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Spineflower Conservation Plan



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SPINEFLOWER CONSERVATION PLAN

Prepared for:

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ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
ANOVA	analysis of variance
BMP	best management practice
Cal-IPC	California Invasive Plant Council
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CNLM	Center for Natural Lands Management
CNOR	Candidate Notice of Review
Corps	U.S. Army Corps of Engineers
DEM	Digital Elevation Model
EIR	environmental impact report
EIS	environmental impact statement
FESA	federal Endangered Species Act
FTP	File Transfer Protocol
GIS	geographic information system
GPS	Global Positioning System
HOA	homeowner's association
HSI	habitat suitability index
I-5	Interstate 5
IPM	Integrated Pest Management
NEPA	National Environmental Policy Act
NLMO	Natural Land Management Organization
NOP	Notice of Preparation
RSABG	Rancho Santa Ana Botanic Garden
SCAQMD	South Coast Air Quality Management District
SEA	Significant Ecological Area

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ACRONYMS AND ABBREVIATIONS(CONT.)

SFVS	San Fernando Valley spineflower
SMA	Special Management Area
SR-126	State Route 126
SSURGO	Soil Survey Geographic Base
SWPPP	Stormwater Pollution Prevention Plan
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCC	Valencia Commerce Center

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1.0 INTRODUCTION

This Spineflower Conservation Plan (Plan) is a conservation and management plan to permanently protect and manage a system of preserves designed to maximize the long-term persistence of the San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*) (spineflower or SFVS) within the project study area described below. This Plan describes a preserve system proposed by the applicant, The Newhall Land and Farming Company (Newhall Land or applicant). The management and monitoring components of this Plan have been developed in consultation with the California Department of Fish and Game (CDFG).

The Plan is organized as follows:

- 1.0 Introduction
- 2.0 Background and Regulatory Framework
- 3.0 Biological Goals and Objectives
- 4.0 Species Description
- 5.0 Occurrence within Project Study Area
- 6.0 Environmental Setting and Land Use
- 7.0 Preserve Design Approach and Methodology
- 8.0 Description of the Preserves
- 9.0 Management Activities
- 10.0 Adaptive Management Program
- 11.0 Monitoring Activities
- 12.0 Spineflower Introduction Program
- 13.0 Funding
- 14.0 Responsible Parties
- 15.0 Reporting
- 16.0 Schedule
- 17.0 Conservation and Take Estimates
- 18.0 References

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1.1 Project Study Area Location

The proposed project study area addressed by this Plan includes portions of the Newhall Ranch Specific Plan area (Specific Plan area), Valencia Commerce Center (VCC) planning area, and Entrada planning area (together referred to as the “project study area”). The SCP project study area, depicted as the SCP boundary on figures in this Plan, is located in an unincorporated portion of the Santa Clara River Valley in northwestern Los Angeles County (*Figures 1 and 2*). The 11,999-acre Specific Plan area lies roughly 0.5 mile west of Interstate 5 (I-5) and largely southwest of the junction of I-5 and State Route 126 (SR-126), with portions of the Specific Plan area located in San Martinez Grande and Chiquito canyons north of SR-126. The Entrada planning area lies just west of I-5, south of SR-126, and just east of the Specific Plan area. The VCC planning area lies roughly in the northwest corner of the junction of I-5 and SR-126, generally northeast of the Specific Plan area and northwest of the Entrada planning area. Elevations in the project study area range from 825 feet above mean sea level (AMSL) in the Santa Clara River bottom at the Ventura County/Los Angeles County line to approximately 3,200 feet AMSL on the ridgeline of the Santa Susana Mountains along the southern boundary.

The City of Santa Clarita is located to the east of the project study area, and the Ventura County/Los Angeles County line is to the west. On a regional level, the Los Padres and Angeles National Forests are located to the north of the project study area; the Angeles National Forest lies to the east, and the Santa Susana Mountains are to the south.

1.2 Purpose and Need

The spineflower is the subject of this Plan. The SFVS is listed as an endangered species under the California Endangered Species Act (CESA) (California Fish and Game Code, Sections 2050–2097) and is a candidate species under the federal Endangered Species Act of 1973 (FESA) (16 U.S.C. Section 1531, et seq.).

The Plan encompasses the project study area (portions of the Specific Plan area and the VCC and Entrada planning areas) in order to address comprehensive conservation planning on Newhall Land properties within Los Angeles County supporting known spineflower populations. The information provided in this Plan will be used by the applicant in requesting a state permit authorizing the take of spineflower in the areas located outside designated spineflower preserves. Specifically, the applicant is requesting: (1) a Candidate Conservation Agreement from the U.S. Fish and Wildlife Service (USFWS) under FESA and (2) a section 2081(b) Incidental Take Permit from CDFG under CESA.



IMAGE SOURCE: USGS 24K Quad

FIGURE 1

Spineflower Conservation Plan
Regional Map



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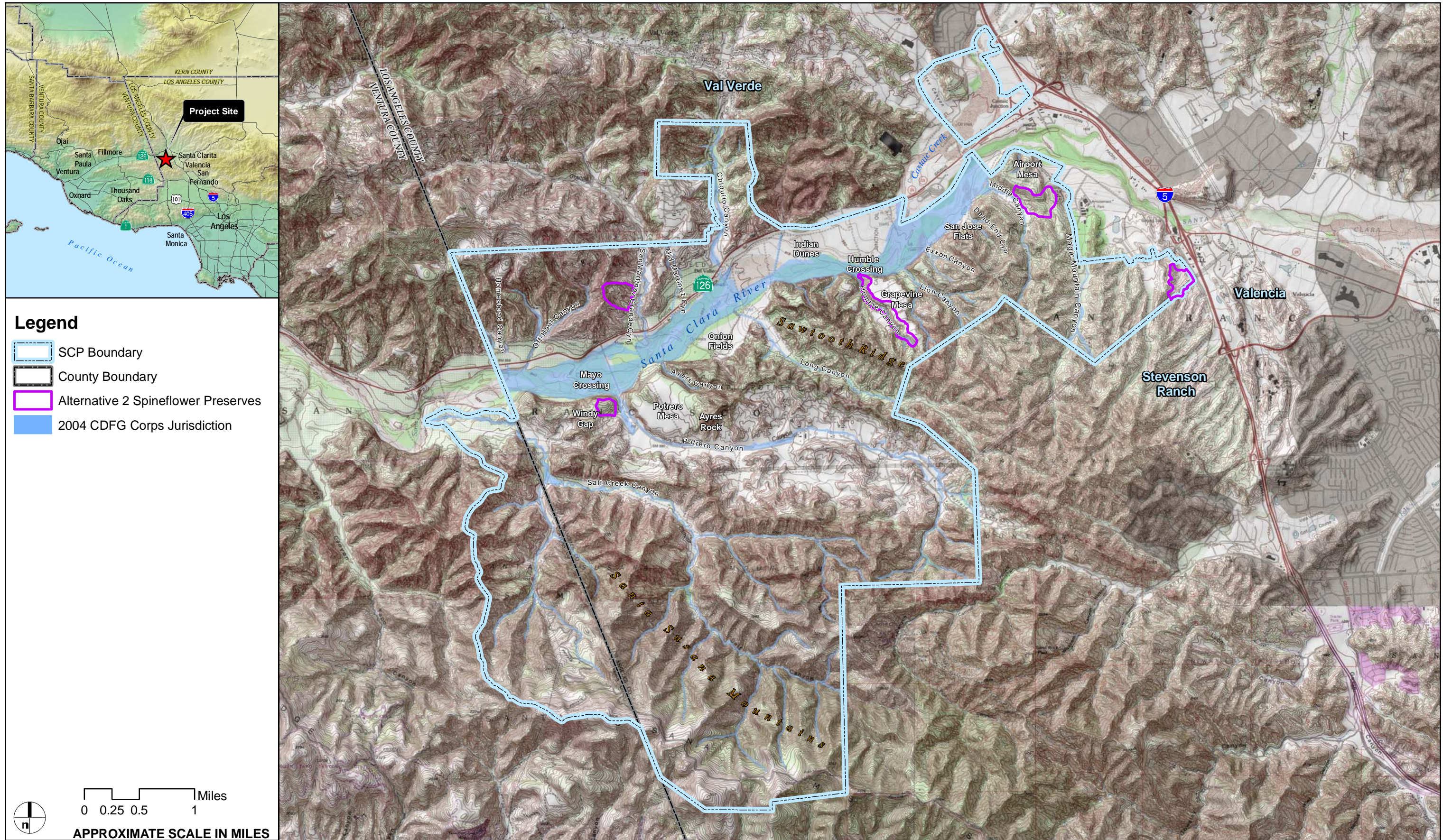


IMAGE SOURCE: USGS 24K Quad

FIGURE 2
Spineflower Conservation Plan
Vicinity Map

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The purpose and need for the Plan under the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. Section 4321, et seq.) and the Plan objectives under the California Environmental Quality Act (CEQA) (California Public Resources Code, Section 21000, et seq.) are:

To develop and implement a practicable/feasible comprehensive spineflower conservation plan that provides for the long-term persistence of spineflower within Newhall Land properties containing known spineflower populations.

