland.

e. Wildlife

The Science Advisors identified several wildlife species that are indicative of grasslands and also indicate the presence of other grassland species. These species include white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), grasshopper sparrow (*Ammodramus savannarum*), California horned lark (*Eremophila alpestris actia*), Savannah sparrow (*Passerculus sandwichensis*), lark sparrow (*Chondestes grammacus*), western meadowlark (*Sturnella neglecta*), loggerhead shrike (*Lanius ludovicianus*), American badger (*Taxidea taxus*), western skink (*Eumeces skiltonianus*), ring-necked snake (*Diadophis punctatus*), western spadefoot toad (*Scaphiopus hammondi*), and a variety of bats. Several other raptors depend on grasslands for foraging, including red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), turkey vulture (*Cathartes aura*), and merlin (*Falco columbarius*). It should be noted that although the Science Advisors listed burrowing owl as a grassland indicator species, they are quite rare in the study area and currently there are no known nesting sites (Hamilton and Willick 1996).

f. Human-Related Disturbances and Threats

Threats to valley and foothill grasslands may include disturbance of clay soils by agricultural activities, invasion of exotic species, grazing and urban development.

3.2.4 Woodlands and Forest

a. General Description

Woodlands and forests in the study area consist of coast live oak woodland, coast live oak savanna, Mexican elderberry woodland, coast live oak forest, canyon live oak forest, and bigcone spruce forest.

Oak woodlands consist of multilayered vegetation with a canopy that is 20 to 80 percent tree cover (Gray and Bramlet 1992). Oak woodlands occur throughout the lower elevations of western California, generally from sea level to 4,900 feet (Holland and Keil 1995). Oak forests are similar to oak woodlands, but have 80 percent or more canopy cover (Gray and Bramlet 1992).

Thorne (1976) distinguishes between northern, foothill, southern, and island oak communities in California. Southern and coastal woodlands, including coast live oak woodland found in the study area, extend from eastern Mendocino County at 40^{o} N latitude through the North Coast, Central Coast, and Transverse ranges on north-facing and coast-facing slopes and in canyons below 3,900 feet (Barbour and Minnich 2000). The range continues through the interior valleys and foothill slopes of the Peninsular ranges, mainly between 500 and 4,600 feet, and south to the Sierra San Pedro Martir at 30^{o} N latitude in Baja California, Mexico (Barbour and Minnich 2000). According to Munz and Keck (1949), the southern oak woodlands are found in the valleys of southern California between Los Angeles and San Diego counties east to about 5,000 feet in the San Jacinto Mountains of western Riverside County. According to Holland and Keil (1995), coast live oak woodlands range from Sonoma County to Baja California, generally in mesic areas including canyon bottoms and north-facing slopes, whereas southern oak woodlands extend from Ventura County southward. This roughly corresponds with Griffin (1977) who distinguishes oak woodlands from the Santa Ynez Mountains of Santa Barbara County southward as southern oak woodland.

Generally, oak woodlands are open where moisture is limited in drier more exposed aspects, and densest in moist areas (Holland and Keil 1995). North-facing slope occurrences are also denser than south-facing slope occurrences (Holland and Keil 1995). Average annual rainfall of areas supporting oak woodlands is between 15 and 25 inches. Runoff tends to be rapid. The growing season is seven to 10 months (Munz and Keck 1949). Oak trees, in general, require 60 to 80 years to mature (Holland 1988a).

Many understory shrubs in woodlands and forest are shade tolerant and include scrub oak (*Quercus berberidifolia*), California blackberry, snowberry (*Symphoricarpos mollis*), California walnut (*Juglans californica*), California-lilac (*Ceanothus* spp.), laurel sumac, gooseberry, toyon, California laurel, manzanita (*Arctostaphylos* spp.), poison-oak, Mexican elderberry, mountain-mahogany, sugarbush (*Rhus ovata*), big-leaf maple and white alder. Herbaceous understory species include California goldenrod (*Solidago californica*), western wild rye (*Elymus glaucus*), giant ryegrass, *Melica* spp., *Stellaria* spp., *Claytonia* spp., ripgut grass, wild cucumber, nightshade, *Phacelia* spp., and common eucrypta (*Eucrypta chrysanthemifolia*) (Gray and Bramlet 1992).

Soils that commonly support coast live oak include sandstone and shale-derived soils (Sawyer and Keeler-Wolf 1995). Coast live oak typically occupies slopes with deep soils, alluvial terraces, and the recent alluvium of canyon bottoms (Griffin 1977; Brown 1982). Open woodlands form when soils are shallow (Holland and Keil 1995).

Canyon live oak forest is similar in composition to coast live oak forest, but is dominated by canyon live oak.

Mexican elderberry woodland accounts for only 8 acres and is present in scattered locations within the study area, typically associated with linear ravines such as a tributary to Chiquita Creek. Mexican elderberry is the dominant species present, with coastal sage scrub understory species also present, including California sagebrush and California buckwheat. Non-native grasses are also often present in the understory, including wild oats and rattail fescue.

Bigcone spruce forest is dominated by Douglas-fir and canyon live oak, with lesser amounts of interior live oak, big-leaf maple, California laurel, and California ash (*Fraxinus dipetala*) (Gray and Bramlet 1992). McDonald (1990) noted that Douglas-fir and canyon live oak are strongly associated and may be considered a climax community.

b. Distribution of Woodlands and Forest in the Study Area

Woodlands and forest occur throughout the study area and comprise approximately 5,837 acres, of which 2,620 acres are in the planning area and 3,217 acres are in the CNF (*Figure 14-R*). Including the CNF, woodland and forest comprise about 5 percent of the natural vegetation communities/land covers in the study area. Among the five major upland vegetation communities, woodland and forest account for approximately 7 percent of the total._The largest areas of coast live oak woodland are in the eastern portion of the study area in Caspers Wilderness Park and the hills west of Bell Canyon and in the northern portion of the study area in Live Oak Canyon and upper Arroyo Trabuco. Live oak forest primarily occurs on the Donna O'Neill Land Conservancy at Rancho Mission Viejo, at the head of Cristianitos Creek, on the northern slopes of Blind Canyon, and in small patches in lower Chiquita Canyon and east of Cañada Gobernadora. Canyon live oak forest and bigcone spruce forest are not present in the planning area and are limited to upper elevations of the CNF.

c. Distribution of Woodlands and Forest in the Subareas

The vast majority of woodlands and forest in the planning area are located in Subarea 1 (89 percent), followed by Subarea 2 (7 percent), Subarea 4 (2 percent) and Subarea 3 (2 percent) (*Table 3-1*). Proportionally, woodlands and forest account for 6 percent of the natural vegetation community/land covers in Subarea 1, 5 percent in Subarea 2, 3 percent in Subarea 3, but less than 1 percent in Subarea 4.

d. Wildlife

Woodlands and forests provide habitat for a variety of species, including nesting, cover, and food. The Science Advisors identified several key wildlife species that are indicators of high quality oak woodlands and indicators of other woodland species: Cooper's hawk (*Accipiter cooperii*), long-eared owl (*Asio otus*), western screech owl (*Otus kennicottii*), acorn woodpecker (*Melanerpes formicivorus*), Nuttall's woodpecker (*Picoides nutallii*), ash-throated flycatcher (*Myiarchus cinerascens*), bobcat (*Lynx rufus*), brush mouse (*Peromyscus boylii*), Pacific slender salamander (*Batrachoseps pacificus*), and various bats.

e. Human-Related Disturbances and Threats

Threats to oak woodlands primarily stem from destruction, reproductive depression, and disease. Holland and Keil (1995) state that in the vast majority of California oak woodland sites, oak reproduction ceased around 1900. The loss of acorn viability can be attributed to cattle and sheep in rangelands and an overabundance of deer in many northern California areas (Holland and Keil 1995). The oak woodland vegetation community also has been altered by the replacement of native bunch grasses with exotic annual grasses that produce many more seeds. Man's reduction in the number of predators of seed-eating animals which predate oak acorns also has been found to be a threat (Holland and Keil 1995). Introduced annual grasses, due to their rapid growth and uptake of available surface water, also contribute to the loss of native grasses historically present in oak woodlands and savannas as well as diminishing water supplies for oak seedlings (Stephenson and Calcarone 1999). In some areas, it appears that California laurel is replacing coast live oak, possibly due to grazing (Holland 1988a). Wood-cutting, although not as prevalent in the southern portion of the State, has left areas of stumps because oaks were not able to reestablish (Holland 1988a). Root rot, caused by overwatering during the summer in urban oaks, also has been known to cause mortality (Holland and Keil 1995). Since about 1995, a dieoff of oaks in the Santa Cruz and Marin counties, termed Sudden Oak Death (SOD), has occurred, apparently indirectly from a water mold of the genus *Phytophthora* (EBCNPS 2001). This water mold breaks down the tree's circulatory system and makes it vulnerable to invasion by bark beetles, which normally cannot invade healthy trees. This water mold is infecting at least three species of oak: coast live oak, tanoak (*Lithocarpus densiflorus*), and black oak (*Quercus kelloggii*).

3.2.5 Riparian Vegetation Communities

a. General Description

Riparian vegetation communities typically consist of one or more deciduous tree species with an assorted understory of shrubs and herbs (Holland and Keil 1995). The transition between riparian vegetation and adjacent non-riparian vegetation often is abrupt, especially in montane areas where the topography is steep (Grenfell 1988a). Vegetation height can vary from 3 to 10 feet in scrub to 100 feet in riparian forest (Grenfell 1988a). Riparian vegetation communities generally occur among mid- to large-order streams below 4,000 feet, primarily within the foothills and valleys (Stephenson and Calcarone 1999).

The present distributional range of riparian vegetation communities apparently has been influenced more by long-term climatic history than the surrounding upland vegetation communities. Riparian communities are not restricted to specific climates or soil types, but are primarily dependent on a permanent supply of water. Variables that affect the community structure and composition include the nature of the water supply (*i.e.*, the amount of water carried by a stream or present within a lake, and the lateral extent and depth of subterranean aquifers), altitudinal gradients, north-south and east-west axes, historical land uses, and the nature and size of the stream banks and flood plains (Bowler 1988; Holland and Keil 1995). The amount of water carried by a stream or present within a lake is determined by the climate (precipitation patterns) and the size of the watershed (Warner and Hendrix 1984).

Soils within riparian corridors usually consist of interbedded layers of fine and coarse sediments ranging from clay, silt, sand and gravel to rounded river-rocks and large boulders. The fine-grained particles generally collect in areas where the water movement is slight and the coarse particles generally accumulate where the water flows more quickly. Meandering stream channels within broad floodplains deposit and redistribute sediments over time, creating a horizontal patchwork and vertical layers. Soils closest to the stream channel are usually relatively young, while the seldom-flooded areas within the floodplain are often deep and well-developed (Holland and Keil 1995). Organic materials (*e.g.*, decomposing plant litter) are often present within the soils and nutrient levels are comparatively high. These organic materials are the primary food source for the vegetation within shady headwater situations (Bowler 1988; Holland and Keil 1995).

Valley and foothill riparian communities occur at elevations from near sea level to the lower margins of the montane coniferous forest areas within cismontane California. These communities range from the broad valley flood plains to narrow steep canyons. Within valley and foothill riparian communities, the climate is comparatively warm during the winter, with precipitation falling primarily as rain and the summers are dry and long (Holland and Keil 1995).

Riparian communities are dynamic systems. The stream channels may be swept clean of vegetation during floods as sediments are shifted during erosion flood events. Floodwaters may undercut stream banks and, over time, can cut through exposed bedrock, grinding organic debris into small fragments. As a result of channel-cutting and sediment deposition, streams may shift their banks, particularly in areas with gentle topography. Streams in steep areas gradually cut downward, forming canyons or ravines (Holland and Keil 1995).

In southern California, most streams have very low flow during the summer, and in many cases surface flow may dry up (Stephenson and Calcarone 1999). Seasonably variable water flows allow herbaceous annuals and perennials to colonize newly exposed and denuded sites such as an exposed stream channel or a sand or gravel bar. These plants may be swept away during the next winter's storm events (Holland and Keil 1995).

Annually variable water flows result in a gradation of environments as well. Some areas of the floodplain may be flooded annually while other areas may be flooded only during years of extremely high waters. Areas that regularly are flooded are often in a condition of perpetual succession. That portion of the riparian community nearest to the stream channel may not advance beyond the pioneer stage, while areas farther from the stream channel may advance through several stages of succession before being swept clean by periodic floods (Holland and Keil 1995).

Many riparian woody and herbaceous species are adapted to periodic flooding. Some have deep root systems that anchor them against the floodwaters and some have flexible stems that bend with the flood waters. Many have rhizomes that are protected by layers of sediments and others have no adaptations, but are able to persist if they become established at sites that protect them from the full force of the flood waters (*e.g.,* among large rocks) (Holland and Keil 1995). Cottonwood and willow species germinate almost exclusively on recently deposited or exposed alluvial soils (Faber and Keller 1985).

b. Riparian Vegetation in the Study Area and Distribution in Subareas

As described above in the methods section, the NCCP database is used for landscape-level portrayal of riparian vegetation in the study area. Nine distinct associations of riparian vegetation are present in the study area (*Table 3-2* and *Figure 15-M*). In order of their prevalence, they include southern coast live oak riparian forest, southern sycamore riparian woodland, southern willow scrub, southern arroyo willow riparian forest, white alder riparian forest, canyon live oak ravine forest, mule fat scrub, herbaceous riparian, and black willow riparian forest. The descriptions of these riparian communities primarily are based on Gray and Bramlet (1992) and MBA (1996).

1. Southern Coast Live Oak Riparian Forest

Southern coast live oak riparian forest is dominated by coast live oak (*Quercus agrifolia*), with western sycamore (*Platanus racemosa*), Mexican elderberry (*Sambucus mexicana*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and Goodding's black willow (*Salix gooddingii*). Understory vegetation includes holly-leaf redberry (*Rhamnus ilicifolia*), California coffeeberry (*Rhamnus californica*), mule fat (*Baccharis salicifolia*), coastal goldenbush (*Isocoma menziesii* ssp. *veneta*), poison oak, toyon, laurel sumac, California mugwort (*Artemisia douglasiana*) and Douglas' nightshade (*Solanum douglasiana*).

(a) Distribution of Southern Coast Live Oak Riparian Forest in the Study Area

Southern coast live oak riparian forest is by far the most common riparian vegetation community in the study area. It comprises approximately 3,258 acres, accounting for 44 percent of the riparian in the study area, with 2,106 acres (65 percent) of the total in the planning area and 1,152 acres in the CNF (*Table 3-2*). This vegetation community occurs throughout the study area, including Arroyo Trabuco, San Juan Creek, Cañada Gobernadora, Chiquita Canyon, Cristianitos Creek and its tributaries, Gabino Canyon, Airplane Canyon, Verdugo Canyon, Bell Canyon, Crow Canyon, Trampas Canyon, Live Oak Canyon, Lion Canyon, Hot Spring Canyon, Hickey Canyon and Rose Canyon (*Figure 15-M*).

(b) Distribution of Southern Coast Live Oak Riparian Forest in the Subareas

Within the Subareas, the large majority of coast live oak riparian forest in the planning area is in Subarea 1 (65 percent) followed by Subarea 2 (19 percent), Subarea 4 (10 percent), and Subarea 3 (5 percent) (*Table 3-2*). Proportionally, coast live oak riparian forest is a predominant riparian vegetation community in all of the Subareas, accounting for 36 percent of Subarea 1 (second to sycamore riparian woodland which comprises 41 percent), 97 percent in Subarea 2, 47 percent in Subarea 3 and 39 percent in Subarea 4.

2. Canyon Live Oak Ravine Forest

Canyon live oak ravine forest generally is a montane riparian community of steep headwaters of mainstreams dominated by canyon live oak (*Quercus chrysolepis*), big-leaf maple (*Acer macrophyllum*), California laurel (*Umbellularia californica*), coast live oak, bigcone Douglas-fir (*Pseudotsuga macrocarpa*), and interior live oak (*Quercus wislenzii*). Canyon live oak ravine forest comprises 277 acres in the study area and is confined to the CNF in scattered locations generally north of Arroyo Trabuco (*Figure 15-M*).

TABLE 3-2
RIPARIAN COMMUNITIES IN THE SOUTHERN SUBREGION STUDY AREA[1]

Riparian Community	Subregion Total	Planning Area[2]	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Cleveland National Forest	Other[2]
Canyon Live Oak Ravine Forest	277	0	0	0	0	0	277	0
Herbaceous Riparian	55	49	30	0	0	19	6	0
Mule Fat Scrub	204	204	187	0	2	12	0	3
S. Coast Live Oak Riparian Forest	3,258	2,106	1,379	409	110	204	1,152	4
Southern Arroyo Willow Riparian Forest	506	506	278	0	89	113	0	26
Black Willow Riparian Forest	3	3	3	0	0	0	0	0
Southern Sycamore Riparian Woodland	1,742	1,656	1,593	5	10	24	86	24
White Alder Riparian Forest	390	0	0	0	0	0	390	0
Southern Willow Scrub	916	601	404	5	22	150	315	20
TOTAL[3]	**7,351**	**5,125**	**3,874**	**419**	**233**	**522**	**2,226**	**77**

1 Source is NCCP vegetation base. Riparian acreages include both USACE and CDFG jurisdictional wetlands and non-jurisdictional riparian.

2 The "Other" category includes the cities of Lake Forest and Dana Point, an "Existing Use" Girl Scout Camp, and other areas that are in the study area but are "Not a Part" of the Subareas.

3 Subtotals may not sum precisely due to rounding error.

3. Southern Sycamore Riparian Woodland

Southern sycamore riparian woodland is an open to dense woodland dominated by western sycamore and coast live oak. Understory vegetation includes scalebroom, mule fat, willow riparian scrub (see description below), holly-leaf redberry, California coffeeberry, laurel sumac, Mexican elderberry, fuschia-flowered gooseberry (*Ribes speciosum*), poison-oak, giant ryegrass (*Leymus condensatus*), beardless wild rye (*Leymus tritocoides*), lemonadeberry, Douglas' nightshade, and California mugwort. Large patches of grassland dominated by bromes also may be present.

(a) Distribution of Southern Sycamore Riparian Woodland in the Study Area

Sycamore riparian woodland comprises approximately 1,742 acres in the study area, including 1,656 acres (95%) of the total in the planning area and 86 acres in the CNF (*Table 3-2*). It is the second most common riparian community in the study area, accounting for 32 percent of the total riparian. It generally is associated with floodplains and terraces of larger streams such Arroyo Trabuco, lower Gobernadora, upper San Juan Creek, upper Bell Canyon, Fox Canyon, Talega Canyon, Gabino Canyon, and La Paz Canyon (*Figure 15-M*).

(b) Distribution of Southern Sycamore Riparian Woodland in the Subareas

Within the Subareas, the vast majority of sycamore riparian woodland in the planning area is in Subarea 1 (96 percent), with only 1 percent in Subareas 3 and 4, and less than 1 percent in Subarea 2 (*Table 3-2*). Proportionally, sycamore riparian woodland is the dominant riparian type in Subarea 1, accounting for 41 percent of the total in the subarea. It is much less common in the other Subareas, accounting for only 1 percent of the riparian in Subarea 2, 4 percent in Subarea 3 and 5 percent in subarea 4.

4. Southern Willow Scrub

Southern willow scrub is dominated by willow trees (*Salix* spp.) and also may contain gooseberry (*Ribes* spp.), Mexican elderberry, and an understory of herbaceous hydrophytes. Arroyo willow is the dominant species within perennial and intermittent stream channels at elevations up to about 2,450 feet. Goodding's black willow occurs along streambanks and in wet places within drier areas at elevations below about 1,500 feet (Faber and Keller 1985).

(a) Distribution of Southern Willow Scrub in the Study Area

Willow riparian scrub comprises approximately 916 acres in the study area, including 601 acres (66 percent) of the total in the planning area and 315 acres in the CNF (*Table 3-2*). It comprises 12 percent of the total riparian in the study area. Willow riparian scrub is found in lower Arroyo Trabuco, in patches along Chiquita Creek, San Juan Creek south of Bell Canyon, in patches along Cristianitos Creek, lower Gabino Creek, tributaries to Verdugo Canyon, and in various smaller drainages and tributaries throughout the study area, including the CNF (*Figure 15-M*).

(b) Distribution of Southern Willow Scrub in the Subareas

Within the Subareas, the majority of willow riparian scrub is in Subarea 1 (67 percent), with 25 percent in Subarea 4, 4 percent in Subarea 3 and 1 percent in Subarea 2 (*Table 3-2*). Proportionally, willow riparian scrub accounts for 10 percent of the riparian in Subarea 1, 29 percent in Subarea 4, 10 percent in Subarea 3 and only 1 percent in Subarea 2.

5. Southern Arroyo Willow Riparian Forest

Southern arroyo willow riparian forest, in contrast to southern willow scrub, has a closed canopy of arroyo willow in arborescent form. The understory is comprised of different associations of stinging nettle (*Urtica dioica*), poison-oak, California mugwort, western ragweed (*Ambrosia psilostachya* var. *californica*), docks (*Rumex* spp., mustards, nightshades (*Solanum* spp.), poison hemlock (*Conium maculatum*), milk thistle (*Silybum marianum*), and California blackberry (*Rubus ursinus*).

(a) Distribution of Arroyo Willow Riparian Forest in the Study Area

Southern arroyo willow riparian forest comprises approximately 506 acres in the study area, all of which are in the planning area. It accounts for 7 percent of the riparian in the study area. This vegetation community occurs in small patches in Chiquita Canyon south of Oso Parkway, portions of lower Arroyo Trabuco, San Juan Creek south of its confluence with Bell Canyon, Cañada Gobernadora throughout Coto de Caza and in GERA, above and associated with Oso Reservoir, and lower Cristianitos Creek (*Figure 15-M*).