To comply with federal and state environmental review requirements under NEPA and CEQA, respectively, the impacts associated with this Plan are addressed in a joint Draft Environmental Impact Statement/Draft Environmental Impact Report (EIS/EIR). The U.S. Army Corps of Engineers (ACOE) and CDFG are the lead agencies in connection with preparation of the EIS/EIR.

2.0 BACKGROUND AND REGULATORY FRAMEWORK

In May 1999, there was only one known extant population of spineflower, located in Ventura County in the vicinity of Laskey Mesa on the Ahmanson Ranch property in the southeast edge of the Simi Hills.¹ Spineflower was thought to be extinct until it was rediscovered at Laskey Mesa in May 1999. It had last been collected in 1927 from the Castaic area of Los Angeles County (CDFG 2001). Subsequently, spineflower was discovered at Newhall Ranch in 2000.

In 2003, the Ahmanson Ranch property was acquired by the State of California through the Wildlife Conservation Board and transferred to the Santa Monica Mountains Conservancy (Conservancy) for the purposes of wildlife habitat preservation, corridor protection, restoration and management, wildlife-oriented education and research, and for compatible public uses, consistent with wildlife habitat preservation and protection of sensitive biological resources. It is now called the Upper Las Virgenes Canyon Open Space. Based on this acquisition, in 2007, the USFWS acknowledged that threats to the spineflower “from habitat destruction or modification are less than they were four years ago [2003], because one of the two populations (Ahmanson Ranch) is in permanent, public ownership and is being managed by an agency that is working to conserve the plant” (72 FR 69034, 69082). The USFWS further acknowledged that the other population (Newhall Land's holdings) is under threat of development; however, a Candidate Conservation Agreement is being developed between USFWS and Newhall Land. The USFWS further determined that, until the Candidate Conservation Agreement is finalized, the threat of development still exists, but the USFWS decided to retain the spineflower's listing priority to

¹ Laskey Mesa is located within the former Ahmanson Ranch property in Ventura County.

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reflect threats that are high but non-imminent in the 2007 Candidate Notice of Review (CNOR), which was published on December 6, 2007 (72 FR 69034, 69082).

Currently, spineflower is known from the Upper Las Virgenes Canyon Open Space in Ventura County and the applicant's land holdings in Los Angeles County. These two spineflower populations are approximately 17 miles apart (*Figure 3*).

At the state level, spineflower was listed as endangered under the CESA, effective as of September 8, 2002. At the federal level, the spineflower remains a federal candidate species.

3.0 BIOLOGICAL GOALS AND OBJECTIVES

The goal of this plan is to ensure the long-term persistence of spineflower within the project study area. As proposed by the applicant in this plan, the long-term conservation of spineflower will be achieved first by establishing a system of preserves to protect the core occurrences of spineflower in the project study area, and second, by implementing management and monitoring within an adaptive management framework to maintain or enhance the protected spineflower occurrences.

The preserve design and adaptive management framework proposed in this plan have been developed based on the following biological goals and objectives, which describe the desired conditions of (1) the spineflower populations, (2) the communities in which the spineflower occurs, and (3) the ecosystem processes known or hypothesized to maintain the spineflower populations and associated communities. For each goal, a set of objectives provides the steps for attaining the goals, and a short explanation or rationale is provided for each objective.

Population

Goal 1: Maintain or increase San Fernando Valley Spineflower populations within the preserves

Objective 1.1

Maintain or increase the distribution of the spineflower within each preserve. Persistence of an endangered plant is enhanced when it occupies a larger geographic area. The more extensive the distribution (i.e., areal extent), the lower the probability that localized events such as wildfire, pest outbreaks, or disease will remove the entire population. Therefore, it is anticipated that maintaining or increasing the distribution of spineflower within each preserve will reduce the probability that foreseen and unforeseen changes in habitat conditions will result in population declines that could threaten persistence throughout the preserve system.

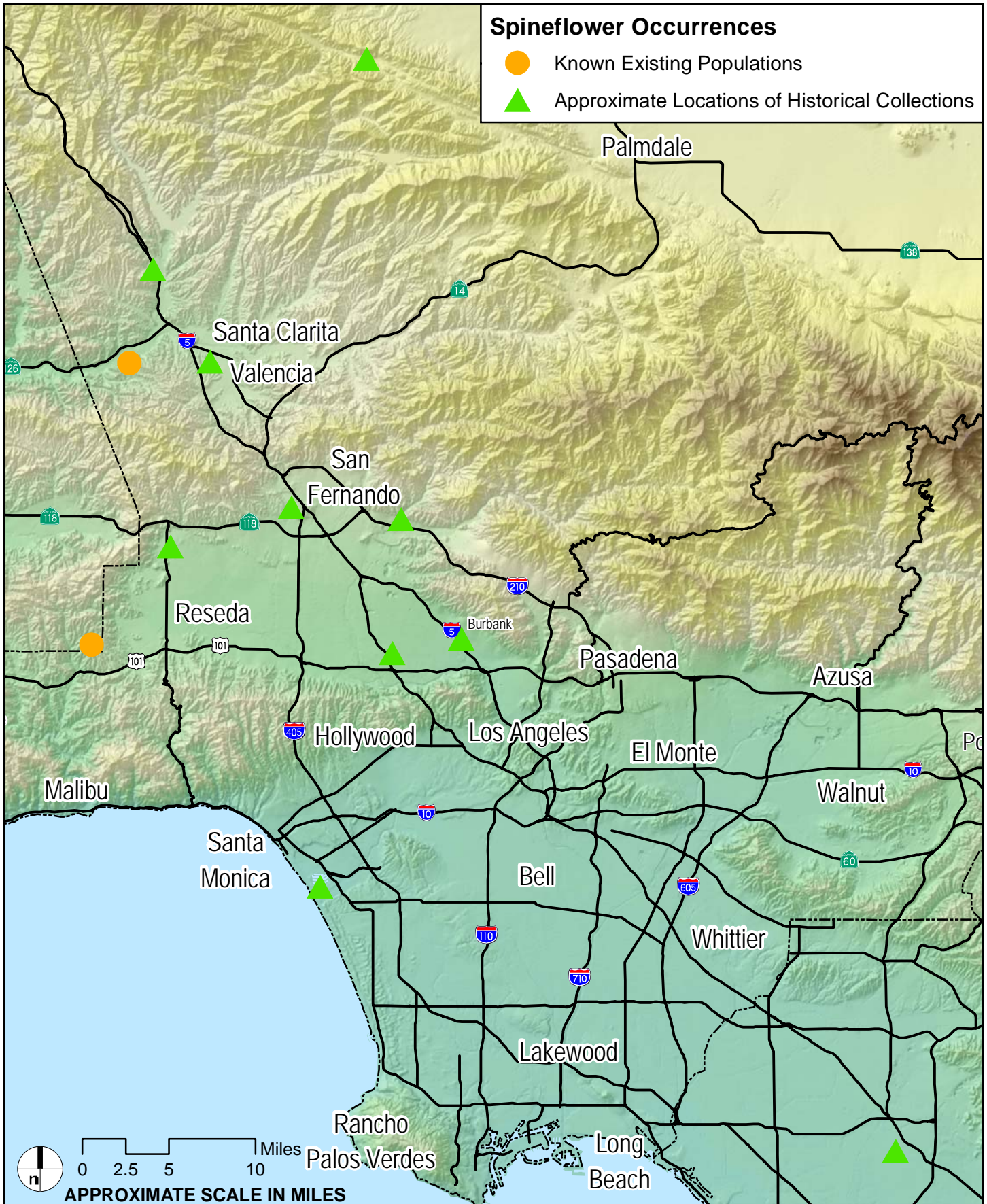


IMAGE SOURCE: USGS 24K Quad

FIGURE 3

Spineflower Conservation Plan



Existing and Historical Locations of Spineflower

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Objective 1.2

Maintain or increase the abundance of the spineflower within each preserve. In general, more abundant populations (i.e., those comprising more individuals) will have a greater probability of persisting and maintaining genetic diversity necessary to adapt to a changing environment than smaller (less abundant) populations. Existing anthropogenic alterations to the habitat within the preserves, including the invasion and spread of exotic plants, may have reduced spineflower abundance. Management of preserves will be designed to remove unnatural barriers to spineflower populations and maintain conditions conducive to persistence of a viable seed bank, in order to increase abundance and enhance long term population persistence. It is important to note that this objective will be reached within the context of an ecological system so that maintaining or increasing spineflower abundance retains ecological functions as near to “natural” as possible rather than compromising other aspects of the ecosystem.

Objective 1.3

Reduce or prevent the increase of identified stressors or anthropogenic factors that negatively impact spineflower individual and population performance. Management of the preserves will be designed to address anthropogenic factors that are known or hypothesized to reduce spineflower individual and population performance, including exotic plants, Argentine ants (*Linepithema humile*), trampling or erosion due to trespass, and introduction of unseasonal runoff from off-site locations.

Objective 1.4

Increase understanding of the ecological factors influencing the distribution, abundance, and population persistence of the spineflower in order to inform management and monitoring within the preserves. Many gaps remain in the understanding of the ecology of the spineflower, making it difficult to devise management strategies to prevent its extirpation, and to design efficacious monitoring protocols. Studies, management, and monitoring will be designed and implemented to increase information about the spineflower needed to inform habitat management and increase the effectiveness of monitoring, thus facilitating Objectives 1.1 through 1.3.

Objective 1.5

Plan and conduct small scale experimental management trials to test the effects of proposed on-the-ground management treatments and evaluate effectiveness and spineflower’s response. Tools and treatment methods needed to manage spineflower and its habitat, including measures to address excessive competition and implement weed control in

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occupied habitat, will be tested by implementing small scale experimental trials. The results will be monitored and evaluated, and those measures which produce a favorable spineflower response or otherwise do not result in adverse ecosystem effects, would then be implemented across larger areas over time.

Communities

Goal 2: Maintain or enhance the structure and native species composition of the native communities within the spineflower preserves.

Objective 2.1

Maintain a mosaic of naturally occurring native communities within the preserves. Under this objective, management would be implemented if a 25% or greater change is observed in the absolute cover of existing native plant communities within each preserve, as measured through a combination of remote sensing and aerial mapping at 10-year intervals. Land slated to be included within the spineflower preserves currently supports a mosaic of native plant communities likely reflecting different abiotic conditions (e.g., soils, topography, and microclimate) and disturbance history (time since fire, cultivation, grazing regime, and other land uses). The proposed preserves also include considerable acreage of disturbed land and non-native annual grassland, which can be restored to native vegetation types and perhaps even suitable spineflower habitat. The existing native plant communities differ in native plant species composition, including the presence and relative abundance of spineflower. As a result of their different plant species composition and physiognomy (structure), these communities likely differ in the habitat conditions (e.g., food availability, abiotic conditions) and thus animal species composition. Through a variety of direct and indirect mechanisms, these plants and animals could be essential to the long-term persistence of the spineflower populations (e.g., by maintaining populations of pollinators and/or seed dispersers).

Anthropogenic contributions to global climate change are generally accepted by the scientific community, and these changes over time may influence the type and composition of native vegetation communities as well as other aspects of the natural environment in Southern California.

Objective 2.1(a)

Restore damaged habitats potentially capable of supporting spineflower, within the preserves. Specific areas shall be restored where they appear capable of being potentially occupied by spineflower. A spineflower Habitat Characterization Study will be conducted prior to development. The results of the study will be used to inform the restoration of potentially

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suitable spineflower habitat, and maps will be produced showing the areas where such restoration will occur. Area-specific plans will be prepared for each location where restoration will occur and reviewed by the proposed adaptive management working group, and approved by CDFG.

Objective 2.1(b)

Revegetate areas within preserves that have been damaged and do not support native habitats but are unlikely to support spineflower in the future. Damaged habitats with deeper valley soils, for example, may not be suitable for spineflower, but may be capable of supporting other appropriate native habitats and pollinator habitat. These locations will also be identified and plans prepared, similar to Objective 2.1(a), to revegetate them and repair soil damage.

Objective 2.2

Maintain or increase the absolute cover of native plant species by 15% within each preserve every 10 years. Native plant species are important components of natural communities. Maintaining or increasing their relative abundance will facilitate the persistence of native plant populations and the maintenance of native plant communities to which native animals, fungi, and other organisms are adapted.

Because early successional stages characterized by sparse native plant cover provide the ideal habitat for some species, perhaps including the spineflower, increasing *total* native plant cover would be an inappropriate target. Instead, the objective will be to maintain and enhance the natural community structure and species composition, and to increase relative native plant cover—the proportion of the total plant cover that is composed of native plant species.

Objective 2.3

Maintain or increase the diversity of native plant species within each preserve by at least 15%, as measured within each preserve every 10 years. Maintaining the diversity of native plant species is also important for the persistence of native communities. A function of species richness and evenness, diversity is often created and maintained by natural ecological processes, including disturbances (e.g., fire) that enhance the diversity of habitat conditions for animals as well as other organisms. Species diversity will be examined at both at the landscape scale (i.e., total diversity), which is a function of community heterogeneity, and at the local or ‘plot’ scale (i.e., alpha diversity).

Though the abundance and diversity of other organisms including animals and fungi are also important, it can be difficult and costly to monitor all of the different groups of organisms.

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Native plant species can be used cautiously as indicators of native community structure for purposes of monitoring overall habitat conditions, unless research indicates this assumption is not met in this system.

Objective 2.4

Increase understanding of the ecology of the native communities needed to inform management of the preserves by undertaking the studies specified as part of the adaptive management program. Greater knowledge about the ecology of the natural communities within the preserves will facilitate management to attain the objectives designed to attain the population, community, and ecosystem goals. Information that could facilitate conservation and management includes: (1) ecological factors that influence the spatial variability in abiotic and biotic conditions within the communities, (2) species composition of various taxonomic groups (including mammals, birds, herpetofauna, insects, fungi, etc.), (3) components of the natural disturbance regimes, (4) ecological responses to disturbance, and (5) successional relationships among communities.

Ecosystem

Goal 3: Facilitate the natural ecological processes required to sustain the native populations and communities in the preserves.

Objective 3.1

Maintain or enhance opportunities for migration of plant and animal populations, including spineflower, between potentially isolated preserves. Following development, the preserves will contain remnant patches of native habitat. All else being equal, small areas are less likely to support persisting populations of endangered species than large areas. If extirpations occur, recolonization will be unlikely due to patch isolation. Genetic diversity is often lower in small, isolated habitat patches, due to genetic bottlenecks, inbreeding, and genetic drift.

Providing opportunities for plant and animal populations to migrate between protected areas can increase the probability of species persistence by increasing the size of populations, allowing recolonization following localized extinctions, and increasing genetic exchange among otherwise isolated populations.

Objective 3.2

Maintain the hydrologic conditions within the preserves. Direct and indirect impacts associated with adjacent development, particularly that which occurs upslope of the preserves,

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can alter hydrology and thus affect soil moisture and erosion processes. Increased moisture underneath and on the soil surface is predicted to facilitate the invasion and spread of Argentine ants—non-native arthropods that outcompete native ants that could be important spineflower pollinators and/or seed dispersers. Increases in soil moisture can also facilitate populations of native and non-native plants that can outcompete spineflowers, which are poor competitors. Preserves should be managed to prevent alterations to soil moisture by avoiding concentrated runoff, inhibiting drainage, and other factors that could increase soil moisture.

4.0 SPECIES DESCRIPTION

This section summarizes the biological data for the spineflower and includes a description of the results of previous and ongoing pollination, germination, and viability studies that have been conducted at Ahmanson Ranch in Ventura County and in the project study area in Los Angeles County.

4.1 Current Status

State: Endangered, September 2002

Federal: Candidate (Priority 6), May 2004

CNPS List 1B.1

4.2 Taxonomy

SFVS was first described as *Chorizanthe fernandina* by Watson in 1880. The type specimen was collected in 1879 from San Fernando Canyon near the San Fernando railroad station (Brown 1884 and Goodman 1934, as cited in Sapphos 2001). In 1923, Jepson revised the taxonomy of SFVS and renamed it *Chorizanthe parryi* var. *fernandina* (City of Calabasas 1999, 2000). SFVS is a member of the Polygonaceae family and is among 50 taxa in the genus *Chorizanthe* that occur in western North America and southwestern South America (Hickman 1993).

4.3 Distribution

SFVS is endemic to Southern California and is known from 10 historical locations and 2 current locations.

Historical Distribution

Historical records include specimens collected between 1879 and 1929 that represent at least 10 SFVS locations in Los Angeles and Orange counties (CDFG 2001; CDFG 2007) (*Figure 3*). In Los Angeles County, collections were made at nine locations within the San Fernando Valley along the foothills of the San Gabriel Mountains. Only one collection was made in Orange

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County from hills near Santa Ana. SFVS was thought to occur in San Diego and San Bernardino counties, but these locations were later determined to be mislabeled or misidentified (CDFG 2001).

Table 1 summarizes the 10 historical occurrences of SFVS previously located in Los Angeles County and Orange County (CDFG 2001; CDFG 2007). However, all of the historical occurrences listed in *Table 1*, except Element Occurrence 6, are considered extirpated (CDFG 2001; CDFG 2007). Element Occurrence 6 is in the San Martinez Grande Preserve Area; historical observations in the area made in 1893 are attributed to this occurrence.

Table 1
Summary of the Historical Locations of SFVS

Element Occurrence	County	Location	Last Year Observed
1	Los Angeles	Little Tujunga Wash, along the southwest base of the San Gabriel Mountains	1920
2	Los Angeles	Elizabeth Lake, on sandy banks	1929
5	Los Angeles	Near Castaic, sandy wash along Castaic Valley	1929
6	Los Angeles	Newhall, general vicinity	1893
7	Los Angeles	Chatsworth Park, general vicinity	1901
8	Orange	Hills near Santa Ana, believed to have been in the foothills of Lomas de Santiago (CDFG 2001)	1902
9	Los Angeles	Ballona Harbor, in the general vicinity of Ballona Creek	1901
10	Los Angeles	San Fernando, in the vicinity of lower San Fernando dam just downstream from Los Angeles reservoir and upper Van Norman Lake	1922
12	Los Angeles	Burbank, general vicinity	1890
13	Los Angeles	Tolucca, vicinity of North Hollywood ¹	Before 1930

¹ There is an additional historical collection of SFVS housed at the Rancho Santa Ana Botanical Gardens dated 1930 (CDFG 2001).