(b) Distribution of Arroyo Willow Riparian Forest in the Subareas

Within the Subareas, 55 percent of the southern arroyo willow riparian forest in the planning area is in Subarea 1, 22 percent in Subarea 4, and 18 percent in Subarea 3 (*Table 3-2*); this community is not documented in Subarea 2. Proportionally, southern arroyo willow riparian forest accounts for 21 percent of the riparian in Subarea 4 and 38 percent in Subarea 3, but only 7 percent in Subarea 1 and none in Subarea 2.

6. Black Willow Riparian Forest

Black willow riparian forest is a multilayered forest with a canopy dominated by black willow, with some arroyo willow and red willow. The understory of black willow riparian forest is similar to that described above for arroyo willow riparian forest. There is a single 3-acre patch of non-jurisdictional black willow riparian forest just north of San Juan Creek and east of the Color Spot Nursery.

7. White Alder Riparian Forest

White alder riparian forest typically is a montane riparian community found along perennial streams above 4,000 feet. It is dominated by white alder (*Alnus rhombifolia*), with red willow, black cottonwood (*Populus balsamifera* spp. *trichocarpa*), California laurel, and big-leaf maple. California mugwort, California rose (*Rosa californica*) and California blackberry occur as understory species.

(a) Distribution of White Alder Riparian Forest in the Study Area

White alder riparian forest comprises approximately 390 acres, all of which are in the CNF in upper Arroyo Trabuco and its tributaries Holy Jim Canyon and Falls Canyon, as well as upper Bell Canyon, Hot Spring Canyon, and Cold Spring Canyon (*Figure 15-M*).

(b) Distribution of White Alder Riparian Forest in the Subareas

White alder riparian forest has not been documented in the planning area.

8. Mule Fat Scrub

Mule fat scrub is dominated by mule fat, but also may include willows (*Salix* spp.), sedges (*Carex* spp.), stinging nettle, Bermuda grass (*Cynodon dactylon*), western ragweed, California mugwort, Douglas' nightshade, castorbean (*Ricinus communis*), cocklebur (*Xanthium* spp.), rabbit's-foot grass (*Polypogon monspeliensis*), knotgrass (*Paspalum* sp.), and *Echinochloa* sp. (Gray and Bramlet 1992; Holland 1986; Sawyer and Keeler-Wolf 1995). Mule fat scrub usually occurs in intermittent streambeds, seeps, and the toe of landslides where local seeps develop.

(a) Distribution of Mule Fat Scrub in the Study Area

Mule fat scrub comprises approximately 204 acres in the study area, all which are in the planning area (*Table 3-2*). Mule fat scrub comprises 3 percent of the riparian in the study area and 4 percent of the riparian in the planning area. Mule fat scrub occurs in drainages throughout the study area. Areas with large concentrations of mule fat scrub include San Juan Creek near the confluence with Bell Canyon and smaller patches are present in lower Arroyo Trabuco, tributaries to Chiquita and Gobernadora creeks, and in isolated drainages in Prima Deshecha and San Clemente (*Figure 15-M*).

(b) Distribution of Mule Fat Scrub in the Subareas

Within the Subareas, the large majority of mule fat scrub in the planning area is in Subarea 1 (92 percent), with 6 percent in Subarea 4, and 1 percent in Subarea 3 (*Table 3-2*). No mule fat scrub is documented in Subarea 2. It almost certainly occurs in this Subarea, but may occur in patches smaller than the mapping precision of the NCCP vegetation map would allow. In any case, mule fat scrub likely would be a very minor component of the riparian vegetation in Subarea 2. Proportionally, mule fat scrub is a minor component of the riparian vegetation communities in the Subareas where it has been documented, accounting for 5 percent of Subarea 1, 1 percent of Subarea 3, and 2 percent of Subarea 4.

9. Herbaceous Riparian

Herbaceous riparian is an early successional stage of riparian forest and scrub typically resulting from frequent flooding or scouring of woody vegetation. Disturbed sites are colonized by pioneer wetland species such as verbena (*Verbena* sp.), California mugwort, knotgrass, barnyard grass (*Echinochloa crus-galli*), sweetclover (*Melilotus* spp.), Bermuda grass, cattails (*Typha* spp.), smilo grass (*Piptatherum miliaceum*), Mexican sprangletop (*Leptochloa uninervia*), cocklebur, *Epilobium* spp., Johnson grass (*Sorghum halapense*), western ragweed, rabbit's-foot grass, mustard, wild radish (*Raphanus sativa*), and speedwell (*Veronica* spp.).

(a) Distribution of Herbaceous Riparian in the Study Area

Herbaceous riparian comprises approximately 55 acres in the study area, of which 49 acres are in the planning area and 6 acres are in the CNF. Herbaceous riparian accounts for less than 1 percent of the total riparian in both the study area and planning area. Herbaceous riparian occurs in scattered locations, including Chiquita Canyon, Cañada Gobernadora, Trampas Canyon, upper Arroyo Trabuco and lower Hot Spring Canyon (*Figure 15-M*).

(b) Distribution of Herbaceous Riparian in the Subareas

Within the Subareas, herbaceous riparian only is documented in Subareas 1 and 4, with 61 percent in Subarea 1 and 39 percent in Subarea 4 (*Table 3-2*). In both Subareas, herbaceous riparian accounts for very small percentages of the total riparian, with 4 percent of the total for Subarea 4 and only 1 percent for Subarea 1.

c. Wildlife

The multiple strata (*e.g.*, canopy, shrubs, herbaceous species) of riparian communities provide diverse and valuable habitat for terrestrial wildlife, including breeding areas, shade, cover, water and food (Warner and Hendrix 1984). Fish and other aquatic species benefit from important shading and other attributes. Riparian areas are of particular importance because the moisture of the stream channels is important as a water source in the dry California landscape and the areas are productive during the summer months when upland plant communities tend to be dormant (Warner and Hendrix 1984; Grenfell 1988a; Holland and Keil 1995). Riparian areas also function as important movement, migration and dispersal corridors for a variety of wildlife. The Science Advisors identified several wildlife species as indicators of healthy riparian systems and indicators of the presence of other riparian species. These species included red-shouldered hawk (*Buteo lineatus*), Cooper's hawk (*Accipiter cooperii*), sora (*Porzana carolina*), common yellowthroat (*Geothlypis trichas*), two-striped garter snake (*Thamnophis hammondii*), red racer (coachwhip) (*Masticophis flagellum piceus*), arroyo toad (*Bufo californicus*), California treefrog (*Hyla cadaverina*), southwestern pond turtle (*Emys [Clemmys] marmorata pallida*), arroyo chub (*Gila orcutii*), threespine stickleback (*Gasterosteus aculeatus*), and several bats. It should be noted, however, that these species do not all occur in all types of riparian communities. For example, the pond turtle requires perennial water and would not be expected to occur in sycamore alluvial woodland unless that woodland also supported a pond or perennial river or stream.

d. Human-Related Disturbances and Threats

Riparian vegetation communities are directly threatened by conversion to other uses (*e.g.*, agriculture, mineral extraction, sand and gravel mining), flood control projects, and cattle grazing. Riparian areas also are directly and indirectly threatened by adjacent activities such as agriculture and urban development. If unmitigated, these activities can have many adverse effects, including reduction of the floodplain, alterations to normal fluvial processes, alteration of hydrologic regimes, degradation of water quality, and colonization by exotic plant species.

3.2.6 Other Wildland Vegetation Communities/Covers

The study area supports several other wildland vegetation communities and land covers, including vernal pools, coastal freshwater marsh, slope wetlands, lakes and reservoirs, stream courses, and cliff and rock (*Figure 16-M*). These communities and land covers comprise a relatively small portion of the study area (*Table 3-1*). The distributional information for the wetland and aquatic communities are based on the NCCP database, the slope wetlands assessment conducted by PCR (2003a) and the vernal pool study conducted by PCR (PCR 2003b).

a. Cliff and Rock

Cliff and rock supports a variety of vascular plants and lichens, depending on the amount of water and microhabitat conditions of the particular site (Gray and Bramlet 1992). Gray and Bramlet distinguish between xeric and mesic cliffs and rock outcrops.

Xeric cliffs typically are on inland, south- and southwest-facing slopes. Plant species on xeric cliffs include California brickellbush (*Brickellia californica*), long-stemmed buckwheat (*Eriogonum elongatum*), chia (*Salvia columbariae*), Bigelow's spike-moss (*Selaginella biglovii*), bird's-foot fern (*Pellea mucronata*), wild canterbury-bell (*Phacelia minor*), dudleya (*Dudleya* spp.), littleseed muhly (*Muhlenbergia microsperma*), California fluffweed (*Filago californica*), grape soda lupine (*Lupinus excubitus*), Spanish bayonet, needlegrass (*Achnatherum coronata*), strigose deerweed (*Lotus strigosus*), San Diego jewelflower (*Caulanthus heterophyllus*), sapphire eriastrum (*Eriastrum sapphanirum*), white pincushion (*Chaenactis artemisiaefolia*), and bicolor cudweed (*Gnaphalium bicolor*).

Mesic cliffs typically occur in moist canyons and ravines near perennial water sources. Plant species on mesic cliffs include California wishbone (*Mirablis californica*), Bigelow's spike-moss, *Phacelia* spp., coffee fern (*Pellea andromedaefolia*), lanceleaf dudleya (*Dudleya lanceolata*), snapdragon (*Antirrihinum* spp.), California polypody (*Polypodium californicum*), silverback fern (*Pentagramma triangularis*), California cloak fern (*Notholaena californica*), and California threadstem (*Pterostegia drymarioides*). Mesic cliffs also supports foliose- and cructose-type lichens, mosses and liverworts (Gray and Bramlet 1992).

Rock outcrops are similar to vegetated cliffs, but occur on gentler slopes and support a different vegetation community (Gray and Bramlet 1992). Typical species found on rocks include pine-bush (*Ericameria pinifolia*), dot-seed plantain (*Plantago erecta*), rat-tail fescue, California croton (*Croton californicus*), rosin-weed (*Osmadenia tenella*), many-stemmed dudleya (*Dudleya multicaulis*), turkish rugging (*Chorizanthe staticoides*), rattlesnake spurge (*Chamaesyce albomarginata*), sapphire eriastrum, Bigelow's spike-moss, awn grass (*Aristida* spp.), cottonweed (*Micropus* spp.), nest straw (*Stylocline* spp.), herba impia (*Filago* spp.), and cryptantha (*Cryptantha* spp.).

Cliff and rock may be used by a variety of wildlife. Prominent species associated with cliff and rock habitats include golden eagle, prairie falcon (*Falco mexicanus*), coastal rosy boa, banded gecko (*Coleonyx variegatus*), woodrats (*Neotoma* spp.), and various bats.

Of the 72 acres of mapped cliff and rock in the study area, 62 acres are in the CNF (*Figure 16-M*). The 10 acres of cliff and rock in the planning area are found in three general locations: west of Trampas Canyon, in the southern portion of the Donna O'Neill Land Conservancy at Ranch Mission Viejo, and in middle Gabino Canyon. All three locations are in Subarea 1.

b. Aquatic Communities/Covers

1. Vernal Pools

Gray and Bramlet (1992) classify vernal pools as seasonal wetlands under the Orange County Vegetation Classification System. Vernal pools are seasonal depressional wetlands that form in depressions underlain by a relatively impervious soil layer. Mima mound topography is present where "the depressions are part of an undulating landscape, where soil mounds are interspersed with basins, swales, and drainages" (USFWS 1998c, page 22).

Specific soil types are critical to the formation of vernal pools. The surface and subsurface layers must be nearly impermeable to water and must occur on flat or gently sloping topography (USFWS 1998c). In southern California, these soils almost always are alluvial materials with clay or clay loam subsoils. Basaltic or granitic substrates or indurated hardpan layers may also contribute to poor drainage.

Southern Orange County supports "vernal-pool like" ephemeral ponds that support listed species (*i.e.,* Riverside fairy shrimp [*Streptocephalus woottoni*] and San Diego fairy shrimp [*Branchinecta sandiegonensis*] [USFWS 1998c]). These ponds are derived from geological activity such as faulting (sag ponds along San Mateo Creek), landslide movement (*e.g.,* Saddleback Meadows), or are man-made stock ponds.

(a) Distribution of Vernal Pools in the Study Area

The Dudek/PCR studies conducted in 2001 mapped three pools on Chiquita Ridge and three pools on the Radio Tower Road mesa located between Highway 74 and Trampas Canyon (*Figure 16-M*) (Dudek 2001b; PCR 2003b). A large pool on Chiquita Ridge supports both the Riverside and San Diego fairy shrimp and a smaller pool supports the San Diego fairy shrimp. Two of the three pools on the Radio Tower Road mesa support both species and the third supports only the San Diego fairy shrimp (see *Section 3.4.1*). Pools on Saddleback Meadows and near the intersection of Antonio Parkway and FTC-North support the Riverside fairy shrimp. Vernal pools also provide breeding habitat for amphibians such as the western spadefoot toad (*Scaphiopus hammondii*).

Vegetation in the vicinity of pool complexes on RMV is native and non-native grassland. Plant species within the pools include hairy pepperwort (*Marsilea vestitsa*), goldenbush, cocklebur, bracted vervain (*Verbena bracteata*), curly docks (*Rumex crispus*), water pigmy-stonecrop (*Crassula aquatica*), low barley (*Hordeum depressum*), yerba mansa, toad rush, rabbit's-foot grass, and Bermuda grass (*Cynodon dactylon*).

(b) Distribution of Vernal Pools in the Subareas

The Chiquita Ridge, Radio Tower Road and Antonio Parkway/FTC-North vernal pools are located in Subarea 1 and the Saddleback Meadows vernal pools are located in Subarea 2.

2. Coastal Freshwater Marsh

Coastal and valley freshwater marshes are seasonally or permanently flooded sites typically dominated by perennial hydrophytic monocots up to 6-7 feet in height (Gray and Bramlet 1992; Kramer 1988). Freshwater marsh supports cattails (*Typha domingensis, T. angustifolia*), bulrush (*Scirpus americanus, S. maritimus, S. californicus S. acutus, S. microcarpus*), sedges (*Cyperus eragrostis, C. niger, C. odoratus, C. esculentus*), spike rushes (*Eleocharis acicularis, E. macrostachya*), and yerba mansa (*Anemopsis californica*) (Barbour and Major 1977; Holland and Keil 1995; MBA 1996; Sawyer and Keeler-Wolf 1995). Forbs in freshwater marsh include marsh fleabane (*Pluchea odorata*), common monkeyflower (*Mimulus guttatus*), scarlet monkeyflower (*Mimulus cardinalis*), willow weed (*Polygonum lapathifolium*), whorled dock (*Rumex conglomeratus*), willow dock (*Rumex salicifolius*), willow-herb (*Epilobium ciliatum*), yellow waterweed (*Ludwigia peploides*), cut-leaf water parsnip (*Berula erecta*), slender aster (*Aster subulatus* var. *ligulatus*), rosilla (*Helenium puberulum*), western goldenrod (*Euthania occidentalis*), white water-cress (*Rorippa nasturtium-aquaticum*), and stinging nettle (MBA 1996). Grasses associated with freshwater marsh include rabbit's-foot grass, knotgrass, water bent (*Agrostis semiverticillatus*), Mexican sprangletop, and western witchgrass (*Panicum capillare*).

(a) Distribution of Freshwater Marsh in the Study Area

The study area supports approximately 33 acres of freshwater marsh, with all of it in the planning area. Freshwater marsh occurs throughout the planning area, generally in association with creeks and drainages, including Arroyo Trabuco, Chiquita Canyon, Cañada Gobernadora, San Juan Creek, Cristianitos Creek, upper Gabino Canyon and Dove Canyon (*Figure 16-M*).

(b) Distribution of Freshwater Marsh in the Subareas

Within the Subareas, freshwater marsh is mapped in Subarea 1, accounting for 58 percent of the total; Subarea 4, accounting for 39 percent of the total; and Subarea 2, accounting for only 3 percent of the total (*Table 3-1*). Freshwater marsh is not documented in Subarea 3. Overall, freshwater marsh accounts for a very small proportion of the natural vegetation communities in the Subareas, ranging from 0 percent in Subarea 3 to less than 1 percent in the other Subareas.

3. Slope Wetlands

Slope wetlands are normally found where there is a discharge of ground water to a sloping land surface. Elevation gradients may range from steep to slight and these wetlands can occur in nearly flat landscapes if ground water discharge is a dominant source to the wetland surface. Principle water sources are usually ground water return flow, interflow from surrounding uplands, and precipitation. Hydrodynamics of slope wetlands are dominated by downslope unidirectional water flow and water losses are primarily by saturation and subsurface discharge soil, surface flows, and by evapotranspiration. Slope wetlands may develop channels, but the channels generally serve only to convey water away from the slope wetland following periods of heavy precipitation. The plant communities in slope wetlands can be emergent or scrub-shrub depending on the hydroregime and soil type.

The slope wetlands in the study area vary from perennially saturated to those that are saturated only during the winter months. All the wetlands generally support hydrophytic vegetation closely and would be described as either alkali meadow or freshwater seeps (Gray and Bramlet 1992).

(a) Distribution of Slope Wetlands in the Study Area

Slope wetlands are known only from the planning area and are located in two primary areas: 10 along Chiquita Canyon and five along Radio Tower Road (*Figure 16-M*). Of the other two slope wetlands, one is located in a tributary to Gobernadora Canyon and the other just north of the Donna O'Neill Land Conservancy. All of the slope wetlands are located in Subarea 1 except the location north of the Land Conservancy.

4. <u>Alkali Meadow</u>

Alkali meadows include seeps and wet areas in low-lying alkaline or saline soils (Gray and Bramlet 1992). Typical species in alkali meadows include beardless wild rye, tarragon (*Artemisia dracunculus*), white sweetclover (*Melilotus albus*), common sunflower (*Helianthus anuus*), sedges, Mexican rush (*Juncus mexicanus*), western ragweed, and bristly ox-tongue (*Picris echioides*).

Alkali meadows provide suitable habitat for small mammals and birds, including raptors, and may function as raptor foraging habitat similar to grasslands and agriculture. They also provide habitat for sensitive plant species such as southern tarplant (*Centromadia parryi* spp. *australis*) and Coulter's saltbush (*Atriplex coulteri*), which occur in alkaline soils.

(a) Distribution of Alkali Meadow in the Study Area

Approximately 42 acres of alkali meadow occur in the planning area (*Figure 16-M*); 38 acres are in Subarea 1 in middle Chiquita and Gobernadora canyons and 4 acres are in "Not a Part" of Subarea 1 in the Tesoro High School area in middle Chiquita Canyon.

5. <u>Open Water</u>

Open water refers to permanent or semi-permanent bodies that hold water year-round or for the majority of the year (as opposed to vernal pools which are more ephemeral). They may support vegetation that is tolerant of, or requires, permanently flooded conditions (Gray and Bramlet 1992). Open water often contains several phytoplankton species and filamentous blue-green and green algae

(Gray and Bramlet 1992). Other vegetation in lakes and reservoirs includes aquatic species such as horned-pondweed (*Zannichellia palutris*), mosquito fern (*Azolla filiculoides*), duckweed (*Lemna* spp.), milfoil (*Myriophyllum* spp.), waterwort (*Elatine* sp.), fennel-leaved pondweed (*Potamegton pectinatus*), common water nymph (*Najas guadelupensis*), and hornwort (*Ceratophyllum demersum*) (Gray and Bramlet 1992; MBA 1996). Emergent hydrophytes include cattail, bulrush, nutsedge (*Cyperus eragrostis*), spikerush, and knotgrass (MBA 1996). Terrestrial species along the fluctuating shoreline of lakes and reservoirs include willow, mule fat, dock, swamp Timothy (*Crypsis schoenoides*), toad rush (*Juncus bufonius*), hyssop loosestrife (*Lythrum hyssopifolia*) and cocklebur. Invasive forbs and grasses along shorelines include Bermuda grass, *Echinochloa* sp., Mexican sprangletop, *Setaria* spp., *Chenopodium* spp., alkali-mallow (*Malvella leprosa*), and pigweed (*Amaranthus* spp.).

A variety of migratory and resident wildlife use open water and the associated emergent and shoreline vegetation for breeding, foraging and resting. The Science Advisors identified several wildlife species indicative of open water and the presence of other species using these areas: great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula*), pied-billed grebe (*Podilymbus podiceps*), tricolored blackbird (*Agelaius tricolor*), red-winged blackbird (*Agelaius phoeniceus*), sora, common yellowthroat, southwestern pond turtle, Pacific treefrog (*Hyla regilla*), western toad (*Bufo boreas*), and various bats.

(a) Distribution of Open Water in the Study Area

A total of 388 acres of open water occur is present in the study area, of which 387 acres are in the planning area and only 1 acre in the CNF (*Table 3-1*). Open water accounts for less than 1 percent of the land cover in the study area. Areas mapped as open water range in size from small lakes and ponds to large reservoirs such as Lake Mission Viejo and upper Oso Reservoir. Smaller bodies of open water are scattered throughout the study area, including Cristianitos Canyon, upper Gabino Canyon (Jerome's Lake), San Juan Creek (CalMat Lake), lower Arroyo Trabuco, and Coto de Caza (Portola Reservoir) (*Figure 16-M*).

(b) Distribution of Open Water in the Subareas

Open water is present in all of the Subareas, with 240 acres in Subarea 4; primarily Lake Mission Viejo and upper Oso Reservoir (*Table 3-1*). Subarea 1 also supports a relatively large amount of open water, with 113 acres comprised of the artificial lake in Trampas Canyon, CalMat Lake in San Juan Creek, and smaller waterbodies such as Jerome's Lake and the clay pit ponds in lower Gabino. Subarea 3 supports 24 acres of open water, primarily the Portola Reservoir. Subarea 2 has less than 1 acre of open water. Proportionally, open water accounts for relatively small amounts of the natural vegetation/land covers in the Subareas: 3 percent in Subarea 4; 2 percent in Subarea 3; and less than 1 percent in Subareas 1 and 2.