Current Distribution

Currently, SFVS is known from only two locations: the vicinity of Laskey Mesa in Ventura County (Element Occurrence 11; CDFG 2007) and in the project study area (Newhall Land property) in Los Angeles County (Element Occurrences 6, 14, 15, 16; CDFG 2007). The Laskey Mesa area and project study area locations are approximately 17 miles apart. The Laskey Mesa is within 1 mile of the historical collection sites at Chatsworth Park (Element Occurrence 7 in 1901). Element Occurrence 6, collected in 1893, occurs within the project study area and is presumed to be the same as populations discussed herein in the San Martinez Grande Preserve Area (*Figure 3*).

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The Laskey Mesa area is located on the southern edge of the Simi Hills near the City of Calabasas in an area formally known as Ahmanson Ranch. The Simi Hills are within the Transverse Ranges geographic subdivision of California (Hickman 1993). Following the rediscovery of SFVS at Ahmanson Ranch, biologists working with Sapphos Environmental Consulting conducted a directed search for SFVS that included historical localities, suitable habitat areas within the historical range of SFVS, and suitable habitat areas near the existing population at Laskey Mesa. A total of 7 historical locations and 21 other locations were surveyed with negative results in 1999 and 2000 (Sapphos 2001).

Section 5 provides a discussion of the current known distribution within the Specific Plan area and the Entrada and VCC planning areas on Newhall Land property holdings within the project study area in Los Angeles County.

4.4 Abundance

Historical records do not include information regarding the abundance of SFVS. Existing data on the abundance of SFVS and the area occupied are from annual surveys conducted at Ahmanson Ranch and in the project study area (Newhall Land property) (*Table 2*). Surveys of the Ahmanson Ranch population at Laskey Mesa were conducted in 1999, 2000, 2001, and 2002. The population has varied from a low of 23,000 SFVS individuals in 1999 (a relatively dry year) to 1.8 million individuals in 2001 (a year of relatively normal rainfall) (Glenn Lukos Associates and Sapphos 2000; Sapphos 2003a).

Table 2
Annual Population Estimates of SFVS and Area Occupied at
Ahmanson Ranch and Property Owned by Newhall Land

Area	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ahmanson Ranch (Population)	23,000	1.46 million	1.8 million	220,935	—	—	—	—	—
Ahmanson Ranch (Acres Occupied)	5.9	10.3	12.9	3.6					
Newhall Land property (Population)	—	—	—	7,814	5.9 million	560,000	7.4 million	1.8 million	760
Newhall Land property (Acres Occupied)	—	—	—	0.59 ¹	16.37	5.33	11.45	8.49	0.12

¹ The 2002 acres occupied number does not include VCC planning area; the VCC SFVS polygon boundaries were not mapped using Global Positioning System (GPS) units in 2002.

In the Specific Plan area, SFVS locations were first identified at Airport Mesa and Grapevine Mesa during limited surveys conducted in 2000. However, 2000 survey data did not include

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population estimates (URS 2002). In 2000, FLx and Katherine Rindlaub Biological Consulting recorded three polygons, representing 1,000 to 2,000 individuals of SFVS on the Entrada planning area (FLx 2004). In 2001, surveys of San Martinez Grande Canyon and the VCC planning area identified approximately 14,750 and 4,600 SFVS individuals, respectively (FLx 2002a, 2002b).

In 2002, 2003, 2004, 2005, 2006, and 2007, surveys were conducted throughout the Specific Plan area and Entrada and VCC planning areas (*Table 2*). The number of SFVS individuals has varied dramatically, from a low of 7,814 in 2002 to a high of 7.4 million in 2005 (Dudek and Associates 2002a, 2002b, 2002c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2005a, 2005b, 2005c, 2006a, 2006b, 2006c; Dudek 2007a, 2007b, 2007c). The area occupied has also varied from year to year (*Table 2*). The total occupied footprint has increased each year since 2003. As of 2007, the total mapped footprint of spineflower occurrence in the project study area was 20.2 acres. In 2004, spineflower populations occupied 26% of the total mapped footprint of spineflower area. The area occupied varied in 2003, 2005, and 2006, but on average was more than double the area occupied in 2004, averaging about 60% occupancy. In 2007, only 0.12 (0.6%) acre was occupied by spineflower.

The variation of SFVS abundance and area occupied from year to year is typical of annual plant species. In the case of SFVS, it appears that climatic conditions influence SFVS abundance and area occupied. On the Newhall Land property, the estimated number of SFVS was lower in 2002, 2004, and 2007, compared to 2003 and 2005, with 2006 falling in between. Years 2002, 2004, and 2007 experienced below-average rainfall; in year 2003, rainfall was considered normal, according to the Western Regional Climate Center. Winter 2004/spring 2005 rainfall was considered to be above normal; in winter 2005/spring 2006, rainfall was slightly below average but not as low as it was in 2002, 2004, and 2007, according to the Western Regional Climate Center (WRCC 2006).

At Laskey Mesa, only 50% of the SFVS were observed to flower in 2002, a below-average rainfall year (Sapphos 2003a). In relatively natural habitat areas of Grapevine Mesa in the spring of 2002, only a handful of individuals survived to reproduce; these were typically at locations protected from wind, beneath the drip line of a shrub, or otherwise more protected from exposure. Failed, desiccated rosettes were commonly observed (Meyer 2004). With better climatic conditions in 2003 and 2005, the SFVS population on the Newhall Land property increased by several orders of magnitude.

It is important to emphasize that the population numbers described above are estimates: spineflower populations are highly aggregated and densities vary considerably within the same polygon. Preliminary studies indicate that variability between areas is lower than the variability

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from year to year (Dudek and Associates 2006d), although the exact area of occupancy has changed each year. For example, in 2002, 2004, and 2007—years of low abundance—spineflower occurred in some areas where they did not occur in 2003, a highly abundant year. These results need further analyses and will be addressed by future monitoring described in *Section 11.0*. Analysis of variance (ANOVA) tests of the density of spineflower individuals and acres occupied at the five core locations gave contrasting results. The area occupied varied more between sites than between years, while density varied more annually than between sites. There was no significant interaction between year and site when a two-way ANOVA was used, which means all of the sites tended to change year to year in a similar fashion. More data are needed, but the preliminary interpretation is that preferred spineflower location is controlled by intrinsic environmental characteristics (e.g., soil type), while population density (and, in turn, actual numbers of individuals) is controlled by extrinsic environmental characteristics (e.g., rainfall).

After mapping the boundaries of each polygon, the number of individuals was counted/estimated in a rectangular “sample estimation area,” which is a subset of the total polygon. The sample estimation area was between 200 centimeters² (10 by 20 centimeters) and 2 meters² (1 by 2 meters), depending on various factors (e.g., size of the polygon, plant densities, variations in plant densities within the polygon). The number of subsets within the total polygon was determined and added/multiplied, resulting in a total estimate of the number of individuals of the polygon (e.g., $4 \times 125 = 500$; $8 \times 12 = 96$; $9 \times 100 = 900$). This number was then rounded to the nearest magnitude or multiple of a magnitude (e.g., 500, 100, 1,000). Although the spineflower population numbers are expected to overestimate true population densities (Dudek and Associates 2006d), the area occupied should be accurate, as it represents completely mapped units. The general agreement between population estimates and occupied area indicates that, at least for general qualitative analyses, the population estimates are adequate.

Moreover, there is a substantial difference in the overall size of any given individual, which has a direct bearing on reproductive output. There is a positive logarithmic relationship between the size of SFVS individuals and involucre production, with smaller plants producing fewer involucres than larger plants (Sapphos 2003b). That is not to say that small individuals are less valuable. Small-size plants may be the result of poor conditions at a given micro-site where the plant was growing, but also may relate to timing of germination. Later-germinating plants may not achieve the same overall size as plants that have had more time to develop (Sapphos 2003b). However, later-germinating individuals likely contribute to the adaptability of the seed bank to respond to different environmental conditions. In rainfall years with multiple germination events, a mix of plant sizes may represent different ages of individual plants.

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4.5 Description

SFVS is a low-growing herbaceous annual. Germination occurs following the onset of late-fall and winter rains and typically represents different cohorts emerging from the seed bank over the winter and early spring growing season. Spineflower initially forms a basal rosette. As day lengths increase in springtime, flowering stalks are produced. Flowering generally occurs between April and June. Overall size of spineflower can vary, ranging from small, button-sized erect plants with little branching to larger, decumbent plants up to 30.5 millimeters in height and between 5.1 and 40.6 millimeters across. Leaves are oblong to oblanceolate, between 5 and 40 millimeters, and they form a basal rosette. The involucre is urn shaped, with six bracts and straight awns enclosing its small white flower, which measures 2.5 to 3 millimeters (Hickman 1993). Each involucre produces a single flower that forms a single seed. SFVS can generally be differentiated from co-occurring spineflowers, including Turkish rugging (*Chorizanthe staticoides*) and lastarriaea (*Lastarriaea coriacea*), by its decumbent habit, white flowers, entire leaves, and straight-tipped involucre awns. Plants become desiccated and die by late summer, leaving branches brittle and dry but usually with intact involucres still attached and containing seed. SFVS disarticulates (breaks apart) with clumps of four to eight involucres that are rigidly held together. In contrast, the involucres of Turkish rugging and lastarriaea disarticulate readily and one by one. Seeds are eventually released from the involucre, but the exact mechanism and timing of this release has not been described.

4.6 Habitat at Existing and Historical Locations

Vegetation

For purposes of discussing vegetation, the Vegetation Classification and Mapping Program “List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database” (CDFG 2003a) was used, with a few exceptions. In certain instances, the vegetation communities observed in the field did not match the vegetation communities described by CDFG (2003a). In these instances, Dudek developed additional vegetation community classifications.

Historical accounts describe SFVS as occurring within scrub communities in washes, riverbeds, and upland sites. Although historical accounts do not provide specific information regarding local habitat conditions, based on their locations, occurrences described within upland areas probably occurred within California sagebrush scrub communities, while occurrences described as occurring within sandy washes were probably within Riversidean alluvial fan sage scrub communities (Sapphos 2001). Historically occupied habitat likely also included native grasslands (Meyer 2004). The interstitial spaces between bunchgrasses were likely occupied by annual forbs and geophytes, including various species of *Chorizanthe* (Keeley 1990).

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At the two current known locations, SFVS generally occurs within sparsely vegetated grassland and scrub communities and associated ecotones. At Laskey Mesa, SFVS is described as occurring along the interface between California sagebrush scrub and grassland habitats. This observed distribution may be the result of past dryland farming of the mesa top, which likely removed any SFVS growing in the farmed area (CDEFG 2001). Past farming and livestock grazing practices are likely to have modified the vegetation on Laskey Mesa; therefore, it is not known whether this area was native grassland, coastal scrub, or a mix of both prior to European contact. On the Newhall Land property, the majority of SFVS sites occur within California sagebrush scrub and California annual grassland but also occur on agricultural land. In this sense, agricultural land means areas recently subjected to terracing and grubbing for agricultural purposes, but which were not planted with actual crops or were planted with crops in the recent past. SFVS sites also occur within openings in southern coast live oak woodland, undifferentiated chaparral, and alluvial scrub. Sparsely vegetated areas with low overall cover of herbaceous vegetation and some bare ground are typical of existing SFVS sites at Ahmanson Ranch and on the Newhall Land property, although SFVS has also been observed in areas of dense annual grasses.

Soils and Geology

A geologic investigation of historical and existing locations indicated that SFVS sites are associated with two generic conditions: (1) alluvial deposits of riverine systems and (2) contact points between exposed bedding planes where the parent material is exposed at the surface (Sapphos 2000). These conditions are consistent with the observation that SFVS occurs in areas with thin, poorly developed soils that are relatively low in nutrients. On the Newhall Land property, SFVS occurs on eight geologic formations: Artificial Fill, Quaternary Alluvium, Quaternary Landslide, Quaternary Older Alluvium, Quaternary Slopewash, Quaternary Terrace Deposits, Undifferentiated Terrace Deposits, and Undifferentiated Saugus formation. The Saugus formation consists of interbedded sandstones, siltstones, and mudstones deposited during late-Pliocene and early-Pleistocene times, 2.5 to 0.7 million years before present. The Quaternary formations were deposited in the past 1.8 million years, during Pleistocene times (Allan E. Seward 2004). At Laskey Mesa, the underlying geology is Tertiary-aged unnamed shale and sandstone, about 5.1 million years before present (Dibblee 1992), which is older than the underlying geologic formations on the Newhall Land property.

Existing and historical SFVS sites are potentially associated with a variety of soil units. Soil units at historical sites were highly variable, and 7 of the 12 historical sites lacked adequate specificity as to location such that it is not possible to determine the historical geologic and soil composition at these locations. Five sites that could be correlated with geologic data did not match those occurring on Ahmanson Ranch (Sapphos 2001). At Laskey Mesa, SFVS is

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associated with San Andreas sandy loam (2% to 9% slopes), Zamora loam (2% to 9% slopes), and Santa Lucia shaly silty clay loam (15% to 30% slopes) (Glenn Lukos and Associates, Inc. and Sapphos 2000). On the Newhall Land property, although SFVS sites occur on a variety of soil units, approximately 90% of polygons occurred within Terrace escarpments, Castaic-Balcom silty clay loams (30% to 50% slopes), Castaic-Balcom silty clay loams (30% to 50% slopes, eroded), Zamora loam (2% to 9% slopes), and Saugus loam (30% to 50% slopes). The occupied soils at Ahmanson Ranch and on the Newhall Land property appear similar in that they are primarily loam or silty clay loam, with a much lower level of occurrence on sandy loams.

At both Laskey Mesa and the Newhall Land property, SFVS occurs primarily in areas of poorly developed soils with shallow depth to bedrock. At Laskey Mesa, soils in adjacent unoccupied areas with dense grasses were found to be more developed and have higher levels of nutrients. SFVS plants also frequently grew in areas of rock outcroppings in weathered, degraded parent material featuring poorly developed soils lacking true soil horizons (Sapphos 2001). SFVS distribution at Laskey Mesa is possibly influenced by past land use and invasion of European annual grasses and forbs and may be a response to a buildup of thatch, in light of the fact that livestock were removed from annual grasslands on Laskey Mesa about 8 years prior to the discovery of SFVS at Ahmanson Ranch (Meyer 2004). Similarly, plants occurring in undisturbed areas on the Newhall Land property consistently occur on soils lacking the organic soil horizon, whereas occupied mesa-tops typically consist of very well-developed soils (Allan E. Seward 2002).

SFVS sites also differ from adjacent unoccupied areas in the level of soil compaction. Soils at Ahmanson Ranch SFVS sites generally have higher bulk densities (dry weight of soil per unit of volume) than adjacent areas supporting non-native weedy species (St. John 1999, as cited in Sapphos 2001). SFVS is also in areas with disturbed soils, occurring along infrequently used dirt roads and trails at Ahmanson Ranch (Sapphos 2001). On the Newhall Land property, SFVS is found on recently created artificial fill slopes and in areas disturbed by fossorial rodent activity. Specifically, within the Entrada planning area, SFVS occurs along manufactured slopes adjacent to the golf course, and a number of the occurrences in the undisturbed sage scrub throughout Entrada are associated with fossorial rodent activity. Within the VCC planning area, SFVS occurs along the edges of dirt roads that have been in use for decades. Within the Specific Plan area, SFVS occurrences are associated with fossorial rodent activity in a number of areas of undisturbed sage scrub; in particular, San Martinez Grande Canyon and the areas within and surrounding Potrero Canyon, Grapevine Mesa, and Airport Mesa and in annual grasslands that have been used for grazing for decades.

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Elevation, Slope, and Aspect

Existing SFVS populations in the vicinity of Laskey Mesa occur between 1,200 and 1,400 feet AMSL, while populations on the Newhall Land property occur between 960 and 1,320 feet AMSL (Sapphos 2001; Dudek and Associates 2002a, 2002b). SFVS occurs primarily on slopes with a south-facing aspect. These southern exposures experience more sunlight and heat, which leads to less dense herbaceous growth and/or less dense vegetation when compared to areas with a northern exposure. Therefore, SFVS's tendency to occur on these slope exposures may be due to the prevalence of more sparsely vegetated habitat areas on hotter, drier slopes.

At Laskey Mesa, site characteristics from 1999 to 2002 surveys indicated that 96% of occupied habitat had a predominantly south-facing aspect (Sapphos 2002). SFVS sites on the Newhall Land property are mostly on slopes with a south-facing component, with 50% of sites occurring on south-, southwest-, or southeast-facing slopes.

At Laskey Mesa, SFVS occurs on slopes with gradients between 4% and 47%, with an average slope of 20% (Sapphos 2001). These calculations may overestimate the slope because SFVS tends to occur in localized depressions or along narrow shelves and benches at Ahmanson Ranch (CDFG 2001). On the Newhall Land property, approximately 90% of SFVS occurrences are on slopes with gradients between 0% and 25%.

4.7 Competition

SFVS appears to occur most often in areas with little or no competing vegetation. This has also been reported for other species of *Chorizanthe* (Davis and Sherman 1992; McGraw and Levin 1998; Kluse and Doak 1999; Coppoletta and Moritsch 2002). Preliminary studies within the project study area found no correlation between spineflower densities and vegetation type (i.e., native or non-native herbs) or ground cover (e.g., thatch, bare ground, litter) when analyzed at the level of mapped polygons. The exception to this was a negative correlation, with the percentage of native shrubs indicating shading may be an inhibitor of spineflower occurrence (Dudek and Associates 2006d). Studies conducted on the Newhall Land property in 2007 found that compared to areas that typically contain spineflower (i.e., in years of average or above-average rainfall), areas containing spineflower in 2007 tended to have greater cover of bare ground, less cover of thatch, and thatch that was not as deep. In addition, the majority of co-occurring species in 2007 were non-native annual species, suggesting the similarity of ecological requirements and the potential that competitive effects of non-native plants may be especially important in years of below-average rainfall (Dudek 2007d).

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Test-plot experiments at Laskey Mesa studied the effect of treatment combinations of vegetation removal and supplemental watering in both north- and south-facing plots by measuring mean number of plants, mean number of involucre, and mean plant size. Results indicated that maintaining subplots free of all competing vegetation produced spineflower plants of exceptional size and number of involucre by producing additional primary, secondary, and tertiary branching (Sapphos 2003c). This result is similar to the response of SFVS individuals that germinated on grubbed slopes in the Airport Mesa area of the Newhall Land property in 2002. Exceptionally large plants were frequently observed at this location, while SFVS plants in more typical habitat areas with normal levels of competing vegetation were very small and frequently failed to survive the hot, dry conditions found during the 2002 growing season (Meyer 2004). The Sapphos study also indicated that vegetation removal increased the number of seeds produced per plant; however, this was the result of an increase in the number of flowers produced and not of an increase in seed set (Sapphos 2003c).