6. Watercourses

Watercourses include perennial rivers and streams, intermittent rivers and streams, ephemeral rivers and streams, and flood control channels (*Figure 16-M*). These watercourses generally are devoid of vegetation either as a result of severe flooding or as a maintained flood control channel. Although they are often intermixed with riparian and open water, they are characterized by their lack of vegetation. Watercourses are dynamic, high-energy systems and the active part of the channel may change over time based on rainfall and recent flow and flooding patterns (MBA 1996).

The specific wildlife species associated with watercourses depends on the location and type of watercourse (*e.g.,* a natural stream course versus an artificial flood control channel), intermixing with riparian and wetland communities, and availability of perennial and ephemeral water sources. Natural stream courses in San Juan Creek, lower Gabino Canyon, and Talega Canyon support the arroyo toad. Watercourses with perennial water provide habitat for two-striped garter snake, southwestern pond turtle, arroyo chub, threespine stickleback, and various bats (foraging habitat). Watercourses with at least ephemeral water provide habitat for other amphibian species such as western toad and Pacific treefrog and reptiles such as silvery legless lizard (*Anniella pulchra pulchra*) and red racer. Watercourses also provide movement and dispersal habitat for mammals such as coyote (*Canis latrans*) and bobcat (*Lynx rufus*).

(a) Distribution of Watercourses in the Study Area

A total of 75 acres of watercourse is present in the study area, all of which are in the planning area. Watercourses in natural settings are located in upper Arroyo Trabuco, San Juan Creek and lower Gabino Creek. Watercourses in urban settings are located in San Clemente south of Avenida Pico west of I-5, south of Calle del Cerro, and east of Camino de Las Mares and in Mission Viejo along Los Alisos Boulevard and Jeronimo Road.

(b) Distribution of Watercourses in the Subareas

Within the Subareas, watercourses primarily are in Subareas 1 and 4, with about 25 acres (33 percent) in Subarea 1 and 35 acres (47 percent) in Subarea 4 (*Table 3-1*). About 8 acres (11 percent) of watercourses are present in Subarea 2 and no watercourses are documented in Subarea 3. Proportionally, watercourses account for relatively little of the natural vegetation communities/land covers in the Subreas with less than 1 percent in any of the Subareas.

3.2.7 Non-Natural Land Covers

a. Agriculture

Agriculture consists of annual crops, vineyards, orchards, dairies, stockyards and other farming and ranching activities (Gray and Bramlet 1992). Agriculture in the study area primarily is cattle grazing, orchards, and nursery operations on RMV land.[2]

1. <u>Distribution of Agriculture in the Study Area</u>

Agriculture comprises approximately 4,044 acres of the study area, of which all but 1 acre are in the planning area (*Figure 17-R*). The Colorspot and Tree of Life nurseries are located on RMV land adjacent to San Juan Creek. Citrus orchards are located adjacent to Colorspot Nursery, in Chiquita Canyon and Cristianitos Canyon, and near the RMV headquarters. Avocado groves are located in the Cristianitos/middle Gabino area. Barley fields are located throughout lower and middle Chiquita and Gobernadora Canyon. The total mapped agriculture on RMV overstates the actual amount of active agriculture in any given year because of the annual variation in the amount of planted barley. Typically RMV plants 800 to 1,000 acres of barley annually, depending on weather conditions, but the NCCP database includes 2,430 acres mapped as dryland crops. In fallow years, the uncultivated areas may function more as grasslands, providing suitable nesting habitat for species such as the grasshopper sparrow.

(b) Distribution of Agriculture in the Subareas

Within Subareas, the vast majority of agriculture (86 percent) in the planning area is located in Subarea 1. Subareas 2, 3 and 4 support similar amounts of agriculture, each accounting for about 4 percent of the total. Proportionally, agriculture accounts for 8 percent of the total land cover (including natural areas providing habitat for species and non-natural areas) in Subarea 1 (*Table 3-1*). In Subarea 2 agriculture accounts for 5 percent of the total land cover, 4 percent in Subarea 3 and less than 1 percent in the highly urbanized Subarea 4.

b. Disturbed Areas

Disturbed areas include cleared or graded, burned, and mined areas. Disturbed areas may be barren or support ruderal (weedy) vegetation such as tocalote, wild oat, black mustard, prickly sow-thistle (*Sonchus asper*) and prickly lettuce (*Lactuca serriola*) (Gray and Bramlet 1992).

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[2] Grazing on RMV occurs primarily on natural grasslands in the San Mateo Creek Watershed during the fall-spring and on cultivated barley fields in the Chiquita and Gobernadora sub-basins in late spring-summer. Areas that are planted in barley, but used for cattle grazing are mapped as agriculture while natural grassland pastures are mapped as grassland.

1. Distribution of Disturbed Areas in the Study Area

Disturbed areas in the study area include active and former sand and gravel mining operations in Arroyo Trabuco, Trampas Canyon and San Juan Creek and clay mining in Cristianitos Canyon, as well as various pre-construction cleared areas (*Figure 17-R*). Disturbed areas comprise approximately 1,816 acres in the study area, of which 1,792 acres are in the planning area and only 24 acres in the CNF.

2. Distribution of Disturbed Areas in the Subareas

Within Subareas, the majority of disturbed areas (58 percent) in the planning area is located in Subarea 1 (*Table 3-1*). Subarea 4 supports 31 percent of the disturbed areas and Subareas 2 and 3 support 2 percent and 4 percent, respectively. Proportionally, disturbed areas account for 2 percent of the total land cover (including natural areas providing habitat for species and non-natural areas) in Subarea 1. In Subarea 2 disturbed areas account for 1 percent of the total land cover, and 2 percent in Subareas 3 and 4.

c. Developed

The developed category includes all urban areas, road, non-natural parks, and cleared and graded areas (may overlap with the disturbed category) (Gray and Bramlet 1992).[3]

1. Distribution of Developed in the Study Area

Most of the City of Mission Viejo is developed, as are large portions of San Juan Capistrano and San Clemente (*Figure 17-R*). Other substantially developed areas are Rancho Santa Margarita, Coto de Caza, Dove Canyon and Ladera Ranch. Developed is the second largest land cover in the study area after chaparral, totaling 32,743 acres and accounting for about 25 percent of the land cover in the study area (*Table 3-1*). The 32,678 acres of developed land in the planning area accounts for about 36 percent of the land cover in this area.

2. Distribution of Developed in the Subareas

Within Subareas, the large majority of existing development in the planning area is in Subarea 4 (75 percent), with relatively little of the total in Subarea 1 (3 percent), Subarea 2 (less than 1 percent), and Subarea 3 (7 percent) (*Table 3-1*). Proportionally, Subarea 4 supports the greatest amount of existing development, accounting for 73 percent of the total land cover. Subarea 3 also supports a

[3] The potential overlap between the "Disturbed" and "Developed" categories can occur in aerial photo interpretation due to the sometimes unknown future status of cleared or graded areas. Because neither Disturbed or Developed are considered to have significant habitat value and because of the relatively small total amount of Disturbed revising the database to update the status of disturbed areas was not considered to be a high priority.

relatively large amount of development, accounting for 59 percent of the total land cover. Subareas 1 and 2 are the least developed, with 2 percent and 6 percent development, respectively.

SECTION 3.3 GEOMORPHIC AND HYDROLOGIC CONDITIONS AND PROCESSES

3.3.1 Geomorphic Setting

a. Regional Geology

The San Juan Creek and San Mateo Creek watersheds are located on the western slopes of the Santa Ana Mountains, which are part of the Peninsular Ranges that extend from the tip of Baja California northward to the Palos Verdes Peninsula and Santa Catalina Island. The geology of the region is complex and has been dominated by alternating periods of depression and uplift, mass wasting, and sediment deposition (*Figure 18-M*). Within the watersheds, the Santa Ana Mountains are composed of igneous, metavolcanic, and metasedimentary rocks of Jurassic age and younger. The exposed rocks in the mountainous areas are slightly metamorphosed volcanics, which have been intruded by granitic rocks of Cretaceous age, principally granites, gabbros, and tonalites. Overlying these rocks are several thousand stratigraphic feet of younger sandstones, siltstones, and conglomerates of upper Cretaceous age, composed largely of material eroded from the older igneous and metavolcanic rocks now underlying the Santa Ana Mountains.

Younger sedimentary rocks comprise the bedrock between the Santa Ana Mountains, their foothills, and the Pacific Ocean. Most of the study area is underlain by these marine and non-marine sandstones, limestones, siltstones, mudstones, shales, and conglomerates, many of which weather, erode, and/or hold groundwater in characteristic ways. Overlying them are Quaternary stream terrace deposits and Holocene stream channel deposits.

During the past two million years or longer, at least three processes that fundamentally affect structure and process along the major stream channels have affected the two watersheds:

1. Continuing uplift, typically 400 feet or more, which has left at least four major stream terrace levels along the major streams.

2. Downcutting of the main canyons to sea levels, which have fluctuated widely during the global glaciations. The flat valley floors were deposited as sea level rose, leaving often-sharp slope breaks at the base of the existing hillsides and tributary valleys. These materials are geologically young, soft, and prone to incision under certain conditions.

3. Soils formed under climates both warmer/colder and drier/wetter than at present, which led to development of hardpans that have been eroded to form mesas. These hardpan mesas have minimal infiltration and presently channel flows into headwater streams.

b. Terrains

Terrain designations are largely based on soils, geology and topography, as these provide many of the fundamental factors that influence the hydrology and geomorphology characteristic of each terrain. Bedrock is the raw material from which soils are weathered, and, as such, it determines the size and types of particles that will comprise the soil. The resistance of different kinds of bedrock to weathering and erosion also controls the topography of the landscape within a given terrain and, therefore, influences the hydrology of the watersheds and morphology of the drainage networks. Watershed hydrology is also strongly influenced by the climatic patterns typical of Southern California.

There are three major geomorphic terrains found within the San Juan Creek and San Mateo Creek watersheds: **(1)** sandy and silty-sandy; **(2)** clayey; and **(3)** crystalline. These terrains are manifested primarily as roughly north-south oriented bands of different soil types (*Figure 19-M*). The soils and bedrock that comprise the western portions of the San Juan Creek Watershed (*i.e.,* Oso Creek, Arroyo Trabuco, and the lower third of San Juan Creek) contain a high percentage of clays in the soils. The soils typical of the clayey terrain include the Alo and Bosanko clays on upland slopes and the Sorrento and Mocho loams in floodplain areas. In contrast, the middle portion of the San Juan basin, (*i.e.,* Cañada Chiquita, Bell Canyon, and the middle reaches of San Juan Creek) is a region characterized by silty-sandy substrate that features the Cieneba, Anaheim, and Soper loams on the hill slopes and the Metz and San Emigdio loams on the floodplains. The upstream portions the San Juan Creek Watershed, which comprise the headwaters of San Juan Creek, Lucas Canyon Creek, Bell Creek, and Trabuco Creek, may be characterized as a "crystalline" terrain because the bedrock underlying this mountainous region is composed of igneous and metamorphic rocks. Here, slopes are covered by the Friant, Exchequer, and Cieneba soils, while stream valleys contain deposits of rock and cobbly sand. The upland slopes east of both Chiquita and Gobernadora canyons are unique in that they contain somewhat of a hybrid terrain. Although underlain by deep sandy substrates, these areas are locally overlain by between 2 and 6 feet of exhumed hardpan.

1. <u>Run-off Patterns of Specific Terrains</u>

Runoff patterns typical of each terrain are affected by basin slope, configuration of the drainage network, land use/vegetation, and, perhaps, most importantly the underlying terrain type. Although all three terrains exhibit fairly rapid runoff, undisturbed sandy slopes contribute less runoff than clayey ones because it is easier for water to infiltrate into the coarser substrate. Runoff in crystalline terrains tends to be rapid and is highly influenced by the presence and density of coverage of impervious areas of rock outcrop that typify the terrain. As a result, the volume of runoff generated by the same amount and intensity of rainfall in a sandy watershed is generally lower than that generated in a clayey or crystalline watershed. When comparing clayey and crystalline terrains, the former seals and becomes impervious upon saturation, while the latter allows for some infiltration through shallow sands that overlay bedrock. Therefore, runoff in clayey terrains is generally more rapid than in crystalline terrains, notwithstanding site-specific differences such as slope and land cover/vegetation.

Expected runoff patterns based on terrains should be distinguished from estimated runoff potential based on soil hydrogroups. Although both provide valid, and typically congruent information, the effect of terrains predominates at low to moderate return interval events (*i.e.,* 2-, 5-, and 10-year events), while the effect of soil hydrogroups predominate at larger return-interval events (*e.g.,* 25-, 50-, and 100-year events).

During low to moderate storm events terrains influence the likelihood and extent of channel migration, avulsion, or incision. However, during extreme storm events, the influence of terrains is minimal and runoff is more strongly influenced by soil hydrogroup. For example, a Type C soil in a sandy terrain would produce less runoff during a 5-year event than a Type C soil in a clayey terrain. However, during a larger storm event, runoff from both terrains would be comparable (assuming similar vegetation, slope, and land use).

2. Channel Characteristics of Specific Terrains

Sandy and silt-sandy terrains are generally able to infiltrate larger volumes of water than are clayey and crystalline terrains. As a result: **(1)** sandy terrains play a vital role in groundwater recharge; **(2)** undisturbed sandy terrains are typified by lower runoff rates than clayey or crystalline terrains; **(3)** stream valleys in undisturbed sandy terrains tend to have wide floodplains and are often channel-less; **(4)** flows tend to persist longer after storms or further into the summer within sandy watersheds; and **(5)** there is a greater contrast between runoff conditions in undeveloped and urbanized watersheds in sandy terrains than in clayey or crystalline terrains.

Crystalline terrains are typified by narrow, well-defined stream valleys nestled between steep mountainous slopes. Unlike sandy streams that are susceptible to incision, streams in crystalline areas often flow over bedrock and have stable grades. The topography, soils, and hydrography of the crystalline geomorphic terrain are all inherently controlled and influenced by the underlying bedrock.

In Southern California clayey terrains are also typified by more gentle topography than sandy or crystalline areas. Ridges tend to be lower and broader because the underlying bedrock is often more easily eroded. Clayey terrains also feature streams with fairly well-defined channels that have evolved to handle the higher runoff rates associated with clayey slopes. Clayey terrains are generally less susceptible to many of the environmental problems that plague sandier soils (such as enhanced sediment loading, incision, and headcutting).

Of the three terrains present in the San Juan Creek Watershed, streams in sandy terrains are the most vulnerable to channel incision or channel widening associated with land use changes. The two main risks associated with development within sandy terrains are dramatically increased peak discharge and channel incision accompanied by headward erosion. To a certain extent, the two are inherently linked, and both result from the unique erosion and runoff properties of sandy watersheds. Studies have shown that urbanization in sandy watersheds can result in a proportionately greater increase in storm peaks and associated alteration of downstream channel morphology than in more clayey watersheds. Sandy terrains are often typified (under undisturbed conditions) by the presence of poorly defined channels along grassy, vegetated valley floors. Increased flood peaks due to urbanization cannot only cause channel incision along grassy swales, but channel incision itself further serves to increase flood peaks through enhanced conveyance. The result is an amplified cycle of erosion and downcutting that destroys floodplain interaction, increases sediment yields and the tendency for flooding downstream, and significantly alters vegetation communities.

3.3.2 Historic Context

Physical and biological conditions in the watersheds have been affected over time by both natural and anthropogenic forces. Early historical accounts of lower San Juan Creek suggest near-perennial flow, with a freshwater lagoon near the mouth and a "green valley full of willows, alders and live oak, and other trees not known to us" (c.f., Friar Crespi in 1769). Natural events that have helped shaped the current conditions in the watershed include wet and dry cycles, flooding and fires. Anthropogenic effects include changes in patterns of water use, urban development, mining, grazing, and agriculture. The spatial and temporal effect of key historical events is based on not only the scale of the event, but the timing relative to other events. Investigating these patterns can be valuable for understanding natural processes and for long-range planning of future land use changes.

a. Natural Processes

The geology, topography, and climate of the coastal watersheds of Southern California make them unique among the watersheds in the United States. The Transverse and Peninsular Ranges are intensely sheared and steep due to ongoing uplift and tectonic activity. In addition, these ranges are located close to the coast, resulting in steeper, shorter watersheds than those found in most other portions of the country.

The Mediterranean climate in Southern California is characterized by brief, intense storms between November and March. It is not unusual for a majority of the annual precipitation to fall during a few storms in close proximity to each other. The higher elevation portions of the watershed (typically the headwater areas) typically receive significantly greater precipitation, due to orographic effects.

In addition, rainfall patterns are subject to extreme variations from year to year and longer-term wet and dry cycles. The combination of steep, short watersheds; brief intense storms; and extreme temporal variability in rainfall result in “flashy” systems where stream discharge can vary by several orders of magnitude over very short periods of time.

Wet and dry cycles, typically lasting up to 15 to 20 years, are characteristic of southern California. The region presently appears to be emerging from a wetter-than-normal cycle of years beginning in 1993. Previously, five consecutive years of sub-normal rainfall and runoff occurred in 1987 through 1991.

Prior droughts of recent note include the brief, “hard” droughts of 1976 to 1977 and 1946 to 1951. Previous notable wet periods of the recent past were observed in 1937 to 1944 and 1978 to 1983. An unusually protracted sequence of generally dry years began in 1945 and continued through 1977. During this period, rainfall was approximately 25 percent below the average for the prior 70 years (Lang *et al*. 1998). Both recharge and (especially) sediment transport were diminished to even greater degrees. Although wet years did occur during this period, dry conditions were sufficiently persistent to result in lower groundwater levels and contraction in the extent of riparian corridors. In many areas, landslide activity was much less than during strings of wet years. Throughout Chiquita and Gobernadora canyons, many of the channel segments that may have cut across debris aprons formed by the 1938 floods and subsequent wet years may have re-filled during this period. At a broader regional scale, the 33 years of below-average rainfall, recharge, and sediment entrainment coincided with the post-war period of especially intensive hydrologic data collection, resulting in underestimates of hydrologic activity. Most of the hydrologic design studies performed in southern Orange County were based on data collected between the years of 1960 through 1985, when rainfall, recharge, and sediment yields were below longer-term norms. Therefore, they may not account for variations in flow and sediment associated with long-term climate trends.

b. Floods

Major floods are a necessary component of riparian ecosystems in that they serve to re-establish (“reset”) the plant communities by scouring older vegetation, establishing new areas of bare substrate, and facilitating dispersal of disturbance-adapted riparian plant species. Furthermore, major floods alter the location, continuity, and supply of sediment and large organic matter to the channel networks.

Major, flood-related disturbance of the channel and riparian systems may be expected with mean recurrences of 10 to 20 years. Large floods occurred in coastal southern California in 1907, 1916, 1937, 1938, 1969, 1978, 1983, 1993, 1995, and 1998. Historical accounts of the 1916 flood indicate that San Juan Creek extended fully across the valley downstream from the mission and what is now Interstate 5 (USACE 1999a). Peak runoff values were estimated to be in the range of 104 to 151 (cfs/mi^2) for Aliso, Trabuco, San Juan, and San Onofre creeks, and 234 cfs/mi^2 for Laguna Creek at

Laguna Beach in a more clay-rich watershed. No data are available for either flood from San Mateo Creek or its major tributaries. The February 1969 peak flows were long-duration events, which eventually generated peak flows of 22,400 cfs at the La Novia gauging station in San Juan Capistrano, the highest reported prior to general urbanization in the watershed. The January and March 1995 events led to peaks of 15,200 cfs and 25,600 cfs, respectively; the latter being the largest flow recorded on San Juan Creek. Five distinct major crests were observed in February 1998, with a peak flow of 17,000 cfs.

c. Watershed Scale Fires

Nearly all portions of the two watersheds have been subject to watershed-scale fires from one to three times (and in limited areas, four or five times) during the past century (Fife 1979; Stephenson and Calcarone 1999) (*Figure 20-M*). The primary hydrologic effects of the fires are sharp increases in sediment yields and often aggradation in the channel downstream. It should be noted that not all areas falling within a mapped fire periphery have actually been burnt. Generally, north-facing slopes and riparian corridors are much less likely to burn, and other areas may be affected only by a rapidly moving (and less destructive) ground fire. Pockets of soil and vegetation which have survived for many decades (or perhaps centuries) without high-intensity burning occur throughout the two watersheds.

As described in detail above, fires can result in shifts or changes in the vegetation community. Coastal sage scrub is generally considered to be relatively resilient to disturbance. However, frequent or intense fires may result in temporary to long-term increases in grassland species. In extreme instances frequent or intense fires may result in a type-conversion from sage scrub to grassland. Such a conversion may decrease infiltration and increase runoff and erosion into streams that drain the burned sub-basins.

The combination of fire, followed by high rainfall runoff shortly thereafter, can be one of the most significant sequences of events that shape the riparian corridors. This series of events can result in mobilization of large sediment stores that significantly alter the geometry and elevation of downstream channels. Much of the eastern San Juan Watershed was last burned in 1959. The combination of this fire and the subsequent 1969 floods (described above) may have resulted in considerable deposition within the channels and floodplains, which have subsequently incised for many years.

d. Grazing

Large portions of both watersheds have been grazed at varying intensities over the last two hundred years. The exact effects of grazing remain unclear. The season-long, continuous grazing over many years associated with traditional grazing practices was likely responsible for conversion of much of the uplands in the watershed from native grasses and scrub to non-native annual grassland.

However, Heady (1968, 1977) suggested that large native herbivores present prior to European colonization might have been an important factor in grassland formation and ecology. Edwards (1992) also notes "… observation and experiment world-wide are increasingly showing that large grazing-browsing-trampling mammals and native grasslands are coevolved." Therefore, some level and intensity of seasonal grazing may be necessary and beneficial to restoring or maintaining native grasses. Edwards (1992) postulates that livestock grazing can be ecologically beneficial, if specific strategies are devised on the basis of site-by-site needs. Because native plant communities are typically associated with higher infiltration than non-native grasses, grazing-induced conversion of ground cover was likely accompanied by increased runoff and erosion. Lower infiltration rates in the surrounding watershed may have also resulted in a decrease in the depth of shallow subsurface water. Decreases in shallow subsurface water can affect baseflow and width of riparian zones.