The Sapphos study results indicated that any combination of vegetation removal, in which all vegetation other than spineflower was removed, had no significant effect in the west-/northwest-facing plot. However, in south-facing plots, vegetation removal had a significant effect on the mean number of plants within a plot and on the number of involucre produced per plant. Thus, when vegetation was removed, the number of involucre and mean plant size were significantly greater on south-facing plots than north-facing plots. Between north- and south-facing plots, there were no significant differences in plant number, number of involucre, or mean plant size when vegetation was not removed (Sapphos 2003c).

In a second Sapphos study at Laskey Mesa, vegetation removal was accomplished using a weed-whip or an herbicide (RoundUp). Following treatment, the vegetation and duff were removed from the plots, and the plots were seeded with SFVS. The plots treated with the herbicide experienced greater SFVS growth and reproductive output as compared to the weed-whipped plots (Sapphos 2003b). It is important to note that this outcome may have been influenced by rainfall conditions in 2003; rain fell through May 9, 2003. This could have resulted in regrowth of annual grasses within the weed-whipped plots. It is also important to note that the use of herbicides within SFVS preserves would require great caution and site-specific evaluation.

Furthermore, based on a study characterizing the habitat of slender-horned spineflower (*Dodecahema leptoceras*), a species closely related to SFVS, it was noted that soil in plots occupied by slender-horned spineflower had lower levels of nitrogen, phosphorous, electrical conductivity, and organic materials than distant unoccupied plots that appeared visually suitable. In addition, the soil in the occupied plots had higher values of nitrogen and electrical conductivity than unoccupied adjacent suitable plots. The soil in occupied plots had lower values of phosphorus and organic material than unoccupied adjacent suitable plots (Allen 1996).

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Therefore, it is important to note that while unoccupied adjacent and distant plots appeared similar to occupied plots, there were differences in soil characteristics that may influence the success of slender-horned spineflower populations.

The results of the 2006 and 2007 pilot monitoring studies on the Newhall Land property (Dudek and Associates 2006d; Dudek 2007d) and the studies summarized above indicate that spineflower occurrence is controlled by a combination of environmental conditions and competition. SFVS tends to occur most often in open areas, particularly those lacking shrubs. Observed occurrences in settings with disturbed soils (i.e., road sides and burrows) could be interpreted as indicating spineflower is a successional specialist, but the consistent occurrence from 2002 to 2006 in the same areas indicates a highly environmentally controlled distribution.

4.8 Reproduction

Breeding System

SFVS flowers are protandrous (i.e., anthers release pollen prior to stigma becoming receptive to pollen), limiting the extent to which self-fertilization can occur within a flower. However, according to Jones et al. (2002), small flower size and a fruit set higher than expected for exclusively outcrossing systems (i.e., plants that must be pollinated by other plants) indicates that SFVS is likely a facultative selfer (i.e., a plant that can be pollinated by other plants or by itself). SFVS flowers produce a single achene (i.e., a one-seeded, dehiscent fruit), which apparently remains within the involucre even after the plant disarticulates (CBI 2000).

Germination and Viability

Germination and viability tests were conducted using SFVS seed collected from Ahmanson Ranch in 2000 and 2001 (RSABG 2000 and 2001, in Sapphos 2003b). Seeds collected in 2000 were determined to have germination rates between 68% and 73% and viability rates of 90% to 96%. Seeds collected in 2001 had germination rates of between 46% and 49% and viability rates of 90% to 96%. Seed set was between 58% and 72% in 2000 and approximately 60% in 2001. Experiments conducted by Rancho Santa Ana Botanic Garden (RSABG) found that dramatic increases in germination rates were obtained by clipping seed coats (Sapphos 2001). Although this would indicate the presence of a physical seed coat dormancy, the mechanism by which dormancy is overcome in naturally occurring populations remains unknown.

Pollinators

The majority of information regarding the pollination biology of SFVS is from the results of studies carried out at Ahmanson Ranch by Jones et al. (2002). Five species of arthropods were

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found to be responsible for more than 75% of visits to SFVS flowers: two ant species (*Dorymyrmex pyramicus* and *Solenopsis xylonii*), European honeybee (*Apis mellifera*), and two beetle species (*Dasyinae* sp. and *Zabrotees* sp.). Honeybees were the only species carrying sufficient amounts of pollen for analysis, but they were determined to have a high rate of floral constancy (94%). Floral constancy is a measure of how specific a floral visitor is to a given species on any single foraging flight (Jones et al. 2002). High floral constancy indicates that honeybees are capable of being effective SFVS pollinators.

Although the effectiveness of ants as SFVS pollinators remains uncertain, ants were among the most frequent visitors to SFVS in two different studies carried out at Ahmanson Ranch (LaPierre and Wright 2000; Jones et al. 2002). As observed by LaPierre and Wright (2000), the diameter of an SFVS flower is large enough to accommodate ant visitors, suggesting that pollination by ants is at least possible. In addition, Jones et al. (2002) found that SFVS exhibits relatively low nectar production per flower, which often forces floral visitors seeking nectar (such as ants) to visit many flowers while foraging, thereby ensuring the pollination of many flowers. Parasitic wasps and bean weevils were also noted as visitors to SFVS flowers, although it is unknown if either are effective pollinators (Jones et al. 2002).

On the Newhall Land property, Jones et al. (2004) conducted a pollination study at three locations: Grapevine Mesa (Site 1) and Airport Mesa (Site 2) within the Specific Plan area and one location at Entrada (Site 3). The most common visitors during the mid-season (April 23–25, 2004) to Sites 1 and 2 were flies (67% and 58.5%) and beetles (27% and 21.5%). The most common visitors to Site 3 during the mid-season were ants (43%) and beetles (42%). During the late season, May 7 through 9, 2004, the most common visitors at Site 1 were flies (83%) and beetles (12%). The most common visitors at Site 2 during the late season were beetles (31%), ants (28%), and flies (25.5%), and the most common visitors at Site 3 during the late season were ants (70%).

Jones et al. (2004) also evaluated the effectiveness of ants as pollinators. In the laboratory, spineflower was grown in two enclosures, one excluding all insects except ants (*Dorymyrmex insanus*), and one excluding all insects. The plants in the enclosure with ants experienced 64.6% seed set, while the plants in the enclosure without ants experienced 29.2% seed set. Thus, it would appear that ants can be effective pollinators and that spineflower is capable of self-pollination (however, viability studies have not yet been conducted for the seeds).

Plant Size

Based on the results of the 2007 Spineflower Monitoring Pilot Study conducted on the Newhall Land property, plant size was found to have a significant correlation with the number of

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involucres per plant (Dudek 2007d). Because SFVS produces a single seed per involucre, the number of involucres per plant is an indication of reproductive output. In 2007, plant size (i.e., diameter) ranged from a few millimeters across to as large as 12 centimeters across. The number of involucres per plant generally reached as high as 300 involucres per plant.

4.9 Seed Dispersal

Little is known about dispersal of SFVS seeds. Trapping studies conducted at Ahmanson Ranch in September 1999 investigated the potential role of small mammals in SFVS seed dispersal (Sapphos 2001). Four species were found in trap lines set within SFVS habitat: San Diego pocket mouse (*Chaetodipus fallax*), Pacific kangaroo rat (*Dipodomys agilis*), western harvester mouse (*Reithrodontomys megalotis*), and deer mouse (*Peromyscus maniculatus*). No SFVS seeds were found attached to the animals' pelage, and neither seeds nor seed heads were found in the cheek pouches of kangaroo rats or pocket mice. However, this is not surprising given that the SFVS seeds may not disarticulate from the involucre for some months, which would potentially protect the seed from direct herbivory during that stage. In the field, involucres have been observed to attach to human skin, clothing, and shoes, suggesting potential for involucres containing seed to be carried away from the parent plant if they lodge on humans or other animals.

Based on spineflower seed germination tests conducted at RSABG, it appears that the involucres may inhibit or delay germination. Two germination studies conducted in 1999 and 2000 of spineflower seeds still retained within the involucres resulted in germination rates of 34% and 30%. Subsequent germination studies conducted for spineflower seeds removed from the involucres resulted in germination rates of 65% to 100% (Wall 2004).

Ants may play a role in the dispersal of SFVS. LaPierre and Wright (2000) noted one species of harvester ant (*Messor andrei*) carrying SFVS flower parts containing seeds to nest sites, and SFVS parts were also evident in *M. andrei* midden piles. Harvester ants are capable of foraging for seeds as far as 330 feet from the nest, creating the possibility that seeds may be dropped en route.

4.10 Seed Banks and Genetics

The appearance of significant new SFVS populations from year to year in the vicinity of Laskey Mesa and the project study area is consistent with the presence of a seed bank. Ferguson and Ellstrand (1999) note that seed banks are critical to maintaining genetic diversity among isolated populations of slender-horned spineflower, a close relative of the SFVS. In studies of slender-horned spineflower, current-year germinating plants were found to have greater genetic variation than seeds produced during the previous year, indicating that seed banks make important

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contributions to the genetics and population biology. Genetic variation within populations and within the species as a whole was found to be higher in slender-horned spineflower than is generally expected for annuals or endemics. Similar investigations of the role of seed banks in SFVS genetics and population biology have not been conducted.