Intensive grazing within riparian corridors has been associated with suppression of riparian vegetation and trampling of stream banks. The lack of established woody vegetation combined with direct disturbance from cattle could destabilize streams and make them more susceptible to erosion and incision. Therefore, the current width, depth, and geometry of the creeks in the study area may have been influenced by the cumulative influence of long term grazing on the uplands and the stream corridors.

3.3.3 Surface Hydrology

Both the San Juan and San Mateo watersheds are generally characterized by slow infiltration rates relative to adjacent watersheds (*Figures 21-M* and *22-M*). For example, review of existing data for the Santa Margarita and San Luis Rey watersheds shows that these two watersheds have a higher percentage of Type B soils than the San Juan and San Mateo watersheds (Steinitz *et al.* 1996). Therefore, the San Juan and San Mateo watersheds would be considered more slowly infiltrating areas than the Santa Margarita and San Luis Rey (in general). Compared with the San Mateo Watershed, San Juan contains approximately 10 percent less coverage with poorly infiltrating soils (*i.e.*, C and D soil hydrogroups). In contrast, the steep crystalline terrains of the San Mateo Watershed exhibit rapid runoff and relatively lower infiltration capacity.

Significant differences can be found within the watersheds at the sub-basin scale. Within the San Juan Watershed, Chiquita and Gobernadora Canyons possess broad valleys of relatively higher infiltrating sandy soils (*Figure 21-M*). However, the slopes above portions of Gobernadora are characterized by B soils that are overlain by several feet of hardpan that, if undisturbed, cause this area to respond more like a C or D soil.

The composite hydrograph for 2-year, 10-year, and 100-year flows in San Juan Creek at flows the ocean are 5,170 cfs, 29,280 cfs, and 67,280 cfs, respectively. For San Mateo Watershed, the predicted 2-year, 10-year, and 100-year flows at the ocean are 3,200 cfs, 19,160 cfs, and 47,530 cfs, respectively. Predicted flows in the San Mateo Watershed are between 21 percent and 24 percent lower than those in the San Juan Watershed, which is consistent with the 24 percent size difference between the two watersheds (*i.e.*, 133 $mi.^2$ vs. 176 $mi.^2$). Several things are notable about the hydrologic modeling results. First, peak flows from the western portion of the watershed arrive in the lower San Juan Watershed more rapidly than peak flows from the central and eastern portions of the watershed (see *Figure 23-R*). Two-year event hydrographs show that Peak flows from Oso Creek and Trabuco Creek arrive at the main stem of San Juan Creek approximately 2.8 hours before flows from the central and eastern portions of the watershed (as represented by the hydrograph for San Juan Creek upstream of Horno Creek). The more rapid arrival of peak flows from the western watershed occurs for three reasons: **(1)** flow distances from the western tributaries are somewhat shorter to the lower San Juan Watershed than from the areas to the east; **(2)** the western watershed is more urbanized than the eastern watershed, with impervious surfaces in these urban areas shedding runoff much more quickly than more pervious areas to the east, and the hydrograph peak occurring earlier; and **(3)** the central portion of the San Juan Watershed contains higher infiltrating sandy areas that act to attenuate runoff to the main stem of San Juan Creek.

In a planning context, it is important to understand the relationship between the timing of peak flows along the mainstem creek relative to those of the sub-basins. The goal should be to not alter the runoff interactions between the main stem and sub-basin creeks to a level that results in coincident flood peaks, thereby exacerbating the effects of urbanization on downstream hydrology. As a general rule, land planning should attempt to maintain the function of the existing channel network and minimize floodplain constriction in major tributary valleys.

The potential effect of urbanization on low-flow conditions was investigated by analyzing the Oso Creek sub-basin as an example of what could potentially happen in other parts of the San Juan or San Mateo Creek watersheds if similar land use transformations were to occur. The results of the trend analysis conducted for Oso Creek show that annual minimum stream flows and mean summer flows have consistently increased over time as the basin progressively developed. The effect of upstream development on dry season flows is currently observable in the northern portion of the Gobernadora sub-basin, where the Coto de Caza development has increased the magnitude and persistence of low flows to the central Gobernadora watershed.

Wet and dry cycles in southern California typically last for 15 to 20 years, with major floods that act to "reset" the riparian plant communities occurring every 10 to 20 years. The long-term implications of these wet and dry cycles on groundwater levels, width of riparian zones, and landslide activity (which increases sediment delivery to the streams) must be accounted for during future land use planning.

3.3.4 Groundwater

The vast majority of the San Juan and San Mateo watersheds are underlain by alluvial and alluvial-terrace aquifers that have the capacity to store groundwater. Unlike many of the other portions of southern Orange County, the sandy portions of the central San Juan Watershed are moderately permeable and provide significant groundwater recharge opportunities. These areas should be taken into account during the land planning process. Maximizing infiltration, especially in sandy terrains, could also have the effect of minimizing changes in surface runoff and water quality associated with increasing impervious surfaces. At the landscape scale, most of the riparian and aquatic communities have at least transient reliance on groundwater. Of particular import are Chiquita and Gobernadora canyons, which contain some of the greatest volumes of alluvial-aquifer storage and contain riparian zones that depend on contact with groundwater year-round. In these watersheds, maintenance of shallow groundwater with appropriate water chemistry is an important component of maintenance of riparian habits.

These areas also support most of the slope wetlands in the area of study, all of which are sustained by groundwater (see *Figure 16-M*). Approximately half of the slope wetlands are sustained by water emanating directly from landslides, while the other half are sustained by deeper bedrock aquifers with the water being merely conveyed through landslides. Because landslides are more localized features than the bedrock aquifers, both the yields and the quality of groundwater vary considerably over the course of a season. In contrast, flows that are sustained by deeper bedrock aquifers tend to be more consistent in terms of both yield and quality. Groundwater originating within the landslides and other slope deposits are locally significant because they sustain wetlands; however, they have little role in supporting the larger, continuous riparian and aquatic systems.

3.3.5 Sediment Processes

Like many arid systems, sediment yields in the San Juan and San Mateo watersheds generally exceed the transport capacity of the streams. Some of the less steep sub-basins are supply limited, but this is not the general trend for the watersheds. Consequently, San Juan and San Mateo creeks are generally depositional during large flow events. Approximately 80 percent of long-term sediment yields are produced during a few episodic events. Calculated potential average annual sediment yields for the San Juan Watershed range from 1,500 to 6,000 tons/mile^2. Using the Los Angeles District and Modified Universal Soil Loss Equation methods, predicted yields in San Juan Creek during a 100-year event range from 7,800 to 10,270 tons/mile^2. Base sediment yields may increase by factors of approximately 10, 7, 4, and 2 in the first four years following a major fire. In all cases, calculated sediment yields exceed estimated transport capacities by more than a factor of two. Furthermore, the estimated sediment yields do not account for the estimated one billion tons of landslide debris that could be mobilized during a major flood-fire sequence.

Calculated peak sediment transport rates indicate that in the San Juan Creek Watershed, Bell and Cañada Gobernadora canyons represent the largest sediment contribution to San Juan Creek. Cañada Gobernadora has recently exhibited increased sediment transport; however, this is likely due to the construction of Coto de Caza, as opposed to a natural phenomenon. In-channel sediment generation resulting from incision in lower Cañada Gobernadora also contributes to high sediment yield from this sub-basin. Of the sub-basins within the study area of the San Mateo Watershed, the Gabino sub-basins had the highest absolute transport capacity, while the Cristianitos sub-basin had the highest transport rate per unit area. Suspended sediment discharge in San Mateo Creek is generally less than in San Juan Creek for all measured flows. One factor that may contribute to the lower suspended sediment discharge in San Mateo Creek is the presence of less-erosive crystalline terrain in the basin geology (see *Figure 19-M*). This diatomaceous rock that underlies 10 percent of the drainage area in San Juan Creek is known to yield high quantities of sediment as it weathers. Another factor contributing to low yields of suspended sediment in San Mateo is the smaller drainage basin size.

A key element of any effective sediment management plan will be avoiding the creation of major new sources (or sinks) of sediment. New sources can include either new locations or mobilizing sediment through accelerating processes that have been recently inactive in the landscape (*e.g.*, landslides). The most common new source of sediment in a developing landscape is in-channel sediment generation associated with channel incision. Avoiding incision and channel widening are among the most promising approaches to managing sediment yields. Channel incision can increase sediment yields, often by 3 to 7 times, and can persist over a period of 2 to 3 decades. Non-incised, unchanneled reaches, such as portions of middle and upper Chiquita Canyon (as well as most of its tributaries), and middle Gobernadora are important opportunities to maintain existing channel configurations, principally through maintaining existing riparian woodlands plus keeping water tables up and changes in peak flows down, to the degree feasible.

Although avoiding inducing new sediment-generating locations or processes is the most promising approach to managing sediment yields, it should be coupled with land use planning that maintains sediment transport processes through designated channel reaches without interruption or in-stream modifications. This strategy not only will help ensure channel stability, but also will help sustain vegetation communities providing suitable habitat for sensitive species, such as the arroyo toad. As with management of hydrologic processes, it is important to remember that sediment yields can vary widely over time due to episodic events and long-term climatic cycles; land use designs must take these cycles into account.

3.3.6 Water Quality

Water quality constituents of concern in the study watersheds include temperature, turbidity, nutrients (primarily nitrogen and phosphorus), metals, and pesticides (primarily diazinon and chloropyrifos). A significant amount of water quality data has been collected for San Juan Creek since the 1950s. However, most of these data were for nutrients and bacteria and were collected during high-flow events. Unfortunately, there are limited available comparable baseline data for San Mateo Creek. Four water quality monitoring locations have been initiated as part of the baseline data collection for the SAMP and should provide useful information.

The data collected along San Juan Creek suggest that there are one or more significant sources of nitrogen loading between the Caspers and La Novia monitoring stations. It is impossible to ascertain the sources of the additional loading, but it may include factors such as the location of several nursery operations downstream of the Caspers site, development on San Juan tributaries (*e.g.,* Coto de Caza on Gobernadora), and the large amount of grassland in the sub-basins below Caspers. Nitrate measurements at La Novia show a trend of increasing concentration with increased stream discharge, from 0 to approximately 100 cfs (where nitrate concentration = 2.5 to 3.0 milligrams per liter [mg/l]). At higher discharges, nitrate concentration decreases until it drops to background levels at a discharge of approximately 1,000 cfs. These data are consistent with N mobilization either through direct transport by surface storm water runoff or by the displacement of nitrate rich groundwater into the stream system. Nitrogen levels at higher discharge rates reflect the effects of complete washout and subsequent dilution and watershed saturation. The monitoring data for phosphate at La Novia indicate that there is a tendency to higher phosphate levels with increasing stream discharge. This relationship is consistent with erosion being the primary contributor of phosphorus loading via phosphate adsorbed to particulates.

The streams in the San Juan Creek Watershed appear to be generally nitrogen limited (*i.e.,* NIP ratio <10). However, for San Juan Creek at La Novia, the NIP ratio is a function of stream discharge. At both very low and very high flow rates, the San Juan system is nitrogen-limited. However, at intermediate flow rates, the nitrate concentrations have increased (with increasing discharge as discussed above) but phosphate levels have yet to increase significantly, resulting in a transient condition where phosphate is the limiting nutrient. The general pattern of nitrogen being the limiting nutrient implies that algal primary productivity within the San Juan Creek Watershed could generally be reduced most effectively by reducing phosphorus loadings to the streams. Similarly, primary productivity would likely be impacted more by increases in nitrogen loadings than by increases in phosphorus.

Orange County Planning Facilities and Resources Department (PFRD) has monitored several metals in San Juan Creek since the early 1990s. The Orange County data are a composite of both dissolved and particulate phases; however, in waters with typical pH levels of 7 to 8, as found in San Juan Creek, metals are most likely to be found in their particulate phase. Therefore, one can assume that the more bio-available dissolved fraction will have lower concentrations than the particulate phase. Because metals are typically found in their particulate form and are, therefore, transported in the same manner as sediments, it is unlikely that significant metal transport will occur during dry weather, as the majority of sediment transport occurs during storm events. An initial examination of the San Juan Creek monitoring data shows that, with the notable exception of zinc, most metals are found in concentrations below the detection limits.

Monitoring data for zinc at La Novia show that the highest levels of zinc occur at flows between 10 and l00 cfs. This pattern likely results from increased sediment mobilization with higher rainfall and stream discharge, increasing the concentration of particle-bound zinc in San Juan Creek. At the highest flows, zinc concentrations decrease as a result of dilution from rainwater and removal of contaminated sediments from the system. The monitoring results indicate that, on several occasions, zinc concentrations surpass both the acute and chronic toxicity objectives for fresh surface waters (21 micrograms per liter [µg/L] and 23 µg/L) set by other RWQCBs in California (RWQCB 1995). It is not clear whether the zinc originates from anthropogenic origins, or if reflects higher naturally occurring concentrations of zinc in the Monterey Shale or other sediment-generating geologic units which outcrop just upstream of this station.

Bacterial monitoring at the mouth of San Juan Creek indicates persistently high counts of total and fecal coliform (FC), and enterococcus (EC). Total bacterial counts frequently exceed 200 milliliters (ml), which is the RWQCB objective for contact recreation. For calendar year 2000, the log mean fecal coliform concentration at Del Obispo Park was roughly 300 ml. The log mean enterococci concentration for calendar year 2000 was approximately 540 ml. These monitoring stations are located at the most downstream reaches of San Juan Creek, within and below extensive urbanized areas. Although the sources of these bacterial contaminants cannot be ascertained with existing data, future land use changes in the upper watershed will need to protect against additional loadings that may exacerbate the existing bacterial contamination problems in the lower San Juan Creek Watershed.

Pollutant pathways and cycles within the San Juan and San Mateo Creek watersheds can be generalized based upon critical characteristics of sub-basin terrain types. Sandy terrains typically favor infiltration, mobilizing pollutants in subterranean pathways with little or no biogeochemical cycling taking place in surface waters. Silty terrains have higher runoff rates and often contribute fine sediments (that have the ability to adsorb metals and pesticides) to downstream waterways. Clayey terrains are characterized by very high surface runoff rates and therefore play only a minor role in groundwater processes. Although typically resistant to erosion, clay soils can be a significant source of turbidity where incision occurs. Crystalline terrains have high runoff rates during larger storms and, in a natural state, produce much of the sediment and eroded soil that moves down the creeks.

Pollutants may travel with storm water or dry season runoff in either the dissolved or particulate phases. Therefore, a series of water quality management features (*i.e.*, a “treatment train”) may be the most appropriate strategy to control all potential sources of water quality impairment. This “treatment train” should involve a combination of land use and management features, such as promotion of infiltration, retention facilities, series of water quality wetlands, and streamside buffers.

SECTION 3.4 WILDLIFE AND PLANTS

The County, landowners, and the wildlife agencies provided the Science Advisors with a list of wildlife and plant species to be considered in the conservation planning process. While the list provided to the Science Advisors is not exhaustive of all species that might be of concern for conservation planning in southern California, it provides a wide range of species that are representative of the wildlands in the study area and species that ultimately may be selected for regulatory coverage.

3.4.1 Listed Species and Other Planning Species

The Science Advisors developed a species planning hierarchy for the purpose of conducting conservation analyses based on life history characteristics, degree of rarity or endemism, regional and global context, response to management, extant population size and trend, genetics, and other variables as necessary. Species were assigned to one of three groups based on these factors.

a. Group 1

Minimal conservation action is needed for Group1 species. Their conservation would be minimally affected by the outcome of the planning process based on the following criteria:

- The conservation would have a very limited impact on the species;
- The species is not found or is insignificant in the study area; and/or
- The species has very high population numbers in the study area.

The Group 1 species include:

Birds
Allen's hummingbird (*Selasphorus sasin*)
American bittern (*Botarus lentiginosus*)
bald eagle (*Haliaeetus leucocephalus*)
bank swallow (*Riparia riparia*)
Belding's Savannah sparrow (*Passerculus sandwichensis beldingi*)
black rail (*Laterallus jamaicensis*)
black swift (*Cypseloides niger*)
black tern (*Childonias niger*)
Brewer's sparrow (*Spizella breweri*)
brown pelican (*Pelecanus occidentalis*)
California least tern (*Sterna antillarum browni*)
canvasback (*Aythya valisineria*)
clapper rail (*Rallus longirostris*)

common loon (*Gavia immer*)
Costa's hummingbird (*Calypte costae*)
gull-billed tern (*Sterna nicoltica*)
hairy woodpecker (*Picoides villosus*)
harlequin duck (*Histrionicus histrionicus*)
hepatic tanager (*Piranga flava*)
hermit warbler (*Dendroica occidentalis*)
horned grebe (*Podiceps auritus*)
least bittern (*Ixobrychus exilis*)
Lewis' woodpecker (*Melanerpes lewis*)
long-billed curlew (*Numenius americanus*)
mountain plover (*Charadrius montanus*)
olive-sided flycatcher (*Contopus borealis*)
osprey (*Pandion haliaetus*)
peregrine falcon (*Falco peregrinus*)
prairie falcon (*Falco mexicanus*)
purple martin (*Progne subis*)
reddish egret (*Egretta rufescens*)
rufous hummingbird (*Selasphorus rufus*)
large-billed Savannah sparrow (*Passerculus sandwichensis rostratus*)
spotted owl (*Strix occidentalis*)
summer tanager (*Piranga rubra*)
Vaux's swift (*Chaetura vauxi*)
Virginia warbler (*Vermivora virginiae*)
western grebe (*Aechmophorus occidentalis*)
western snowy plover (*Charadrius alexandrinus nivosus*)
white-faced ibis (*Plegadis chihi*)
yellow rail (*Coturnicops noveboracensis*)

Reptiles
southern sagebrush lizard (*Sceloporus graciosus vanderburgianus*)

Mammals
San Diego desert woodrat (*Neotoma lepida intermedia*)
Stephens' kangaroo rat (*Dipodomys stephensi*)

b. Group 2

Group 2 species are best conserved by protecting vegetation communities providing habitat at a landscape level through general NCCP/MSAA/HCP reserve design tenets and through adaptive management. Their conservation can be inferred from a well-planned and managed network of reserves in a functioning landscape. Criteria for Group 2 species include one or more of the following:

- The species is relatively widespread in the study area;
- The species occurs in relatively robust populations within the study area and possibly elsewhere;
- Life history characteristics respond to habitat/landscape-level conservation;
- Detailed surveys or inventories are not crucial in order to conserve the species;
- The species is known to, or likely to, respond well to habitat management;
- The species is locally genetically indistinct; or
- No individual action is needed other than habitat conservation and management.

Group 2 wildlife species are listed in *Table 3-3* and Group 2 plant species are listed in *Table 3-4*.

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
Birds				
American White Pelican (*Pelecanus erythrorhynchos*)	None/CSC/2	large open water bodies	No data points	NA
Barn Owl (*Tyto alba*)	None/None/2, Umbrella Species	grassland[2], agriculture, riparian, woodland	57 historic nest sites[3]	27,160
Bell's Sage Sparrow (*Amphispiza belli belli*)	FSC, BCC/CSC/2	coastal sage scrub, chaparral	2 locations	29,371
Bewick's Wren (*Thyromanes bewickii*)	None/None/2	coastal sage scrub, chaparral, riparian, woodland	No data points	37,117
Black Skimmer (*Rynchops niger*)	FSC, BCC/CSC/2	open water, marsh	No data points	NA
Burrowing Owl (*Athene cunicularia*)	FSC, BCC/CSC/3	grassland, barley fields	No data points	17,761
Coastal Cactus Wren (*Campylorhynchus brunneicapillus couesi*)	BCC/CSC/2	coastal sage scrub w/southern cactus scrub	1,408 locations	20,855
Coastal California Gnatcatcher (*Polioptila californica californica*)	FT/CSC/2	coastal sage scrub	737 locations	20,855
California Gull (*Larus californicus*)	None/CSC/2	agriculture, water, beach, marsh	No data points	4,109
California Horned Lark (*Eremophila alpestris actia*)	None/CSC/2	grassland, agriculture, woodland	16 locations	22,035
California Thrasher (*Toxostoma redivivum*)	FSC/None/2	coastal sage scrub, chaparral	No data points	29,371
Cooper's Hawk (*Accipiter cooperii*)	None/CSC/2	woodland, riparian	44 historic nest sites	7,446

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
Double-crested Cormorant (*Phalacrocorax auritus*)	None/CSC/2	open water, salt marsh	No data points	NA
Elegant Tern (*Sterna elegans*)	FSC, BCC/CSC/2	open water	No data points	NA
Ferruginous Hawk (*Buteo regalis*)	FSC, BCC/CSC/3	grassland, agriculture	No data points	19,414
Golden Eagle (*Aquila chrysaetos*)	BCC/CSC, FP/2, Umbrella Species	coastal sage scrub, chaparral, grassland, agriculture, cliff & rocks	1 historic nest site	48,795
Grasshopper Sparrow (*Ammodramus savannarum*)	None/None/2	Grassland, barley fields	730 locations	17,761
Lark Sparrow (*Chondestes grammacus*)	FSC/None/2	grassland-shrub-woodland margins	No data points	NA[4]
Lawrence's Goldfinch (*Carduelis lawrencei*)	FSC, BCC/None/2	coastal sage scrub, chaparral	1 location	29,371
Least Bell's Vireo (*Vireo bellii pusillus*)	FE/SE/3	southern willow scrub riparian and willow riparian forest	60 nesting sites	1,111
Loggerhead Shrike (*Lanius ludovicianus*)	FSC, BCC/CSC/2	coastal sage scrub, grassland, agriculture	21 locations	40,269
Long-eared Owl (*Asio otus*)	None/CSC/3	woodland, riparian	8 historic nest sites	7,746
Merlin (*Falco columbarius*)	None/CSC/2	grassland, agriculture	No data points	19,414
Northern Harrier (*Circus cyaneus*)	None/CSC/2	marsh (breeding); grassland, agriculture, coastal sage scrub (foraging)	2 historic nest sites	40,269 (foraging)
Pacific Slope Flycatcher (*Empidonax difficilis*)	None/None/2	woodland, riparian, chaparral	No data points	16,261
Red-breasted Sapsucker (*Sphyrapicus ruber*)	FSC/None/2	Woodland	No data points	2,620
Red-shouldered Hawk (*Buteo lineatus*)	None/None/2	woodland, riparian	78 historic nest sites	7,745
So. Ca. Rufous-crowned Sparrow (*Aimophila ruficeps canescens*)	None/CSC/2	coastal sage scrub	411 locations	20,855
Sharp-shinned Hawk (*Accipiter striatus*)	None/CSC/2	coastal sage scrub, grassland, woodland, riparian	No data points	43,972
Short-eared Owl (*Asio flammeus*)	None/CSC/2	saltmarsh, grassland, agriculture	No data points	19,414
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	FE/SE/3	southern willow scrub and willow riparian forest	7 nesting sites	1,111
Swainson's Hawk (*Buteo swainsoni*)	FSC, BCC/ST/2	grassland, agriculture	No data points	19,414
Tricolored Blackbird (*Agelaius tricolor*)	FSC, BCC/CSC/3	marsh (breeding); grassland, agriculture	Several historic nesting areas –	19,414 (foraging)

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
		(foraging)	see text in Chapter 13.	
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	FC, BCC/SE/3	southern willow scrub and willow riparian forest	No data points	1,111
White-tailed Kite (*Elanus leucurus*)	FSC, MNBMC/FP/3	riparian, woodland, grassland, agriculture, coastal sage scrub	36 historic nest sites	48,015
Yellow-breasted Chat (*Icteria virens*)	None/CSC/3	riparian	130 nesting sites	5,125
Yellow Warbler (*Dendroica petechia*)	None/CSC/3	riparian	34 nesting sites	5,125
Amphibians				
Arroyo Toad (*Bufo californicus*)	FE/CSC/3	riparian, water courses with sandy benches along streams	See text	See text
California Red-legged Frog (*Rana aurora draytonii*)	FT/CSC/3	riparian, water courses	No data points	NA
Coast Range Newt (*Taricha torosa torosa*)	None/CSC/2	coastal sage scrub, chaparral in association with water	No data points	NA
Western Spadefoot Toad (*Scaphiopus hammondii*)	FSC/CS/3	coastal sage scrub, chaparral, grassland, vernal pool	22 locations	NA
Reptiles				
California Glossy Snake (*Arizona elegans occidentalis*)	None/None/3	coastal sage scrub, chaparral, grassland	4 locations	44,700
California Mountain Kingsnake (*Lampropeltis zonata*) (San Diego population)	None/CSC/2	coniferous forest, chaparral (high elevation)	No data points	NA
Coast Patch-nosed Snake (*Salvadora hexalepis virgultea*)	None/CSC/2	coastal sage scrub, chaparral, grassland	3 locations	44,700
Coastal Western Whiptail (*Cnemidophorus tigris multiscutatus*) [new name: *Aspidoscelis tigris stejnegeri*]	None/None/2	coastal sage scrub	85 locations	20,855
Coronado Skink (*Eumeces skiltonianus interparietalis*)	None/CSC/2	chaparral, grassland, coastal sage scrub, coniferous forest	20 locations *Eumeces skiltonianus*. May not all be Coronado skink	NA
Northern Red-diamond Rattlesnake (*Crotalus ruber ruber*)	None/CSC/3	coastal sage scrub, chaparral, grassland	18 locations	44,700
Orange-throated Whiptail (*Cnemidophorus hyperythrus beldingi*) [new name: *Aspidoscelis hyperythra beldingi*]	None/CSC/2	coastal sage scrub, chaparral, woodland	174 locations	31,992
Rosy Boa (*Charina trivirgata*)	FSC/None/2	chaparral, coastal sage scrub with cliff & rock	3 locations	NA

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
San Diego Banded Gecko (*Coleonyx variegatus abbotti*)	None/None/3	chaparral, coastal sage scrub with cliff & rock	1 location	NA
San Diego Horned Lizard (*Phrynosoma coronatum blainvillei*) (most recent adopted common name is coast horned lizard, blainvillei population)	None/CSC/2	coastal sage scrub, chaparral	50 locations	29,371
San Diego Ringneck Snake (*Diadophis punctatus similis*)	None/None/2	woodland, grassland, agriculture, riparian	9 locations	27,160
Silvery Legless Lizard (*Anniella pulchra pulchra*)	FSC/CSC,/3	coastal sage scrub, chaparral, riparian, beach; sandy soils	No data points	NA
Southwestern Pond Turtle (*Emys [=Clemmys] marmorata pallida*)	FSC/CSC/3	ponds, water courses	12 locations	NA
Two-striped Garter Snake (*Thamnophis hammondii*)	None/CSC/3	riparian, vernal pool, marsh, open water, water courses	7 locations	6,217
Mammals				
California Leaf-nosed Bat (*Macrotus californicus*)	None/CSC/2	habitat associations not well understood	No data points	NA
California Mastiff Bat (*Eumops perotis californicus*)	FSC/CSC/2	cliff & rock; forages widely	No data points	NA
Dulzura California Pocket Mouse (*Chaetodipus californicus femoralis*)	None/CSC/2	coastal sage scrub, chaparral	No data points	29,371
Long-legged Myotis (*Myotis volans*)	FSC/None/2	woodland, riparian	No data points	7,746
Northwestern San Diego Pocket Mouse (*Chaetodipus fallax fallax*)	None/CSC/2	coastal sage scrub (sparse)	No data points	NA
Pacific Pocket Mouse (*Perognathus longimembris pacificus*)	FE/CSC/3	coastal sage scrub (sparse)	No data points	NA
Pallid Bat (*Antrozous pallidus*)	None/CSC/2	coastal sage scrub, chaparral, woodland	No data points	31,992
San Diego Black-tailed Jackrabbit (*Lepus californicus bennettii*)	None/CSC/3	coastal sage scrub, chaparral, grassland, agriculture	No data points	NA
Southern Grasshopper Mouse (*Onychomys torridus ramona*)	FSC/CSC/3	grassland, sparse coastal sage scrub	No data points	NA
Spotted Bat (*Euderma maculatum*)	FSC/CSC/2	riparian (forages over water)	No data points	5,125
Townsend's Big-eared Bat (*Corynorhinus townsendii townsendii*)	FSC/CSC/2	grassland, agriculture, woodland, caves, crevices, buildings	No data points	22,035
Fish				
Arroyo Chub (*Gila orcutti*)	FSC/CSC/3	riparian, water courses	Arroyo Trabuco, San Juan Creek, lower Cañada Gobernadora	NA

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
Southern Steelhead (*Oncorhynchus mykiss*)	FE/CSC/3	riparian, water courses	Not documented within planning area. Spawns in San Mateo Creek and its tributary Devil Canyon Creek and potentially present in lower Arroyo Trabuco Creek, a tributary to San Juan Creek.	NA
Threespine Stickleback (*Gasterosteus aculeatus* spp.)	None/None/3	riparian, water courses	Arroyo Trabuco, upper San Juan Creek, upper Bell Canyon	NA
Tidewater Goby (*Eucyclogobius newberryi*)	FE/CSC/2	riparian, water courses	Known from downstream of planning area at mouth of San Mateo Creek.	NA
Invertebrates				
Harbison's Dun Skipper (*Euphyes vestris harbisoni*)	None/None/3	woodland w/larval host plant San Diego sedge (*Carex spissa*)	No data points	NA
Quino Checkerspot Butterfly (*Euphydryas editha quino*)	FE/None/3	coastal sage scrub, grassland w/larval host plant dot-seed plantain (*Plantago erecta*)	No data points	NA
Riverside Fairy Shrimp (*Streptocephalus wootoni*)	FE/None/3	vernal pools	Four general locations: Saddleback Meadows, Antonio Parkway-FTC North, Chiquita Ridge, Radio Tower Road	NA
San Diego Fairy Shrimp (*Branchinecta sandiegonensis*)	FE/None/3	vernal pools	Two general locations:	NA

TABLE 3-3
GROUP 2 AND GROUP 3 WILDLIFE SPECIES

Common Name (Scientific Name)	Federal/State/ Science Advisors Group	Vegetation Communities Providing Habitat	Number of Locations/ Populations	Suitable Habitat Acreage in Planning Area[1]
			Chiquita Ridge, Radio Tower Road	

[1] Riparian/wetland acreage is based on the 2004 NCCP vegetation database. During wetland delineations in proposed development areas some mapping errors were detected and revisions to the riparian/wetland database in these areas will be reported in the next version of the NCCP/MSAA/HCP.

[2] Alkali meadow is included in the grassland category as habitat.

[3] Nest sites for raptors are listed as historic because they reflect a cumulative database collected from about 1990 to 2000. Only a small proportion of nest sites may be active at any given time.

[4] Potential habitat was not estimated for species with specific microhabitat requirements.

Federal and State Designations

BCC U.S. Fish and Wildlife Service Bird of Conservation Concern
CAREG California Game Species
CSC California Special Concern Species
FC Federal Candidate Species
FE Federally Listed Endangered Species
FP State Fully Protected
FSC Federal Species of Concern
FT Federally Listed Threatened Species
MNBMC U.S. Fish and Wildlife Service Migratory Nongame Birds of Management Concern
SE State Listed Endangered
SE State Listed Endangered
ST State Threatened

Science Advisors Categories

1. Species whose conservation is minimally affected by the reserve planning process
2. Species conserved most effectively at the habitat or landscape level.
3. Species requiring species-level conservation action.

Umbrella Species - Species that have large or broad habitat requirements that could serve other species

TABLE 3-4
GROUP 2 AND GROUP 3 PLANT SPECIES

Common Name (Scientific Name)	Status Federal/State/ CNPS/Science Advisors Group	Vegetation Community Associations	Occurrence in Study area
Blochman's Dudleya (*Dudleya blochmaniae* ssp. *blochmaniae*)	None/None/List 1B.1	coastal bluff scrub, coastal sage scrub, Valley and foothill needlegrass grassland	No locations in database.
Catalina Mariposa Lily (*Calochortus catalinae*)	None/None/List 4.2	coastal sage scrub, chaparral, Valley and foothill needlegrass grasslands in heavy soils	The planning area supports about 4,900 individuals in 129 locations. Occurs on Chiquita Ridge, in Cañada Gobernadora, the northeast portion of the Talega Development and the Saddleback Meadows area.
Chaparral Beargrass (*Nolina cismontana*)	None/None/List 1B.2	chaparral and coastal sage scrub; mostly associated with Cieneba sandy loam and Cieneba-Rock outcrop	Occurs in three general areas: 1 individual east of Live Oak Canyon Road, 1 individual east of Lake Mission Viejo near Los Alisos

TABLE 3-4
GROUP 2 AND GROUP 3 PLANT SPECIES

Common Name (Scientific Name)	Status Federal/State/ CNPS/Science Advisors Group	Vegetation Community Associations	Occurrence in Study area
		complex	Boulevard and 6 individuals on the steep, south-facing slopes east of the Northrop Grumman facility.
Cliff Spurge (*Euphorbia misera*)	None/None/List 2.2	sea bluffs, coastal sage scrub	No locations in database.
Coastal Goldenbush (*Isocoma menziesii* var. *sedoides?*)	None/None/None/3	exposed areas on coastal bluffs, coastal bluff scrub	No locations in database.
Coulter's Matilija Poppy (*Romneya coulteri*)	None/None/List 4.2	Coastal sage scrub and chaparral, dry washes, canyons, and mesic slopes	No locations in database, but one location anecdotally known from upper Chiquita Canyon north of Oso Parkway.
Coulter's Saltbush (*Atriplex coulteri*)	None/None/List 1B.2	coastal bluff scrub, coastal sage scrub, Valley and foothill needlegrass grasslands; associated with alkaline or clay soils	The planning area supports approximately 3,100 individuals in 34 locations. Known from three general locations in the planning area: Chiquita Canyon, upper Cristianitos Canyon and upper Gabino Canyon, with the vast majority in Chiquita. Occurs in alkaline soils and is associated with southern tarplant in Chiquita Canyon.
Curving Tarweed (*Holocarpha virgata* ssp. *elongata*)	None/None/List 4.2	coastal sage scrub, Valley and foothill needlegrass grasslands, chaparral, and cismontane woodland	No locations in database.
Heart-leaved Pitcher Sage (*Lepechinia cardiophylla*)	None/None/List 1B.2	chaparral above 1,000 feet, cismontane woodland, coniferous forest	Two populations known from Trabuco Peak in CNF.
Intermediate Mariposa Lily (*Calochortus weedii* var. *intermedius*)	None/None/List 1B.2	chaparral, coastal sage scrub, coastal sage scrub-grassland ecotone, purple needlegrass grasslands	Much of *C. weedii* in the planning area occurs as a Weeds'-intermediate mariposa lily hybrid. It generally occurs in four main areas. Chiquita Canyon/Chiquadora Ridge, Gobernadora east of the creek/northern Central San Juan Creek sub-basin, Cristianitos Canyon/southern Trampas Canyon sub-basins, and La Paz Canyon. A few scattered locations also occur in the Foothill-Trabuco Specific Plan Area on Saddleback Meadows. Except for the La Paz population, this species tends to occur in association with many-stemmed dudleya in the planning area. There are about 21,040 individuals in 184 locations in the planning area.
Many-stemmed Dudleya (*Dudleya multicaulis*)	None/None/List 1B.2	coastal sage scrub, chaparral, Valley needlegrass grasslands; mesic barrens and cobbly clay soils	The planning area supports an estimated 65,245 individuals in 389 locations. Known from five main areas in the planning area: Chiquita Ridge; Chiquadora Ridge; Gobernadora/ Central San Juan east of Gobernadora Creek and north of Colorspot Nursery; Trampas Canyon/Cristianitos Canyon extending south to the Talega development in the San Clemente Watershed; and upper Gabino and La Paz canyons. A smaller cluster occurs east of the Northrop Grumman facilities on the

TABLE 3-4
GROUP 2 AND GROUP 3 PLANT SPECIES

Common Name (Scientific Name)	Status Federal/State/ CNPS/Science Advisors Group	Vegetation Community Associations	Occurrence in Study area
			mesa. There also is a single record for the Bell Canyon area on Starr Ranch (F. Roberts 1997) and locations in Caspers Wilderness Park not in the database, but these populations are considered to be small.
Ocellated Humboldt Lily (*Lilium humboldtii* spp. *ocellatum*)	NoneNone-/List 4.2	oak woodland and stream courses in foothill-mountain transition zone	Suitable habitat on Starr Ranch, Caspers Wilderness Park and in the CNF. Potentially in the Foothill-Trabuco Specific Plan Area.
Pacific Saltbush (*Atriplex pacifica*)	None/None/List 1B.2	coastal bluff scrub, coastal sage scrub, alkali playas	No locations in database.
Palmer's Grapplinghook (*Harpagonella palmeri*)	None/None/List 4.2	open patches of coastal sage scrub, coastal sage scrub-grassland ecotone, purple needlegrass grassland	The planning area supports an estimated 32,965 individuals in 103 locations. Occurs on Chiquadora Ridge, east of Gobernadora Creek in the Gobernadora and Central San Juan sub-basins, and in Cristianitos Canyon.
Parish's Saltbush (*Atriplex parishii*)	NoneNone-/List 1B.1	alkali swales, sinks, depressions, and grasslands with heavy clay-alkali components	No locations in database.
Parry's Tetracoccus (*Tetracoccus dioicus*)	None/None/List 1B.2	chaparral and coastal sage scrub on gabbroic soils	Only known from CNF.
Prostrate Spineflower (*Chorizanthe procumbens*)	None/None/None/3	chaparral, coastal sage scrub, pinyon-juniper woodland, Valley needlegrass grassland; associated with weathered mesa soils and gabbroic clay	No locations in database in planning area but found along Cristianitos Road south of planning area.
Rayless Ragwort (*Senecio aphanactis*)	None/None/List 2.2	coastal sage scrub, cismontane woodland, alkaline soils	No locations in database.
San Miguel Savory (*Satureja chandleri*)	None/None/List 1B.2	chaparral, oak woodlands, oak forest, shaded stream courses	Known from Upper Hot Spring Canyon in CNF.
Southern Tarplant (*Centromadia parryi* spp. *australis*)	None/None/List 1B.1	alkali soils, sinks, depressions, and grasslands with heavy clay-alkali components	Limited to two sub-basins in the planning area. The largest population is in Chiquita Canyon and, including the Tesoro mitigation site, numbers more than 135,000 in about 38 discrete polygons. A large population numbering 10,000+ individuals occurs on the GERA site in Gobernadora.
Sticky Dudleya (*Dudleya viscida*)	None/None/List 1B.2	coastal bluff scrub, coastal sage scrub, chaparral; on shaded steep rocky cliffs and canyon walls	No locations in database. Suitable habitat on Starr Ranch, Caspers Wilderness Park and in CNF.
Summer-holly (*Comarostaphylos diversifolia* spp. *diversifolia*)	None/None/List 1B.2	chaparral	No locations in database.
Thread-leaved Brodiaea (*Brodiaea filifolia*)	FT/SE/List 1B.1	coastal sage scrub, chaparral, grassland, vernal pools; heavy clay soils	About 9,540 flowering stalks in 38 locations counted in the planning area. Found in seven general locations in the planning area, excluding the translocated population at Forster Ranch: Chiquadora Ridge (~

TABLE 3-4
GROUP 2 AND GROUP 3 PLANT SPECIES

Common Name (Scientific Name)	Status Federal/State/ CNPS/Science Advisors Group	Vegetation Community Associations	Occurrence in Study area
			2,000 flowering stalks); Cristianitos Canyon; lower Cristianitos/Gabino canyons (~6,100 individuals); southern Trampas Canyon sub-basin; middle Gabino Canyon sub-basin, Talega ridgeline east of Northrop Grumman; and just east of Trabuco Creek in the Arroyo Trabuco Golf Course area.
Western Dichondra (*Dichondra occidentalis*)	None/None/List 4.2	coastal sage scrub, chaparral, burned areas	Occurs in a 25-acre mapped area in the upper/middle portion of Gabino Canyon and several small populations in Cristianitos Canyon, altogether totaling about 40 acres.

CNPS (California Native Plant Society)

Lists
- 1A: Presumed Extinct in California
- 1B: Rare or Endangered in California and Elsewhere
- 2: Rare or Endangered in California, More Common Elsewhere
- 3: Need More Information
- 4: Plants of Limited Distribution

Threat Code Extension
- 1 Seriously endangered in California (over 80% of occurrences threatened/high degree and immediacy of threat)
- 2 Fairly endangered in California (20 – 80% occurrence threatened)

c. Group 3

Group 3 species are best conserved at the species-specific level. They require one or more of three types of conservation action: **(1)** fine-tuning of reserve design or specific management activities; **(2)** reintroduction and/or specific enhancement; or **(3)** additional data and research are necessary to determine basic needs. Criteria for Group 3 species include one or more of the following:

- The species is known or predicted to occur in extremely low populations;
- The species is narrowly endemic in the study area;
- The species has highly specialized life history requirements;
- The study area is known to be crucial to the survival of the entire species;
- The species is known or suspected to respond poorly to management;
- The species is highly sensitive to small changes in the landscape or habitat;
- The species is dependant on intensive conservation activities; or
- The species is widespread, but extremely uncommon.

Group 3 wildlife species also are listed in *Table 3-3* and Group 3 plant species are listed in *Table 3-4*.

In addition to the Group 1, 2 and 3 species, the Science Advisors identified several wildlife species that may serve as effective "umbrella" species for conservation planning purposes. These umbrella species have habitat requirements that would provide for other species. For example mountain lion (*Puma concolor*) and bobcat require landscape-level habitat linkages and movement corridors that may serve other species. Species with large foraging territories such as large raptors are found in vegetation communities capable of providing habitat for other species. Umbrella species identified by the Science Advisors include:

- American badger (*Taxidea taxus*)
- bobcat (*Lynx rufus*)
- coyote (*Canis latrans*)
- mountain lion (*Puma concolor*)
- red-tailed hawk (*Buteo jamaicensis*)
- great horned owl (*Bubo virginianus*)
- golden eagle (*Aquila chrysaetos*)
- barn owl (*Tyto alba*)

3.4.2 Sensitive Wildlife and Plant Species Distributions in the Planning Area and Subareas

The planning area is divided into the San Juan Creek and San Mateo Creek watersheds and their respective sub-basins for the purpose of discussing the distribution of listed and other sensitive wildlife (see *Figure 24-M*). The San Juan Creek Watershed also includes areas that have not been subdivided into discrete sub-basins for planning purposes. These areas include the Foothill-Trabuco Specific Plan area and Arroyo Trabuco extending south from the CNF to the boundary of San Juan Capistrano. Two other watersheds overlap with the NCCP/MSAA/HCP planning area boundary that was not included in the SAMP studies by WES/CRREL and PCR/BALANCE/PWA: the San Clemente Watershed and the Aliso Watershed. The San Clemente Watershed encompasses undeveloped land in the City of San Clemente, Segunda Deshecha and Prima Deshecha. The Aliso Watershed located in the northwestern portion of the planning area includes Aliso Creek and a few isolated areas of the open space within existing urban development that play little role in the NCCP/MSAA/HCP planning.

Figure 24-M also shows the relationship between the sub-basins and other watersheds and the Subareas. Subarea 1 encompasses the sub-basins in RMV that were the focus of the SAMP studies as well as portions of the San Juan Creek Watershed that include Caspers Wilderness Park, Riley Wilderness Park, Starr Ranch, and Arroyo Trabuco, as well as Prima Deshecha that lies within the San Clemente Watershed. Subarea 2 is mostly in the San Juan Creek Watershed, but also includes a

small portion of the Aliso Watershed. Subarea 3 is entirely within the upper portion of the Gobernadora sub-basin. Subarea 4 is primarily in the San Clemente Watershed, with just a very small portion in the Aliso Watershed.