5.0 OCCURRENCE WITHIN PROJECT STUDY AREA

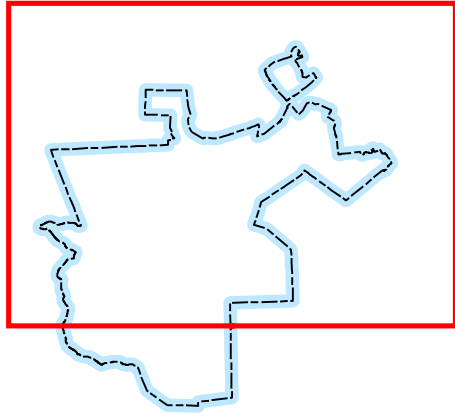
This section describes the results of the 2000, 2001, 2002, 2003, 2004, 2005, 2006, and 2007 surveys and the occurrence data within the project study area. The data discussed includes the number and distribution of occurrences and ecological indicators such as slope, aspect, vegetation, soils, and pollinators. The data also includes the results of the on-site geology and soils testing.

5.1 Description of Annual Survey Efforts





In 2000, URS surveyed portions of the Specific Plan area to the south of and along the Santa Clara River corridor (URS 2002). SFVS was detected at sites along Grapevine Mesa and in the vicinity of Airport Mesa. FLx and Katherine Rindlaub found SFVS within Entrada in 2000 (FLx, March 23, 2004, pers. comm.). In 2001, FLx surveyed portions of VCC and the Specific Plan area, including Long Canyon and San Martinez Grande Canyon, but excluded Grapevine Mesa and Airport Mesa (FLx 2002a, 2002b). At that time, SFVS was detected at sites on the north side of SR-126 at San Martinez Grande Canyon. In 2002, 2003, 2004, 2005, 2006, and 2007, Dudek conducted annual surveys throughout the Specific Plan area and the VCC and Entrada planning areas (Dudek and Associates 2002a, 2002b, 2002c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2005a, 2005b, 2005c, 2006a, 2006b, 2006c; Dudek 2007a, 2007b, 2007c).

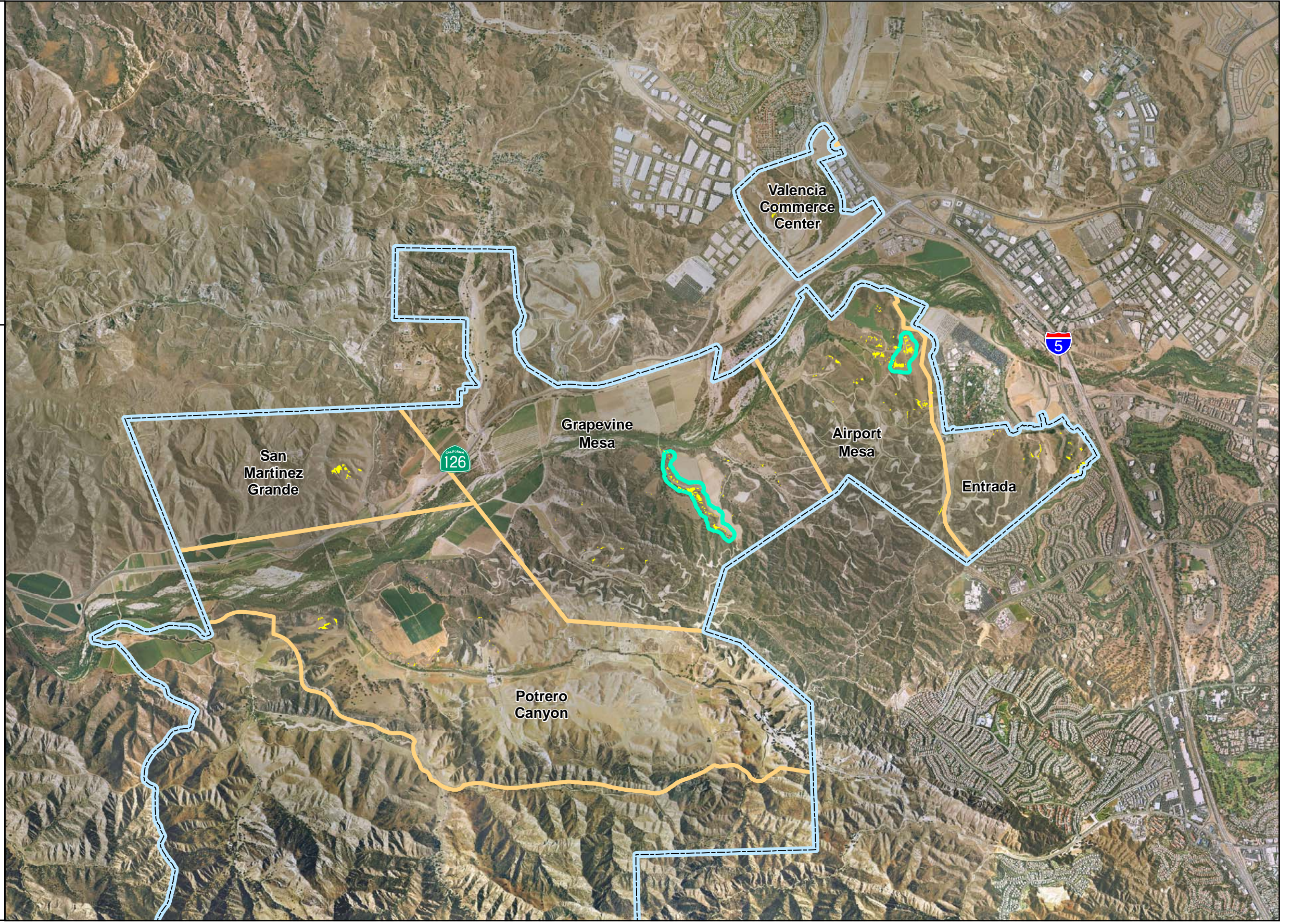
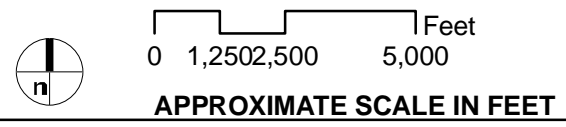
5.2 Distribution and Abundance

The distribution of SFVS on the Newhall Land property has been consistently documented across the entire planning area for six consecutive growing seasons (2002–2007). For planning and discussion purposes, populations have been aggregated geographically into six general occurrences. Each occurrence consists of SFVS polygons that are generally in proximity to each other within a particular vicinity and separated from others by distance or existing site features (e.g., ridgelines, roadways, SR-126). The distribution of SFVS from 2002, 2003, 2004, 2005, 2006, and 2007, and the geographic associations are shown in *Figure 4*.



Legend

-  SCP Boundary
-  Spineflower Geographic Association Boundaries
-  Existing CDFG Conservation Easement
-  Spineflower Cumulative Footprint 2002-2007



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 4

Spineflower Conservation Plan

Spineflower Geographic Associations

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Spineflower Conservation Plan December 2007

The Specific Plan area includes the Airport Mesa, Grapevine Mesa, Potrero Canyon, and San Martinez Grande Canyon occurrences. In 2003 and 2005, during years of average to higher-than-average rainfall, SFVS occurrences within the Specific Plan area accounted for approximately 77% and 87%, respectively, of all SFVS individuals observed on the Newhall Land property. The Entrada occurrence is located in the southeastern portion of the planning area. In 2003 and 2005, the Entrada occurrence accounted for approximately 20% and 10%, respectively, of SFVS observed on the Newhall Land property. The VCC occurrence is located on the slopes above Castaic Creek near Castaic Junction and accounted for approximately 3% of the known SFVS individuals on the Newhall Land property in both 2003 and 2005.

Table 3 summarizes occurrence data and area occupied on the Specific Plan area at Airport Mesa, Grapevine Mesa, Potrero Canyon, and San Martinez Grande Canyon and at the Entrada and VCC planning areas

Table 3
Annual SFVS Population Estimates and Area Occupied on
Property Owned by Newhall Land

Area	2002		2003		2004		2005		2006		2007	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Airport Mesa	463	0.42	1,114,559	6.84	38,236	2.11	1,706,335	4.37	1,216,612	4.13	226	0.07
Grapevine Mesa	7,256	0.11	2,121,160	4.07	458,235	1.55	4,261,660	2.86	33,596	1.40	76	<0.01
San Martinez Grande Canyon	75	0.03	1,124,388	2.10	1,387	0.62	123,527	1.39	1,050	1.02	73	0.02
Potrero Canyon	---	---	233,328	1.45	13,326	0.47	326,654	1.06	88,659	0.64	67	0.01
VCC	---	---	170,181	0.46	1,471	0.09	223,155	0.48	204,405	0.36	60	<0.01
Entrada	20	0.03	1,183,504	1.45	45,733	0.50	750,482	1.30	229,174	0.95	258	0.02
Total	7,814	0.59	5,947,120	16.37	558,388	5.33	7,391,813	11.45	1,773,496	8.49	760	0.12

As described in *Section 4.4*, the number of SFVS individuals has varied dramatically from a low of 7,814 in 2002 to a high of 7.4 million in 2005 (Dudek and Associates 2002a, 2002b, 2002c, 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2005a, 2005b, 2005c, 2006a, 2006b, 2006c; Dudek 2007a, 2007b, 2007c). The area occupied has also varied from year to year (*Table 3*). In 2004, spineflower populations occupied 26% of the total mapped footprint of spineflower area. The area occupied varied in 2003, 2005, and 2006 but, on average, was more than double the area occupied in 2004. Empirical data on plant size was not collected, but individual plants appeared

Spineflower Conservation Plan December 2007

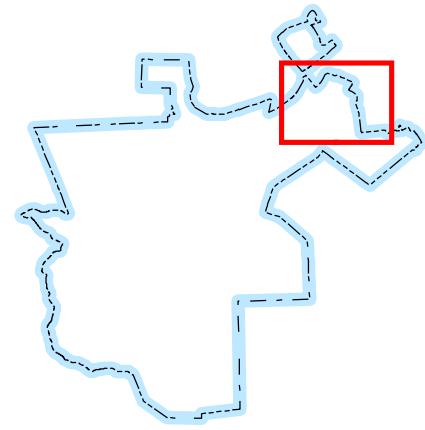
to be larger in 2003 and 2005 than in 2002, 2004, and 2006. In 2007, only 0.12 (0.6%) acre was occupied by spineflower.