Table 3-5 provides a summary of the listed and sensitive species distributions broken out by Subareas and watersheds. *Table 3-5* shows that documented locations of listed and sensitive species are concentrated in Subarea 1 in the San Juan and San Mateo watersheds. This concentration partly reflects the large relative amount of natural vegetation communities/land covers in Subarea 1 compared to the other subareas; 39,165 acres or 74 percent of the total natural vegetation communities/land covers in the subareas (see *Table 3-1*). This concentration also reflects the comprehensive biological surveys in Subarea 1 conducted over the last 15 years by RMV and the Transportation Corridor Agencies for the FTC-North and SOCTIIP projects and a relative lack of survey data for Subarea 2 (the Foothill-Trabuco Specific Plan area).

A detailed narrative description of the species distributions and vegetation communities/land covers by watershed and sub-basins within watersheds is provided following *Table 3-5*.

a. San Juan Creek Watershed

Figures 25-R through *29-R* in the NCCP/MSAA/HCP map book provide "planning species" maps for coastal sage scrub, riparian/aquatic, historic raptor nest sites, grassland, and plants, respectively, for the San Juan Creek Watershed. *Chapter 4, Section 4.3* of this document describes the designation and use of planning species for the purpose of reserve design and evaluation. *Figure 30-R* shows sensitive non-planning wildlife and plant species in the San Juan Creek Watershed.

1. Chiquita Canyon Sub-basin

The Chiquita Canyon sub-basin is divided into three geographic areas: upper Chiquita Canyon, defined as the portion of the sub-basin north of Oso Parkway, middle Chiquita, defined as the portion of the sub-basin south of Oso Parkway to the "Narrows" and lower Chiquita Canyon defined as the portion of the sub-basin from the "Narrows" to the sub-basin boundary south of San Juan Creek and Ortega Highway. For discussion purposes, the Narrow Canyon sub-basin and the western portion of the Gobernadora sub-basin, referred to here as "Chiquadora Ridge," are included in the description below because they are is physically and biologically associated with the Chiquita sub-basin (*Figure 25-R*). The Chiquita Canyon sub-basin is located in Subarea 1.

TABLE 3-5
DOCUMENTED LOCATIONS OF LISTED AND SENSITIVE WILDLIFE AND PLANT SPECIES IN THE SUBAREAS

Species	Subarea 1			Subarea 2		Subarea 3	Subarea 4			
	San Juan WS	San Mateo WS	San Clemente WS	San Juan WS	Aliso WS	San Juan WS	San Juan WS	San Mateo WS	San Clemente WS	Aliso WS
Birds										
Barn Owl (Nest)	42	14	0	0	0	0	1	0	0	0
Bell's Sage Sparrow	1	0	0	0	0	1	0	0	0	0
California Gnatcatcher	481	24	14	18	0	64	79	5	38	0
Cactus Wren	969	192	10	69	6	101	31	7	9	0
California Horned Lark	13	2	0	0	0	0	0	0	0	0
Cooper's Hawk (Nest)	29	12	0	0	0	0	1	0	0	0
Grasshopper Sparrow	504	130	24	0	0	4	12	6	31	0
Great Horned Owl (Nest)	20	6	0	0	0	0	3	0	0	0
Lawrence's Goldfinch	0	0	0	0	0	1	0	0	0	0
Least Bell's Vireo	39	5	5	0	0	2	0	0	8	0
Loggerhead Shrike	8	1	0	0	0	0	4	0	5	0
Long-eared Owl (Nest)	5	3	0	0	0	0	0	0	0	0
Red-shouldered Hawk (Nest)	52	12	0	4	0	0	4	0	1	1
Red-tailed Hawk (Nest)	90	23	5	0	0	1	11	1	5	0
Rufous-crowned Sparrow	316	65	8	6	2	4	2	2	1	0
Sw. Willow Flycatcher	6	0	0	0	0	0	0	0	1	0
Tricolored Blackbird (Colony)	3	1	9	0	0	1	1	0	0	0
White-Tailed Kite (Nest)	26	5	0	0	0	0	2	1	1	0
Yellow Warbler	24	2	0	0	1	6	1	0	0	0
Yellow-breasted Chat	99	15	2	0	0	7	0	0	2	0
Reptiles										
Blind Snake	1	0	0	0	0	0	0	0	0	0
Coachwhip	3	0	0	0	0	0	0	0	0	0
Coast Patch-nosed Snake	2	1	0	0	0	0	0	0	0	0
Glossy Snake	4	0	0	0	0	0	0	0	0	0
Night Snake	3	0	0	0	0	0	0	0	0	0
N. Red-diamond Rattlesnake	10	6	0	0	0	0	1	0	1	0
Orange-throated Whiptail	158	11	0	2	0	1	0	0	0	0
Rosy Boa	3	0	0	0	0	0	0	0	0	0
San Diego Banded Gecko	1	0	0	0	0	0	0	0	0	0
San Diego Horned Lizard	31	17	0	0	0	2	0	0	1	0
San Diego Ringneck Snake	9	0	0	0	0	0	0	0	0	0
Southwestern Pond Turtle	6	2	0	0	0	0	0	0	0	0

TABLE 3-5
DOCUMENTED LOCATIONS OF LISTED AND SENSITIVE WILDLIFE AND PLANT SPECIES IN THE SUBAREAS

	Subarea 1			Subarea 2		Subarea 3	Subarea 4			
Species	**San Juan WS**	**San Mateo WS**	**San Clemente WS**	**San Juan WS**	**Aliso WS**	**San Juan WS**	**San Juan WS**	**San Mateo WS**	**San Clemente WS**	**Aliso WS**
Two-striped Garter Snake	5	2	0	0	0	0	0	0	0	0
Western Whiptail	75	6	0	0	1	2	0	0	0	0
Amphibians										
Arroyo Toad	Breeding Sites	Breeding Sites	0	0	0	0	0	0	0	0
Western Spadefoot Toad	17	5	0	0	0	0	0	0	0	0
Invertebrates										
Riverside Fairy Shrimp	3 pools	0	0	1 pool	5 pools	0	0	0	0	0
San Diego Fairy Shrimp	4 pools	0	0	0	0	0	0	0	0	0
Plants										
Beaked Spikerush	2 sites 1,501 plants	0	0	0	0	0	0	0	0	0
Catalina Mariposa Lily	99 sites 4,880 plants	4 sites 4 plants	1 site 1 plant	6 sites 6 plants	2 sites 2 plants	0	0	9 sites 148 plants	8 sites ? plants	0
Chaparral Beargrass	0	6 sites 6 plants	0	1 site 1 plant	0	0	0	0	0	1 site 1 plant
Coulter's Saltbush	28 sites 2,971 plants	6 sites 115 plants	0	0	0	0	0	0	0	0
Engelmann Oak	0	4 sites 6 trees	0	0	0	0	0	0	0	0
Fish's Milkwort	0	1 site 5 plants								
Many-stemmed Dudleya	206 sites 28,806 plants	174 sites 34,933 plants	0	0	0	0	0	6 sites 1,296 plants	1 site 190 plants	0
Mesa Brodiaea	0	2 sites 2 plants	0	0	0	0	0	0	0	0
Mud Nama	4 sites 10,350 plants	0	0	0	0	0	0	0	0	
Palmer's Grapplinghook	63 sites 21,744 plants	40 sites 11,220 plants	0	0	0	0	0	0	0	0
Paniculate Tarplant	1 site 182 plants	0	0	0	0	0	0	0	0	0

TABLE 3-5
DOCUMENTED LOCATIONS OF LISTED AND SENSITIVE WILDLIFE AND PLANT SPECIES IN THE SUBAREAS

Species	Subarea 1			Subarea 2		Subarea 3	Subarea 4			
	San Juan WS	San Mateo WS	San Clemente WS	San Juan WS	Aliso WS	San Juan WS	San Juan WS	San Mateo WS	San Clemente WS	Aliso WS
Payson's Jewelflower	0	1 site 1 plant	0	0	0	0	0	0	0	0
Piper's Rein Orchid	1 site 6 plants	0	0	0	0	0	0	0	0	0
San Diego Mountain Mahogony	0	1 site 4 plants	0	0	0	0	0	0	0	0
Salt Spring Checkerbloom	3 sites 1,503 plants	0	0	0	0	0	0	0	0	0
Small-flowered Microseris	2 sites 25 plants	22 sites 29,340 plants	2 sites 2 plants	0	0	0	0	0	0	0
Small-flowered Morning Glory	0	1 site 200 plants	0	0	0	0	0	0	0	0
Small-flowered Wild Petunia	1 site 1 plant	0	0	0	0	0	0	0	0	0
Southern Tarplant	38 sites 135,067 plants	0	0	0	0	0	0	0	0	0
Thread-leaved Brodiaea	10 sites 2,4108 plants	24 sites 6,970 plants	0	0	0	0	0	1 site 3 plants	3 sites 37 plants	0
Upright Burhead	0	1 site 1 plant	0	0	0	0	0	0	0	0
Vernal Barley	3 sites 5,401 plants	17 sites 7,393 plants	4 sites 18 plants	0	0	0	2 sites 2 plants	1 site 1 plant	8 sites 10,205 plants	0
Western Dichondra	0	4 sites 40 acres	0	0	0	0	0	0	0	0

Upland vegetation communities mostly are comprised of coastal sage scrub, agriculture, patches of native and annual grassland and patches of chaparral. The 2,016 acres of coastal sage scrub in the sub-basin, including Chiquadora Ridge and Narrow Canyon, supports more than 300 mapped locations of the California gnatcatcher, or about 41 percent of the locations in the planning area (*Figure 25-R*). The sub-basin provides breeding and/or foraging habitat for a variety of the other sensitive wildlife species, including coastal cactus wren, ferruginous hawk, prairie falcon, merlin, northern harrier, wintering burrowing owls, loggerhead shrike, grasshopper sparrow, rufous-crowned sparrow, California horned lark, orange-throated whiptail, coastal western whiptail, San Diego horned lizard, northern red-diamond rattlesnake, mule deer and mountain lion (*Figures 25-R* and *30-R*). Golden eagles whose territories are located in the CNF are known to occasionally forage in grasslands and agricultural areas of the sub-basin.

The mainstem creek supports herbaceous riparian, southern willow scrub, arroyo willow riparian forest, and coast live oak riparian forest that generally are suitable for the least Bell's vireo and several other sensitive riparian and aquatic species, including yellow-breasted chat, yellow warbler, southwestern pond turtle (near the confluence with San Juan Creek), western spadefoot toad, and two-striped garter snake (*Figures 26-R* and *30-R*). The riparian and woodland in the mainstem creek and side canyons also provide nest sites for several raptor species, including Cooper's hawk, white-tailed kite, red-shouldered hawk, great horned owl and barn owl (*Figure 27-R*). A tricolored blackbird breeding colony has been observed on slopes south of San Juan Creek behind an RMV residence in the recent past (300+ pairs in 2001; P. Bloom, pers. comm. 2002).

Vernal pools along Radio Tower Road south of Ortega Highway appear to be associated with localized bedrock landslides from the San Onofre and Monterey formations and support both the federally-listed Riverside fairy shrimp (vernal pool 2) and San Diego fairy shrimp (vernal pools 1 and 2), mud nama (CNPS List 2) and the western spadefoot toad.

The sub-basin provides both north-south and east-west movement opportunities for mountain lion, mule deer, bobcat, coyote and gray fox (see *Section 3.5*). Coastal sage scrub along Chiquita Ridge provides north-south movement opportunities for California gnatcatchers, cactus wrens, and other sensitive sage scrub species (*Figures 25-R* and *30-R*). A known important east-west movement route includes a wildlife corridor from Arroyo Trabuco situated between the Ladera Ranch and Las Flores developments. Based on existing landscape features, potential habitat linkages from Chiquita Ridge to Sulphur Canyon are located just north of the wastewater treatment plant and through the "Narrows" area south of Tesoro High School.

Five locations of the state- and federally-listed thread-leaved brodiaea occur on Chiquadora Ridge southeast of the treatment plant, including the eastern portion of the Chiquita sub-basin and the western portion of the Gobernadora sub-basin (*Figure 29-R*). Four of the five locations are small

(73, 2, 3 and 7 flowering stalks), but the easternmost location on the ridge has about 2,000 flowering stalks.

The sub-basin, including Chiquadora Ridge, supports four general areas of many-stemmed dudleya (*Figure 29-R*). Lower Chiquita Canyon east of the creek and south of treatment plant supports 41 locations totaling about 6,686 individuals. Chiquadora Ridge supports 47 locations numbering about 8,623 individuals. Approximately 18 locations occur on Chiquita Ridge comprising a total of about 1,349 individuals, including four locations totaling 100 to 420 individuals each. The ridgeline east of the "Narrows" in middle Chiquita supports four locations of dudleya, with one numbering about 370 individuals and the other three numbering from 46 to 75 individuals.

The sub-basin supports four general locations for southern tarplant (*Figure 29-R*). Middle Chiquita supports about 35 mapped locations ranging up to about 30,000 individuals in the largest. Estimated discrete locations numbering 7,000, 7,500, 10,000, 20,000, and 30,000 individuals, respectively, are located west of the creek. Locations east of the creek are more disparate and smaller, with the largest numbering about 750 individuals. The Tesoro High School Mitigation site in lower Chiquita supported approximately 1,100 individuals in 2000, 6,000 individuals in 2001 and 11,000 individuals in 2002 as determined during monitoring of the population. This population was introduced to the site in Fall of 1999 as mitigation for impacts to the tarplant at the High School site. This population appears to be self-sustaining and has increased for three consecutive years. Further south in lower Chiquita Canyon there is one population numbering about 400 individuals. A wetland seep between the Gobernadora and Chiquita sub-basins supports a few hundred individuals during optimal years.

The sub-basin supports five general locations of Coulter's saltbush (*Figure 29-R*). Lower Chiquita Canyon west of the creek supports two locations numbering 200 and 400 individuals. Middle Chiquita just above and below the "Narrows" supports numerous locations ranging from the 10s to 600 individuals. The location with 600 individuals is east and adjacent to the creek about midway between the "Narrows" and Tesoro High School. Locations with 150, 150 and 200 individuals are west of the creek. These locations overlap substantially with the largest southern tarplant population. Middle Chiquita just to the northwest of the treatment plant supports five locations, of which four are west of the creek. The locations west of the creek number 25, 50, 150 and 360 individuals and the location east of the creek has 100 individuals. Two small locations are located in a major side canyon southeast of the Narrows numbering six and 10 individuals, respectively. One small population of less than 20 individuals occurs with southern tarplant (noted above) at a wetland seep between the Gobernadora and Chiquita sub-basins.

Salt Spring checkerbloom occurs in two locations in the slope wetlands in lower Chiquita east of the creek (*Figure 29-R*). These locations number 300 and 1,200 individuals.

The sub-basin also supports populations of Palmer's grapplinghook and Catalina mariposa lily (*Figure 30-R*). The grapplinghook occurs in approximately 35 scattered locations on Chiquadora Ridge southeast of the wastewater treatment plant and at a location supporting about 300 individuals east of the "Narrows." The Catalina mariposa lily is more widely distributed in the sub-basin, with clusters of individuals on Chiquadora Ridge southeast of the wastewater treatment plant, on Chiquita Ridge west of the "Narrows" and on a ridgeline east of the "Narrows."

2. Gobernadora Sub-basin

The Gobernadora sub-basin is divided into two main geographic areas: upper Gobernadora, which includes the Coto de Caza residential development; and lower Gobernadora, which is under RMV ownership. In addition, as discussed above, the western portion of the sub-basin referred to as Chiquadora Ridge is physically and biologically associated with the Chiquita sub-basin, and was discussed above in that context. The upper Gobernadora sub-basin is in Subarea 3 and the lower Gobernadora sub-basin is in Subarea 1.

The valley floor of the sub-basin supports agriculture and grazing activities and is characterized by deep alluvial sandy deposits with interbedded clay lenses. The Gobernadora Ecological Restoration Area (GERA) in the lower portion of the creek is dominated by southern willow scrub. The rolling terrain on the east side of the creek supports a mixture of agriculture, coastal sage scrub, chaparral and oak woodlands (*Figure 26-R*).

The Gobernadora sub-basin, excluding Chiquadora Ridge west of the creek, supports about 1,239 acres of coastal sage scrub and 74 mapped locations of the California gnatcatcher. The slopes east of the creek support a smaller population of the California gnatcatcher compared to the population west of the creek, probably due to the higher percentage of chaparral. Other upland wildlife species in the sub-basin include cactus wren, rufous-crowned sparrow, grasshopper sparrow, coast patch-nosed snake, northern red-diamond rattlesnake, western whiptail, San Diego horned lizard, Coronado skink and mule deer (*Figures 25-R, 28-R* and *30-R*).

Southern willow scrub in GERA provides nesting habitat for approximately 12-15 least Bell's vireo sites, six southwestern willow flycatcher sites, as well as yellow-breasted chat, Cooper's hawk, red-shouldered hawk, and barn owl (*Figures 26-R* and *27-R*). Other woodlands in the area provide nesting habitat for white-tailed kite and long-eared owl. A large colony of tricolored blackbirds periodically occurs in lower Cañada Gobernadora around the boundary of RMV property just south of the boundary with Coto de Caza. Wetlands in southern Coto de Caza support a breeding population of tricolored blackbirds and grasslands and agriculture on RMV property provides foraging habitat for the birds. The sensitive arroyo chub is known from the mouth of the creek at the confluence with San Juan Creek.

Raptors using the grasslands and agriculture areas in the sub-basin for foraging include ferruginous hawk and merlin. Golden eagles whose territories are located in the CNF are known to occasionally forage in grasslands and agricultural areas of the sub-basin.

Lower Cañada Gobernadora, including Sulphur Canyon, provides an important east-west habitat linkage connecting Chiquita and Wagon Wheel canyons with vegetation communities providing habitat to the east in Bell Canyon and Caspers Wilderness Park (see *Section 3.5*). The riparian spine along the mainstem Gobernadora Creek and the adjacent uplands along Chiquadora Ridge both provide north-south habitat linkages for mountain lions and other large mammals. The uplands along the Chiquadora Ridge also provide a habitat linkage for California gnatcatcher, cactus wren and a variety of other birds, reptiles and small mammals.

Central Gobernadora sub-basin east of the creek and the Central San Juan subunit north of the creek comprises a single, large population of many-stemmed dudleya supporting about 61 scattered locations ranging from 1 to 2,000 individuals (*Figure 29-R*). Although there is one location with 2,000 individuals, the remaining 60 locations number 225 or fewer individuals each. The northern portion of the Gobernadora sub-basin on RMV supports 13 locations of many-stemmed dudleya ranging from 5 to 513 individuals, and totaling 1,622 individuals.

Portions of the Ladera Ranch Mitigation site in GERA, on the west side of the Gobernadora Creek "spur" that enters the mitigation area, supports an estimated 10,000+ individuals of southern tarplant that have colonized the mitigation area.

Other sensitive plants known from the sub-basin include Catalina mariposa lily and Palmer's grapplinghook in the uplands and paniculate tarplant in the valley bottom (*Figure 30-R*). A cluster of about 27 Catalina mariposa lily locations are on Chiquadora ridge associated with the cluster in the Chiquita sub-basin southeast of the wastewater treatment plant. Only three locations of Catalina mariposa lily are located east of Gobernadora Creek. There are about 23 locations of Palmer's grapplinghook in the sub-basin, with almost all east of the creek in association with the large population of many-stemmed dudleya. The paniculate tarplant is known from the along the creek near the boundary with Coto de Caza.

3. <u>Bell Canyon Sub-basin</u>

The Bell Canyon sub-basin lies west of the Cañada Gobernadora sub-basin and includes the western portion of Caspers Wilderness Park and all of the Audubon Starr Ranch Sanctuary. It extends into the CNF (*Figure 24-R*). The Bell Canyon sub-basin, excluding the portion in the CNF, is located in Subarea 1. The Bell Canyon sub-basin, including the CNF portion, supports approximately 4,750 acres of coastal sage scrub, 4,672 acres of chaparral, and 960 acres of grassland. About 750 acres in Bell Canyon are disturbed or developed.

The uplands in the sub-basin provide habitat for a variety of sensitive species, including about 29 locations of the California gnatcatcher, 178 locations of the cactus wren, as well as golden eagle, San Diego banded gecko, western patch-nosed snake, coastal rosy boa coastal western whiptail, orange-throated whiptail, San Diego horned lizard, San Diego ringneck snake, mule deer, and mountain lion (*Figures 25-R* and *30-R*). The uplands also provide potential foraging and overwintering habitat for the arroyo toad.

Bell Canyon supports about 1,900 acres of riparian, woodland and forest that support a variety of sensitive species, including arroyo toad (about 29 adults in 1998), western spadefoot toad, yellow warbler, yellow-breasted chat, long-eared owl, Cooper's hawk, white-tailed kite, barn owl, and red-shouldered hawk (*Figures 26-5* and *27-R*). The threespine stickleback is known from upper Bell Canyon on Starr Ranch.

Bell Canyon is one of the key north-south habitat linkages in the planning area (see *Section 3.5*). It is used by mule deer and mountain lion, as well as bobcat, coyote and gray fox. It also provides linkage and dispersal habitat for other sensitive species such as the California gnatcatcher, cactus wren, arroyo toad, western spadefoot toad, and a variety of wildlife species in general.

4. <u>Upper San Juan Creek</u>

Although the upper San Juan Creek was not mapped as a discrete sub-basin in the SAMP, it is a prominent feature in the northeastern portion of the planning area. It is defined as the segment of San Juan Creek above the confluence with Bell and Verdugo canyons, excluding the Lucas Canyon sub-basin described below (*Figure 24-R*). Within the planning area it is entirely in Caspers Wilderness Park and is part of Subarea 1. The dominant upland vegetation community along upper San Juan Creek within the planning area is coastal sage scrub, with chaparral becoming more dominant within the CNF. The creek supports southern sycamore riparian woodland, floodplain scrub, mule fat scrub and intermittent river and stream. The side canyons support coast live oak woodland and canyon live oak ravine forest (*Figure 26-R*).

San Juan Creek above Bell Canyon supports one of the two largest populations of the arroyo toad in the planning area, with more than 400 calling males estimated in 1998 surveys (*Figure 26-R*). The coastal sage scrub supports only nine California gnatcatcher locations, but numerous cactus wren locations (*Figure 25-R*). Other sensitive species known from the area include loggerhead shrike, yellow-breasted chat, red-shouldered hawk, barn owl, western spadefoot toad, and glossy snake (*Figures 26-R, 27-R* and *30-R*). The mainstem creek is a key regional habitat linkage and wildlife movement corridor for mountain lion, mule deer, bobcat and coyote.

5. Lucas Canyon Sub-basin

The Lucas Canyon sub-basin is located both within Caspers Wilderness Park and the CNF (*Figure 24-R*). The Lucas Canyon sub-basin, excluding the portion in the CNF, is located in Subarea 1. Including the CNF, it supports approximately 1,054 acres coastal sage scrub, predominantly on south-facing slopes, and 1,564 acres of chaparral, predominantly on the north-facing slopes (*Figure 25-R*). There also are about 35 acres of grassland and about 110 acres of riparian and woodland in the Lucas Canyon sub-basin. The south facing slopes support nine locations of the California gnatcatcher and 72 cactus wren locations (*Figure 25-R*). In addition, two yellow warbler and two red-tailed hawk nest sites are known from the sub-basin (*Figures 26-R* and *27-R*). There are no other documented sensitive species occurrences in the NCCP database for Lucas. However, it is expected that wildlife species common to coastal sage scrub such as rufous-crowned sparrow, orange-throated whiptail, etc. could occur in Lucas Canyon.

Vegetation communities in Lucas Canyon may provide movement habitat along the canyon bottom for large- and medium sized mammals such as mountain lion, mule deer, bobcat, coyote, and gray fox.

6. Central San Juan & Trampas Canyon Sub-basin

The Central San Juan and Trampas Canyon sub-basin is divided into two main geographic areas: the Central San Juan sub-unit and the Trampas Canyon sub-unit (*Figure 24-R*). The Central San Juan sub-unit includes the reach of San Juan Creek from just south of the confluence with Bell Creek to the east and the confluence with Gobernadora Creek to the west. The Central San Juan sub-unit extends north from San Juan Creek approximately 1.6 miles and encompasses a large north-south trending canyon through the center of the sub-unit. The Trampas Canyon sub-unit is characterized by the silica sand mining operation that dominates the canyon and the rugged terrain between Cristianitos Canyon and San Juan Creek. This sub-basin is in Subarea 1.

(a) Central San Juan Sub-unit

The Central San Juan sub-unit supports coastal sage scrub, chaparral, oak woodlands, grassland, agriculture and disturbed areas (Colorspot Nursery) (*Figure 25-R*). Approximately 13-14 California gnatcatcher locations occur in the coastal sage scrub north of the nursery and they may use coastal sage scrub adjacent to San Juan Creek; this habitat probably is important for dispersal. Uplands adjacent to the creek provide foraging and estivation habitat for the arroyo toad. Other sensitive upland species in uplands in the sub-unit include cactus wren, rufous-crowned sparrow, grasshopper sparrow, San Diego desert woodrat, orange-throated whiptail, coastal western whiptail, northern red-diamond rattlesnake, San Diego ringneck snake, California glossy snake, and western skink (*Figures 25-R, 28-R* and *30-R*). Sandy soils in and adjacent to San Juan Creek provide suitable habitat for the silvery legless lizard.

Riparian and aquatic resources within the creek provide breeding habitat for arroyo toad and the least Bell's vireo (although both species occur in small numbers in this reach of the creek), as well as yellow-breasted chat, yellow warbler, white-tailed kite, Cooper's hawk, red-shouldered hawk, great-horned owl, barn owl, red-tailed hawk, great blue heron, southwestern pond turtle, two-striped garter snake, western spadefoot toad, arroyo chub and threespine stickleback (*Figures 26-R, 27-R* and *30-R*). A breeding colony of tricolored blackbirds has been observed in the past in San Juan Creek east of the intersection of Ortega Highway and Cristianitos Road.

The San Juan Creek portion of this sub-unit is a key connection, especially for movement between the northern and southern portions of the subregion (see *Section 3.5*). It provides continuous upland habitat linkage connections, particularly along the southern side of the creek, for species such as the California gnatcatcher, cactus wren, rufous-crowned sparrow, and a variety of reptiles and small mammals. Large- and medium-sized mammals known or expected to use the riparian vegetation as "live-in" habitat and for movement include mountain lion, mule deer, bobcat, coyote, and gray fox.

North-south movement of large wildlife between San Juan Creek and Trampas Canyon and Cristianitos Canyon currently is constrained by Ortega Highway. High traffic volumes on Ortega Highway contribute to wildlife mortality. Wildlife have been documented to use two wildlife corridors that cross under the highway; a corrugated steel pipe culvert near Radio Tower Road and a concrete box culvert west of Cristianitos Road connecting to Trampas Canyon.

The sub-unit supports about 20 locations of many-stemmed dudleya that generally are contiguous with the Gobernadora locations sub-basin described above (*i.e.*, they are part of the same complex) (*Figure 29-R*). These locations range up to about 2,000 individuals, but the median population size is much smaller at 50 individuals; 13 locations number 11-95 individuals and five number 100-345 individuals. Intermediate mariposa lily tends to overlap with many-stemmed dudleya in the sub-unit, with about 15-16 discrete populations numbering from a few to several hundred individuals. The largest population of intermediate mariposa lily is about 775 individuals.

(b) Trampas Canyon Sub-unit

The Trampas Canyon sub-unit supports a mosaic of upland vegetation communities, including coastal sage scrub, chaparral, grassland, and patches of oak woodland (*Figure 25-R*). The sub-unit supports approximately four California gnatcatcher locations and approximately 20 cactus wren locations. Other sensitive wildlife species known from the sub-unit include orange-throated whiptail, red-diamond rattlesnake, and San Diego desert woodrat near the mouth of the canyon (*Figures 25-R* and *30-R*). Raptors nesting in oak woodlands in the sub-unit include turkey vulture, white-tailed kite, Cooper's hawk, red-shouldered hawk, red-tailed hawk, and great horned owl (*Figure 27-R*). Although the riparian vegetation in the sub-unit does not provide high value breeding habitat for species such as the least Bell's vireo and other sensitive, non-raptor riparian birds, the reservoir provides resting and foraging habitat for common water fowl and other birds associated with open water and wetland vegetation such as pied-billed grebe, western grebe, mallard, ruddy duck, ring-necked duck, double-crested cormorant, herons, and American coot.

Vernal pools along Radio Tower Road south of Ortega Highway (pools 7 and 8) appear to be associated with localized bedrock landslides from the San Onofre and Monterey formations. Vernal pool 7 supports both the Riverside fairy shrimp and San Diego fairy shrimp (*Figure 26-R*). The spadefoot toad also breeds in these vernal pools.

Coastal sage scrub in the central portion of the Trampas Canyon subunit provides a nearly continuous north-south connection between San Juan Creek and the upper portion of the Cristianitos sub-basin for bird species such as the California gnatcatcher and cactus wren (*Figure 25-R*). This portion of the subunit east of Trampas Creek, along with the Cristianitos Canyon sub-basin, connects populations to the north in Chiquita Canyon with the Camp Pendleton population south of the subregion (see *Section 3.5*).

The central portion of the subunit east of the mine and Cristianitos Road is also a habitat linkage between San Juan Creek and Cristianitos, Blind, La Paz, and Gabino canyons used by mountain lion, mule deer, coyote, and bobcat. A concrete box culvert crossing of Ortega Highway just west of Cristianitos Road is a key crossing point for wildlife between San Juan Creek and Trampas Canyon.

North-south movement of large wildlife between San Juan Creek and Trampas Canyon and Cristianitos Canyon currently is constrained by Ortega Highway. High traffic volumes on Ortega Highway contribute to wildlife mortality. Wildlife have been documented to use two wildlife corridors that cross under the highway; a corrugated steel pipe culvert near Radio Tower Road and a concrete box culvert west of Cristianitos Road connecting to Trampas Canyon.

The Trampas Canyon subunit supports one location of about 250 flowering stalks of the thread-leaved brodiaea in the southeastern portion of the subunit (*Figure 29-R*). The Trampas Canyon subunit also itself supports about eight locations of 20-700 individuals each of many-stemmed dudleya that are contiguous with the large population of dudleya in Cristianitos Canyon discussed below.

7. Verdugo Canyon Sub-basin

The Verdugo Canyon sub-basin is in Subarea 1. Uplands within the Verdugo Canyon sub-basin support coastal sage scrub, chaparral, grasslands, and small patches of oak woodland (*Figure 25-R*). Coastal sage scrub and chaparral are the predominant vegetation communities, with the grasslands more prominent toward the canyon's confluence with San Juan Creek. The canyon floor supports sycamore riparian woodland and southern coast live oak riparian forest, with small patches of mule fat scrub (*Figure 26-R*). Southern willow scrub also is present in tributaries to Verdugo Canyon.

There are relatively few sensitive species locations in the sub-basin. One California gnatcatcher and approximately 16 cactus wren locations occur in the coastal sage scrub along the canyon (*Figure 25-R*). The yellow-breasted chat occurs in riparian vegetation in the sub-basin that also supports nest sites for Cooper's hawk, red-shouldered hawk, red-tailed hawk, and barn owl (*Figures 26-R* and *27-R*). There is an historic record of a small breeding colony of the tricolored blackbird at the mouth of the canyon under the Ortega Highway Bridge.

The sub-basin provides a habitat connection for large- and medium-sized mammals (see *Section 3.5*). Mule deer are common in the canyon, and it provides habitat for mountain lion, coyote, bobcat, and gray fox.

8. Foothill-Trabuco Specific Plan Area

The Foothill-Trabuco Specific Plan area, which comprises the majority of Subarea 2, encompasses approximately 3,876 acres in the northern portion of the planning area (*Figure 31-R*). The dominant vegetation communities in the area are coastal sage scrub (about 1,300 acres) and chaparral (1,156 acres), with lesser amounts of grassland (367 acres), riparian (419 acres) and woodland and forest (176 acres). The minimum elevations in this area are about 1,000 feet and most of the Specific Plan Area is above 1,200 feet. The coastal sage scrub and chaparral in this area is more typical of that found in the CNF than at the lower elevations in areas such as Chiquita Canyon.

Although California gnatcatchers are relatively sparse in the Foothill-Trabuco Specific Plan area, the database includes 17 locations scattered throughout the area. Other sensitive wildlife species known from the area include cactus wren, red-shouldered hawk, rufous-crowned sparrow, yellow warbler, yellow-breasted chat, orange-throated whiptail, coastal western whiptail, and Riverside fairy shrimp (from vernal pools on the Saddleback Meadows site).

Sensitive plants detected in the area include small populations of Catalina mariposa lily located west of Live Oak Canyon Road and one location of chaparral beargrass east of the road.

Canyons and drainages within the Foothill-Trabuco Specific Plan area provide important movement corridors for mountain lions and other larger species between Arroyo Trabuco and the CNF (see *Section 3.5*).

9. Arroyo Trabuco

The Arroyo Trabuco area primarily encompasses O'Neill Regional Park extending from the CNF in the north to the City of San Juan Capistrano boundary in the south (*Figure 32-R*). The lower portion extending from the northern boundary of O'Neill Park is in Subarea 1. The portion extending east from O'Neill Park to the CNF and bounded by the Foothill-Trabuco Specific Plan area is in Subarea

2. The dominant vegetation communities are coastal sage scrub and grasslands that total more than 1,000 acres. The arroyo also supports more than 700 acres of riparian and woodland.

Sensitive species in the arroyo include the California gnatcatcher, with about 40 locations scattered within and adjacent to the arroyo. Most of the locations are clustered in the southern portion of the Arroyo Trabuco. Up to 13 nesting territories of the least Bell's vireo have been documented in the arroyo south of Crown Valley Parkway (Dudek 2001a). Other nesting migrants in the arroyo are yellow warbler and yellow-breasted chat. The riparian and woodland in Arroyo Trabuco also provide nesting habitat for several raptors, including Cooper's hawk, red-shouldered hawk, red-tailed hawk, white-tailed kite, great horned owl, and barn owl. Historic nesting sites are also known for the golden eagle, long-eared owl and turkey vulture. Other sensitive species documented in the arroyo include cactus wren, rufous-crowned sparrow, coastal western whiptail, San Diego horned lizard, western skink, red-diamond rattlesnake, arroyo chub, and three-spined stickleback. The Arroyo Trabuco also is an important north-south movement corridor for large mammals such as mountain lion, mule deer, and coyote, although the southern portion of the arroyo at the boundary of San Juan Capistrano represents a dead-end for the mountain lion because of the urban development in the area.

10. <u>San Juan Capistrano</u>

The San Juan Capistrano portion of the planning area is a mix of urban development and undeveloped land dominated by grassland and smaller patches of coastal sage scrub (*Figure 33-R*). It is located in Subarea 4. The coastal sage scrub supports more than 50 locations of the California gnatcatcher. Other upland species occurring in the coastal sage scrub and grassland include cactus wren, rufous-crowned sparrow, grasshopper sparrow, loggerhead shrike, northern red-diamond rattlesnake, and western spadefoot toad. Nesting raptors in the area include Cooper's hawk and red-tailed hawk.

b. San Mateo Creek Watershed

Figures 34-R through *38-R* of the NCCP/MSAA/HCP Map Book provides planning species maps for coastal sage scrub/aquatic resources, historic raptor nest sites, grasslands, and plants, respectively, for the San Mateo Creek Watershed. *Figure 39-R* shows sensitive non-planning wildlife and plant species in the San Mateo Creek Watershed.

1. <u>Cristianitos Canyon Sub-basin</u>

The Cristianitos Canyon is located in Subarea 1. This sub-basin is dominated by grasslands (970 acres), a large component which is native grassland (approximately 330 acres), and coastal sage scrub (approximately 650 acres) (*Figure 34-R*). The grassland is predominant in upper Cristianitos and along the eastern side of the canyon, while coastal sage scrub and chaparral dominate the east-facing slopes on the western side of the canyon within the Donna O'Neill Land Conservancy at Rancho Mission Viejo. Riparian communities in the sub-basin include coast live oak riparian woodland, southern willow scrub and mule fat (*Figure 35-R*). Mule fat is a predominant component in the upper portion of the sub-basin. Tributaries to Cristianitos Creek from the Donna O'Neill Land Conservancy at Rancho Mission Viejo support coast live oak woodland and riparian woodland.

The sub-basin supports approximately 12 California gnatcatcher locations and approximately 67 cactus wren locations (*Figure 34-R*). The sub-basin probably serves as a primary north-south dispersal area for the California gnatcatcher between the large populations in Chiquita Canyon and Camp Pendleton. Other upland sensitive species in the sub-basin include grasshopper sparrow, rufous-crowned sparrow, California horned lark, San Diego horned lizard, coastal western whiptail, orange-throated whiptail, western patch-nosed snake, northern red-diamond rattlesnake, and San Diego desert woodrat (*Figures 34-R, 37-R* and *39-R*). In 2001, five arroyo toads were observed in the reach of Cristianitos Creek from confluence with Gabino Canyon to about 3,000 feet north of the confluence (*Figure 35-R*). This area is marginal arroyo toad breeding habitat because of the fine sediments in the creek stemming from the clay soils east of the creek. Riparian and aquatic sensitive species in the sub-basin include white-tailed kite, Cooper's hawk, red-shouldered hawk, red-tailed hawk, great horned owl, barn owl, southwestern pond turtle, and western spadefoot toad (*Figures 35-R* and *36-R*). The grasslands provide foraging habitat for sensitive wintering raptors such as the ferruginous hawk and Swainson's hawk. Wintering burrowing owls also have been recorded in Cristianitos Canyon. In combination with Talega, Gabino and La Paz canyons, the Cristianitos Canyon sub-basin provides a habitat connection for the mountain lion, mule deer, bobcat, coyote and gray fox to adjoining sub-basins (see *Section 3.5*).

The sub-basin supports a large complex of six discrete locations of thread-leaved brodiaea totaling approximately 6,100 flowering stalks occurs on the hill outcrop adjacent to the mine pits in the southern portion of Cristianitos Canyon on the boundary between the Cristianitos and Gabino and Blind Canyons sub-basins (*Figure 38-R*). About 13 other separate, scattered locations of thread-leaved brodiaea occur in the Cristianitos sub-basin, ranging from one to 120 flowering stalks.

The sub-basin, in conjunction with the Trampas Canyon sub-unit and lower Gabino Canyon, supports a large population of many-stemmed dudleya with about 160 locations and 34,137 individuals. These populations are located in the Cristianitos sub-basin and the southern portion of the Trampas Canyon subunit, extending south to the Talega development in the San Clemente Watershed and eastward into the western portion of the lower Gabino and Blind Canyons sub-basin. This population, which is by far the largest contiguous population in the planning area, occurs on both RMV land and the Donna O'Neill Conservancy and extends into Talega Open Space.

Upper Cristianitos Creek supports two small locations of Coulter's saltbush numbering three and 12 individuals, respectively. The sub-basin contains clay soils that support other sensitive plants including the Palmer's grapplinghook and western dichondra, as well as Catalina mariposa lily within clay and non-clay soils (*Figure 39-R*).

2. Gabino and Blind Canyons Sub-basin

The Gabino and Blind Canyons sub-basin is located in Subarea 1. This sub-basin is divided into three main planning sub-units: the upper Gabino Canyon sub-unit, the middle Gabino Canyon sub-unit and the lower Gabino Canyon sub-unit including Blind Canyon (*Figure 34-R*). The upper Gabino Canyon sub-unit encompasses the open grasslands at the headwaters of Gabino Creek. The middle Gabino Canyon sub-unit is defined by the narrow, steep-sided canyon between upper Gabino Canyon and the confluence of Gabino and La Paz creeks. The lower Gabino Canyon sub-unit includes the portion of Gabino Canyon below its confluence with La Paz Creek and its confluence with Cristianitos Creek, as well as Blind Canyon.

(a) Upper Gabino Sub-unit

The open "bowl-shaped" portion of sub-unit adjacent to upper Gabino Creek is characterized by predominantly native grasslands (approximately 275 acres) on the gentle slopes leading away from the creek, with coastal sage scrub and chaparral dominating the surrounding rugged canyons and hills (*Figure 34-R*). The riparian vegetation in the sub-unit includes relatively open coast live oak riparian woodland, sycamore riparian woodland, and mule fat (*Figure 35-R*).

Numerous cactus wren locations are present in the sub-unit, but the population is not as dense as other areas within the planning area (*Figure 34-R*). There are no documented California gnatcatcher locations in the upper Gabino Canyon sub-unit. The grasslands in the sub-unit provide high quality raptor foraging habitat and also provides habitat for the badger, burrowing owl, spadefoot toad and horned lark (*Figures 36-R* and *39-R*). The riparian vegetation in the sub-unit supports a few raptor nest sites for white-tailed kite, red-shouldered hawk and red-tailed hawk, but not at the density of the down- stream riparian vegetation in middle Gabino Canyon where the canyon is narrow and closely bounded by rugged terrain (*Figure 36-R*). Aquatic resources (Jerome's Lake) in the sub-unit supports the southwestern pond turtle and two-striped garter snake (*Figures 35-R* and *39-R*). As part of the Gabino and Blind Canyons Sub-basin, upper Gabino Canyon also is an important habitat connection for movement and dispersal by the mountain lion, bobcat, coyote and mule deer.

The subunit, in association with middle Gabino and upper La Paz canyons, supports 12 locations of many-stemmed dudleya ranging from about five individuals to about 1,500 individuals, and cumulatively totaling more than 4,100 individuals (*Figure 38-R*). A small population of about 100 individuals of Coulter's saltbush occurs west of and adjacent to the creek. The subunit supports a large population of western dichondra (*Figure 39-R*).

(b) Middle Gabino Sub-unit

The north two-thirds of the middle Gabino Canyon sub-unit is characterized by the narrow canyon bounded by steep, rugged slopes dominated by chaparral and smaller patches of coastal sage scrub (*Figure 34-R*). The lower one-third of the sub-unit broadens somewhat with flat benches supporting small patches of grassland. The riparian vegetation in the sub-unit includes coast live oak riparian woodland, sycamore riparian woodlands, and smaller areas of coast live oak woodland and mule fat scrub (*Figure 35-R*). Some portions of the canyon also support floodplain (alluvial) scrub.

There are three locations of the California gnatcatcher distributed along a north-south trending canyon in the lower portion of the middle Gabino Canyon sub-unit (*Figure 34-R*). As with the upper Gabino Canyon sub-unit, the western portion of the sub-unit includes numerous cactus wren locations, but the population is not as dense as other areas of the planning area. Other sensitive upland wildlife species in the sub-unit include rufous-crowned sparrow and orange-throated whiptail (*Figures 34-R* and *39-R*).

Breeding sites for a small population of the arroyo toad (*e.g.,* two toads in 1998) extend approximately 3,000 feet above the confluence with La Paz Creek (*Figure 35-R*). The riparian vegetation in the sub-unit also supports several nest sites for raptors, including white-tailed kite, Cooper's hawk, long-eared owl, great horned owl, barn owl, and red-tailed hawk (*Figure 36-R*).

As part of the Gabino and Blind Canyons Sub-basin, middle Gabino Canyon also is an important habitat connection for movement and dispersal by the mountain lion, bobcat, coyote and mule deer (see *Section 3.5*).

The subunit supports one location of about 183 thread-leaved brodiaea flowering stalks in the western portion (*Figure 38-R*). Many-stemmed dudleya is known from about five locations in the middle Gabino Canyon sub-unit, with the largest population of about 1,500 individuals located west of the creek near the boundary with the upper sub-unit (*Figure 38-R*). A 25-acre area mapped as western dichondra overlaps with this dudleya population (*Figure 39-R*). Many-stemmed dudleya also is known from two locations of 100 and 200 individuals each in the upper portion if Airplane Canyon and two small locations of about five individuals each at the confluence of Gabino and Airplane canyons.

(c) Lower Gabino and Blind Sub-unit

The lower Gabino and Blind Canyons sub-unit is dominated by native and annual grasslands, with smaller patches of coastal sage scrub and substantial oak woodlands (*Figure 34-R*). The riparian vegetation in the sub-unit consists of southern sycamore riparian woodland, coast live oak riparian forest and woodlands, mule fat scrub and smaller areas of southern arroyo willow forest, coast live oak forest and coast live oak woodland (*Figure 35-R*).

The sub-unit supports approximately five California gnatcatcher locations and numerous cactus wren locations, although at densities much lower than in other areas of the planning area (*Figure 34-R*). Other sensitive wildlife species occurring in upland vegetation communities in the sub-unit include grasshopper sparrow, rufous-crowned sparrow, San Diego horned lizard, orange-throated whiptail, and red-diamond rattlesnake (*Figures 34-R* and *39-R*).

Lower Gabino Canyon supports a moderate size arroyo toad breeding population (~40 adults in 1998) between Cristianitos and La Paz creeks (*Figure 35-R*). The grasslands adjacent to lower Gabino Canyon provide potential upland foraging and estivation habitat for the arroyo toad. Riparian vegetation provides nesting sites for several raptors, including white-tailed kite, Cooper's hawk, red-tailed hawk, and great horned owl, as well as the yellow-breasted chat (*Figures 35-R* and *36-R*).

As described above for the Cristianitos sub-basin, a large complex of thread-leaved brodiaea comprised of six discrete locations totaling approximately 6,100 flowering stalks occurs on the hill outcrop adjacent to the mine pits in the southern portion of Cristianitos Canyon on the boundary between the Cristianitos and Gabino and Blind Canyons sub-basins (*Figure 38-R*). There are several small locations of many-stemmed dudleya in the sub-unit, with one population numbering about 400 individuals.

3. La Paz Canyon Sub-basin

The La Paz Canyon sub-basin is located in Subarea 1. The predominant vegetation communities in the La Paz Canyon sub-basin are coastal sage scrub (552 acres) and chaparral (686 acres) (*Figure 34-R*). Riparian vegetation in the canyon includes southern sycamore riparian woodland, coast live oak woodland, and mule fat scrub (*Figure 35-R*). The canyon bottom also supports alluvial fan (floodplain) scrub.

Sensitive wildlife species in the sub-basin include one location for the California gnatcatcher, 13 locations for the cactus wren, and records for the San Diego horned lizard, grasshopper sparrow, rufous-crowned sparrow and yellow-breasted chat (*Figures 34-R* through *37-R*). Riparian vegetation in the sub-basin supports nest sites for the long-eared owl, white-tailed kite, Cooper's hawk, red-tailed hawk, and red-shouldered hawk.

La Paz Canyon provides movement opportunities for wildlife including mountain lion, bobcat, coyote and mule deer among the Talega and Gabino and Blind Canyon subunits and Camp Pendleton (see *Section 3.5*).

Two locations of many-stemmed dudleya occur in the upper portion of La Paz Canyon; a location with 700 individuals that overlaps with the Gabino Canyon sub-basin and a second with about 500 individuals (*Figure 38-R*).

4. Talega Canyon Sub-basin

The Talega Canyon sub-basin is located in Subarea 1. Upland vegetation communities in the Talega Canyon sub-basin include coastal sage scrub, chaparral and grassland, with a mixture of sage scrub and chaparral in the upper portion of the canyon, and grassland and sage scrub in the lower part of the canyon south of the Northrop Grumman facility (*Figure 34-R*). Riparian vegetation in Talega Creek includes sycamore riparian woodland and coast live oak riparian woodland (*Figure 35-R*).

The sub-basin supports seven California gnatcatchers locations, with 22 cactus wren locations scattered in the sage scrub on the south-facing slopes of the canyon (*Figure 34-R*). Other sensitive upland wildlife species in the sub-basin include rufous-crowned sparrow, grasshopper sparrow, coastal western whiptail, orange-throated whiptail, San Diego horned lizard, northern red-diamond rattlesnake, and San Diego ringneck snake (*Figures 34-R* and *39-R*).

Talega Canyon supports one of the two largest breeding populations of the arroyo toad in the subregion (*Figure 35-R*). The uplands adjacent to Talega Creek provide foraging and estivation habitat for the arroyo toad.

Raptors nesting in Talega Canyon include white-tailed kite, long-eared owl, Cooper's hawk, red-shouldered hawk, red-tailed hawk, great horned owl, and barn owl (*Figure 36-R*). Talega Canyon also supports the two-striped garter snake (*Figure 39-R*).

Talega Canyon is a habitat connection for large- and medium-sized mammals such as mountain lion, mule deer, bobcat, coyote, and gray fox in the San Mateo Watershed (see *Section 3.5*).

Four locations of thread-leaved brodiaea totaling 288 flowering stalks occur in the Talega sub-basin on the mesa east of Northrop Grumman near the boundary with the Gabino and Blind Canyons subunit (*Figure 38-R*). Fourteen locations of many-stemmed dudleya totaling 292 individuals are known from Talega Canyon east of Northrop Grumman. Chaparral beargrass occurs at five locations on the steep, south-facing slopes in the eastern portion of the sub-basin and one in coastal sage scrub in the north-central part of the sub-basin. These beargrass locations are among the few known from the subregion, with the other two recorded sites found in an isolated canyon in Mission Viejo and in the Live Oak Canyon area north of Arroyo Trabuco**.**

5. Other Planning Area

A small area comprising approximately 290 acres is located in the San Mateo Creek Watershed on RMV land south of the Cristianitos sub-basin, southeast of the Donna O'Neill Land Conservancy at RMV and west of the lower Gabino and Blind Canyons sub-basin and the Talega sub-basin (*Figure 24-M*). This area, which is part of Subarea 1, warrants a discussion because although it is outside the identified sub-basins it has important biological resources and reserve design considerations. The dominant landscape feature of the area is lower Cristianitos Creek south of the confluence with Gabino Creek where it exits RMV property (*Figure 35-R*).

Upland vegetation communities in the area are dominated by annual grassland and small patches of coastal sage scrub and southern cactus scrub (*Figure 34-R*). A small patch of native grassland is present on the northeast corner of the area that overlaps with native grasslands in the Gabino and Blind Canyons sub-basin. Riparian vegetation in lower Cristianitos Creek include southern coast live oak forest and woodland, southern sycamore riparian woodland, southern willow scrub, arroyo willow riparian forest, and mule fat scrub (*Figure 34-R*). Recent studies have identified substantial invasive plant species in this area.

The small, scattered patches of coastal sage scrub support only one gnatcatcher location (*Figure 34-R*). Other sensitive wildlife species include about six cactus wren locations in scattered southern cactus scrub, about 16 locations for grasshopper sparrow in grasslands, and scattered locations of rufous-crowned sparrow, San Diego desert woodrat, orange-throated whiptail and western whiptail (*Figures 34-R, 37-R* and *39-R*). The grasslands adjacent to Cristianitos Creek also provide foraging habitat for both breeding resident and wintering raptors such as ferruginous hawk and Swainson's hawk.

The reach of Cristianitos Creek between the confluence with Gabino Creek and the planning boundary supports the arroyo toad (*Figure 35-R*). Toad counts for this reach have ranged from 11 individuals in 1998 to 37 in pre-1997 surveys, and toads have been found in the area in all surveys conducted.

The riparian vegetation supports breeding habitat for the least Bell's vireo, yellow-breasted chat and yellow warbler (*Figure 35-R*). A variety of raptors historically have nested in the riparian vegetation, including long-eared owl, Cooper's hawk, red-tailed hawk, red-shouldered hawk, great horned owl and barn owl (*Figure 36-R*).

The only known sensitive plant from the area is many-stemmed dudleya, with approximately four discrete locations (*Figure 38-R*). Two of the locations have population counts of 20 and 33 individuals

This area, in conjunction with the Cristianitos sub-basin, probably serves as a primary north-south dispersal area for the California gnatcatcher between large populations in Chiquita Canyon and Camp Pendleton. Also, in combination with Talega, Gabino, La Paz, and Cristianitos canyons above the confluence with Gabino Creek, this area provides a habitat connection for the mountain lion, mule deer, bobcat, coyote and gray fox to adjoining sub-basins and Camp Pendleton (*see Section 3.5*).

c. San Clemente Watershed

The San Clemente watershed is a wedge-shaped unit located between the lower portions of the San Mateo Creek and San Juan Creek watersheds (*Figure 40-R*). This hydrologic unit incorporates both City of San Clemente and unincorporated areas. Except for Prima Deshecha, which is located in Subarea 1, the watershed is located in Subarea 4. The area is a mix of urban development and undeveloped land dominated by grassland, with smaller patches of coastal sage scrub and riparian. The San Clemente watershed supports about 52 locations of the gnatcatchers and several other upland and riparian species, including cactus wren, rufous-crowned sparrow, loggerhead shrike, grasshopper sparrow, least Bell's vireo, southwestern willow flycatcher, and red-tailed hawk (*Figure 40-R*).

There are several locations for sensitive plants in the watershed, including a cluster of several species located in the northeastern portion of the watershed in the Talega development area and along the boundary of the Donna O'Neill Land Conservancy at RMV and locations in the Prima Deshecha Landfill, including four locations for thread-leaved brodiaea totaling 137 flowering stalks (not including the Forster Ranch translocation site); nine locations of Catalina mariposa lily; 13 locations of intermediate mariposa lily; three locations of small-flowered morning glory; one location of many-stemmed dudleya totaling 190 plants; 16 locations of vernal barley totaling more than 12,300 individuals; and nine locations of paniculate tarplant totaling more than 6,400 individuals.

SECTION 3.5 WILDLIFE HABITAT LINKAGES AND CORRIDORS

A fundamental concept and central tenet of conservation biology theory is that habitat fragmentation and isolation leads to extinction of local populations as a result of two processes: **(1)** reduction in total habitat area which reduces effective population sizes; and **(2)** insularization of local populations which affects dispersal and immigration rates (Wilcox and Murphy 1985; Wilcove *et al.*1986). Wilcox and Murphy further point out that immigration may be impeded by conversion of natural vegetation communities providing habitat between occupied or potential habitat patches, thus increasing the probability of extinction. It is this latter point that is the crux of the habitat linkage problem. That is, isolation of habitat patches accompanied by intervening inhospitable land cover (*e.g.,* urban development, roadways, etc.) is thought to increase the probability of permanent extinction of local populations. Because of complex community-level interactions (*e.g.,* mutualistic species, habitat guilds, keystone species), the loss of one or a few species from a habitat patch as a direct result of habitat fragmentation (primary extinctions) also may result in multiple "secondary" extinctions within the habitat patch (Wilcox and Murphy 1986).

The planning area is partially urbanized and partially open space. In urbanized areas, there are varying opportunities for wildlife movement, ranging from highly constrained settings such as Mission Viejo where wildlife movement may be restricted to a man-made culvert, to more expansive areas, such as the Arroyo Trabuco, that afford live-in "habitat" for some species while conveying movement between surrounding development for a broader suite of species. Areas presently in open space generally facilitate wildlife movement in multiple directions and provide "live-in habitat" for many species, but can show constrained movement (*e.g.,* along narrow vectors) where the open space is contiguous with already urbanized areas. The identification of the most important movement wildlife corridors and habitat linkages, as defined below, which will continue to support effective movement in a future environment that supports development depends on animal behavior, habitat affinities and local geography.

For broad wildlife movement areas that presently allow for unconstrained movement, future development scenarios will restrict movement patterns to some extent. To weigh the merits of alternative development configurations/reserve designs, there is a need to preliminarily identify wildlife movement opportunities that are likely important to retain for ecosystem function. Identification of the areas most important for retaining effective wildlife movement in a future environment with development requires consideration of available wildlife movement data, existing species distributions, habitat affinities, animal behavior and local geography. To provide guidance for the planning process, these factors were considered to identify the areas discussed below that are considered important for maintaining wildlife movement functions under any reserve alternative.

In order to provide guidance for the planning process, important areas for maintaining wildlife movement functions are described in this subsection. Furthermore, a distinction is drawn between habitat linkages and wildlife corridors:

- ***Habitat linkages*****:** Following Soule and Terborgh's (1999) use of the term "landscape linkage," habitat linkages are natural areas that function to join two larger blocks of habitat. They serve as connections between habitat blocks and help reduce the adverse effects of habitat fragmentation by providing a potential route for gene flow and long-term dispersal. Habitat linkages may serve both as "live-in" habitat and avenues of gene flow for small animals such as reptiles, amphibians, and rodents. Habitat linkages also provide for the transit of larger species, but as contrasted with wildlife corridors, as defined below, also may be "live-in" habitat for larger species (*i.e.,* support breeding sites, frequent use areas, etc.). Habitat linkages also may be represented by continuous habitat or by closely spaced habitat "islands" that function as stepping stones for dispersal and movement (especially for birds and flying insects).

- ***Wildlife corridors:*** As defined here, wildlife corridors tend to be linear features that connect large blocks of habitat and provide avenues for frequent movement, dispersal or migration of larger animals. Because of their more narrow configuration wildlife corridors generally serve a more limited function than habitat linkages and primarily are used for transit of larger species rather than as live-in habitat for a broader suite of species. Wildlife corridors may also contain "choke-points" (*e.g.*, hourglass or funnel shapes) or man-made structures such as culverts and flood control channels that wildlife quickly move through.

Habitat linkages and wildlife corridors facilitate the dispersal by smaller, less mobile species and frequent movement (*e.g.*, daily, weekly, etc.) by large mammal species such as mountain lion, mule deer, coyote and bobcat. The species identified below only highlight a much broader suite of species served by the habitat linkages and corridors. Accordingly, the species identified should not be interpreted as the only species that benefit from the linkages and corridors. It can be reasonably assumed that habitat linkages and corridors that function for large mammals (except coyote) also function for many other species.

Except where only habitat linkages or corridors currently exist, the following discussion identifies habitat linkage and corridor functions within the general wildlife movement areas that appear to be important to be retained in the subregion. Identification of these linkage and corridor functions are based on field studies of wildlife movement in the planning area (*e.g.*, Beier and Barrett 1993, Dudek 1995; MBA 1996; Padley 1992), input from the Science Advisors and the wildlife agencies, and the consultant team's review and analysis of the species, vegetation, and physiographic information for the subregion. Habitat linkages and wildlife corridors in the planning area are shown in *Figure 41-M* and include:

- The Arroyo Trabuco (A) between about Avery Parkway and the CNF provides a habitat linkage for movement and dispersal of large species, as well as for numerous smaller, less mobile species (*e.g.*, Beier and Barrett 1993; Dudek 1995; Padley 1992; Science Advisors 1998). This habitat linkage is in Subareas 1 and 2.

- The area (B) between the Las Flores and Ladera Ranch developments connecting Arroyo Trabuco and Chiquita Ridge provides an existing habitat linkage for species such as California gnatcatcher and a wildlife corridor for large mammals (*e.g.*, Beier and Barrett 1993). This linkage is in Subarea 1.

- The combined Chiquita Ridge and Creek area (C) provides a north-south wildlife habitat linkage from San Juan Creek to the "horseshoe" of habitat surrounding the northern end of Coto de Caza. This linkage is important for species such as California gnatcatcher and cactus wren and also for movement and dispersal of large mammals (*e.g.*, Beier and Barrett 1993; Dudek 1995; MBA 1996; Padley 1992; Science Advisors 1998). This linkage is in Subarea 1.

- The "Narrows" area (D) separating middle and lower Chiquita Canyon consists of oak/ riparian and coastal sage scrub habitats, and relatively little dry land farming. This area provides an east-west habitat linkage between Chiquita Ridge and Chiquadora Ridge and

Sulphur Canyon for both large mammals and small, mobile species such as the gnatcatcher (*e.g.,* Beier and Barrett 1993; MBA 1996; Padley 1992). This linkage is in Subarea 1.

- A mosaic of coastal sage scrub and grassland in lower Chiquita Canyon (E), such as the area adjacent to the wastewater treatment plant, provides an east-west movement corridor for California gnatcatcher dispersal, as well as for dispersal and movement of large mammals. This linkage is in Subarea 1.

- The "horseshoe" connection (F) north of Coto de Caza provides a "stepping-stone" habitat linkage for the California gnatcatcher and cactus wren. It probably has limited existing function as a wildlife corridor for large species, although coyotes likely move through the area and bobcat and mule deer may occasionally use the corridor. This linkage is in Subareas 1 and 3.

- Chiquadora Ridge and adjacent Gobernadora Creek (G) provide a north-south habitat linkage for California gnatcatcher and cactus wren to San Juan Creek, as well for movement and dispersal by large mammals (*e.g.,* Beier and Barrett 1993; MBA 1996; Padley 1992; Science Advisors 1998). This linkage is in Subarea 1.

- Sulphur Canyon (H) provides a north-south and east-west habitat linkage for large mammals between Chiquita Canyon and Wagon Wheel Canyon and Canada Gobernadora that allows wildlife to move east to Bell Canyon and Caspers Wilderness Park. It also provides a north-south connection for smaller species such as California gnatcatcher and cactus wren (*e.g.,* Beier and Barrett 1993; MBA 1996; Padley 1992; Science Advisors 1998). This linkage is in Subarea 1. This linkage is in Subarea 1.

- Canada Gobernadora between Coto de Caza and the mouth of Sulphur Canyon (I) provides an east-west habitat linkage for large mammals between Chiquita Canyon and Wagon Wheel Canyon to the west and Bell Canyon and Caspers Wilderness Park to the east (*e.g.,* Beier and Barrett 1993; MBA 1996). This linkage is in Subarea 1.

- San Juan Creek (J) functions as a central nexus for north-south and east-west wildlife movement in the central part of the planning area. It connects Chiquita Ridge and Chiquita Canyon with the Central San Juan Creek and Trampas Canyon sub-basin to allow dispersal and movement to the south via Cristianitos Canyon. It also serves east-west wildlife movement and dispersal from Chiquita Canyon upstream to the CNF and major tributaries such as Canada Gobernadora, Bell Canyon, and Verdugo Canyon (*e.g.,* Beier and Barrett 1993; Dudek 1995; Padley 1992; Science Advisors 1998). It should be noted that under existing conditions, large wildlife species (coyote, mule deer, bobcat and possibly mountain lion) moving between San Juan Creek and Trampas Canyon and the Radio Tower Road area either use existing corrugated steel and concrete box culverts under Ortega Highway (Dudek 1995) or must cross the highway directly. This linkage is in Subarea 1.

- Habitat west of the silica mine in Trampas Canyon (K) currently provides dispersal opportunities for California gnatcatchers and other species between Chiquita Ridge and gnatcatcher populations in San Juan Capistrano and San Clemente, as well as eastward dispersal between Trampas Canyon and the Talega development to the RMV Conservancy, Cristianitos Canyon and MCB Camp Pendleton. This linkage connects habitat in Subareas 1 and 4.

- Verdugo Canyon (L) provides an east-west habitat linkage for large mammals between San Juan Creek and the CNF (Beier and Barrett 1993; Padley 1992). This linkage is in Subarea 1.

- Upland coastal sage scrub and chaparral adjacent to Verdugo Canyon (M) may provide north-south movement opportunities for the cactus wren and other species, although it is likely that these species also disperse along San Juan Creek. This linkage is in Subarea 1.

- Local gnatcatcher populations in the San Mateo Watershed are relatively small, compared with the remainder of the planning area, and are concentrated along the Cristianitos Creek corridor and overlooking lower Talega Creek. Although there is the potential for gnatcatcher dispersal through coastal sage scrub patches throughout the San Mateo Watershed, an important habitat linkage for gnatcatchers within this watershed appears to be Cristianitos Canyon (N), which links San Juan Creek with local populations in lower Gabino Creek and Camp Pendleton along lower Cristianitos/San Mateo Creek. This linkage is in Subarea 1.

- Gabino Canyon (O) provides a north-south habitat linkage between the planning area and the CNF for large mammals (Beier and Barrett 1993; MBA 1996; Padley 1992; Science Advisors 1998) and may support dispersal by the cactus wren and other species. This linkage is in Subarea 1.

- La Paz Canyon (P) provides a north-south habitat linkage between the planning area and the CNF for large mammals (Beier and Barrett 1993; Padley 1992) and possibly a habitat linkage for dispersal by the cactus wren and other species. This linkage is in Subarea 1.

- Talega Canyon (Q) provides for east-west and north-south movement between the planning area and MCB Camp Pendleton for large mammals (Beier and Barrett 1993; Padley 1992), cactus wren and other species. This linkage is in Subarea 1.

- The Saddleback Meadows (R) area provides a lower elevation habitat linkage between the Southern Subregion planning area and the Central Subarea component of the Central and

Coastal NCCP/MSAA/HCP Habitat Reserve. This area also provides a very limited wildlife corridor between the Central and Southern subregions via two 300-foot-long corrugated steel pipes that cross under El Toro Road (Dudek 1995). This crossing may be used by smaller animals such as coyote, gray fox and raccoons, but likely is not used by bobcat, mule deer or mountain lion because the pipes are long and confining, and preclude visual contact between the two ends because they have a slight bend. This linkage is on the boundary of Subareas 2 and 4.

- The area north of Oso Reservoir (S), including O'Neill Regional Park and the nursery provides a lower elevation "stepping stone" habitat linkage between the Southern Subregion planning area and the Central Subarea component of the Central and Coastal NCCP/MSAA/HCP Habitat Reserve. With habitat restoration, this linkage likely would be suitable for the California gnatcatcher. This linkage is in Subarea 4.

- The Foothill-Trabuco Specific Plan (1985) identified the locations of several habitat linkages and wildlife corridors, generally shown as (T), within the upper Arroyo Trabuco area. The precise locations of extant linkages and corridors needs to be refined and based on information developed through the review of existing developments and recently submitted specific project plans. This linkage is in Subareas 1 and 2.