The variation of SFVS abundance and area occupied from year to year is typical of annual plant species. In the case of SFVS, it appears that climatic conditions may influence SFVS abundance and area occupied. On the Newhall Land property, the estimated number of SFVS was dramatically lower in 2002, 2004, and 2007, compared to 2003 and 2005, with 2006 falling in between. Years 2002, 2004, and 2007 experienced below-average rainfall, but, in 2003, rainfall was considered normal, according to the Western Regional Climate Center. Winter 2004/spring 2005 rainfall was considered to be above normal and in winter 2005/spring 2006 was slightly below average but not as low as 2002, 2004, and 2007, according to the Western Regional Climate Center (WRCC 2006).

5.2.1 Newhall Ranch Specific Plan

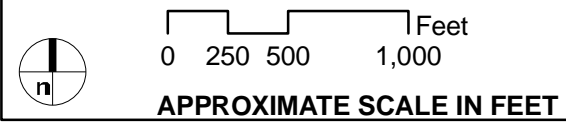
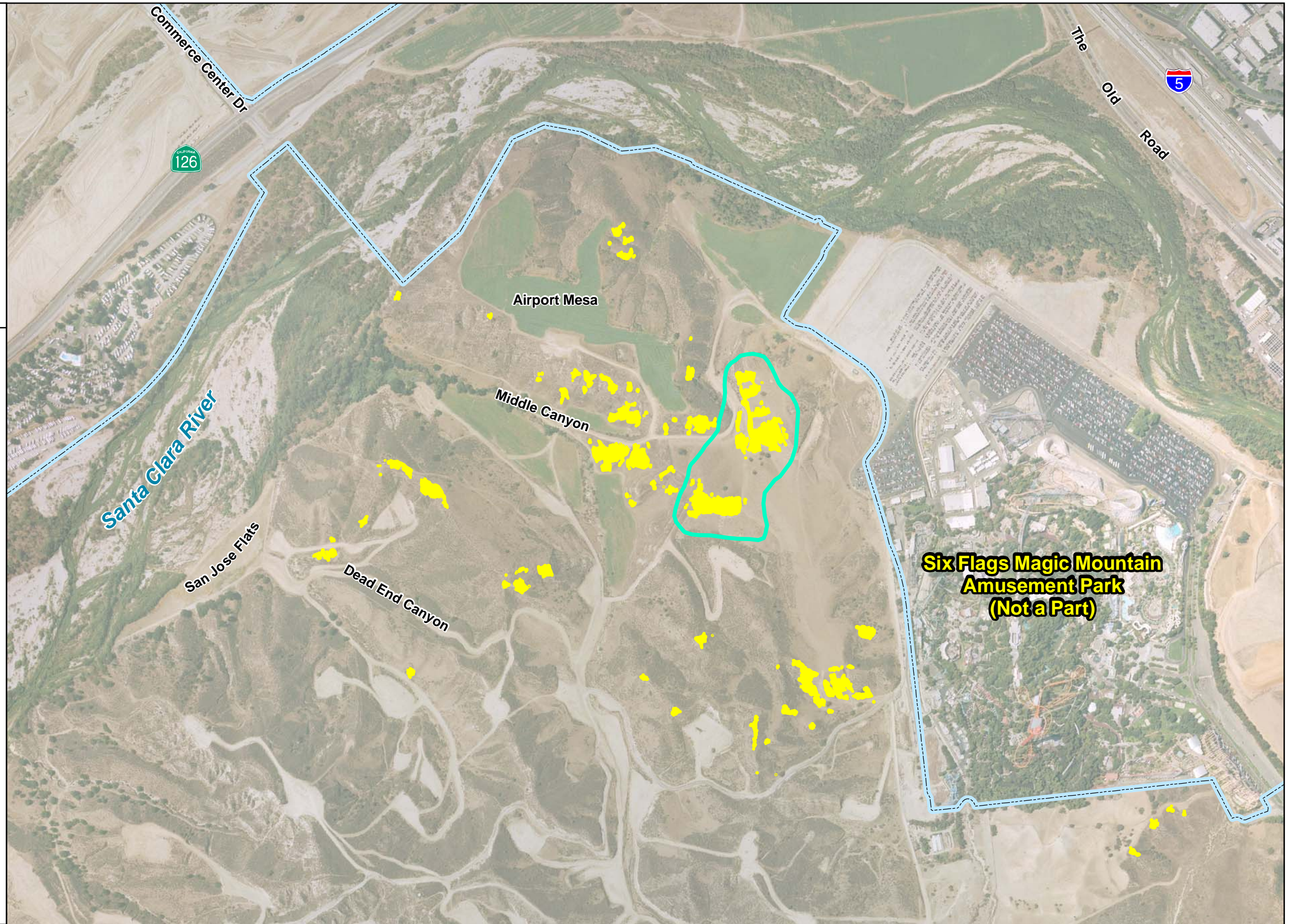
Airport Mesa

SFVS was first detected in the Airport Mesa vicinity in 2000. SFVS polygons were identified and mapped, but no population estimates were made at that time. In 2002, 463 SFVS individuals were observed in 36 polygons. Surveys conducted in 2003 identified 86 polygons and approximately 1.1 million individuals. In 2004, 137 polygons containing 38,236 individuals were detected. In 2005, 154 polygons containing 1.7 million individuals were detected. In 2006, 179 polygons containing 1.2 million individuals were detected. In 2007, 28 polygons containing 226 individuals were detected. The distribution of SFVS from 2002, 2003, 2004, 2005, 2006, and 2007 is shown on *Figure 5*.



Legend

- SCP Boundary
- Existing CDFG Conservation Easement
- 2002-2007 Cumulative Spineflower Occurrences



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 5

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - Airport Mesa

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Spineflower Conservation Plan December 2007

Grapevine Mesa

SFVS was first detected in the Grapevine Mesa vicinity in 2000, but no population estimates were made at that time. The majority of SFVS sites at Grapevine Mesa are located along the slopes to the west and south of the mesa. SFVS was mapped by FLx in 2000 prior to cultivation of the mesa top, and, at that time, the mapped polygon extended onto the top of the west side of the south half of Grapevine Mesa for about 100 feet (the occurrence was mapped by hand rather than by a GPS unit with sub-meter accuracy, so exact limits of polygons are not known). In 2002, approximately 7,256 plants were observed in 11 polygons. Surveys conducted in 2003 identified 80 polygons and approximately 2,121,160 individuals (Dudek and Associates 2004a). In 2004, 97 polygons containing 458,235 individuals were detected. In 2005, 109 polygons containing 4,261,660 individuals were detected. In 2006, 87 polygons containing 33,596 individuals were detected. In 2007, 14 polygons containing 76 individuals were detected. The distribution of SFVS from 2002, 2003, 2004, 2005, 2006, and 2007 is shown on *Figure 6*. San Martinez Grande Canyon

SFVS was first detected in the San Martinez Grande Canyon area in 2001 (FLx 2002b). Surveys conducted in May 2001 identified and mapped seven SFVS polygons totaling approximately 14,750 individuals. In 2002, only one polygon with 75 individuals was observed. Surveys conducted in 2003 identified 13 polygons totaling approximately 1.1 million plants. In 2004, 10 polygons were identified containing 1,387 individuals. In 2005, 11 polygons containing 123,527 individuals were detected. In 2006, 13 polygons containing 1,050 individuals were detected. In 2007, 15 polygons containing 73 individuals were detected. The distribution of SFVS from 2002, 2003, 2004, 2005, 2006, and 2007 is shown on *Figure 7*.

Potrero Canyon

SFVS was not observed during surveys conducted in the area in 2002. The 2003 Potrero Canyon occurrence consists of 16 polygons and approximately 233,328 individuals. In 2004, 32 polygons containing 13,326 individuals were detected. In 2005, 27 polygons containing 326,654 individuals were detected. In 2006, 32 polygons containing 88,659 individuals were detected. In 2007, 11 polygons containing 67 individuals were detected. The distribution of SFVS from 2003, 2004, 2005, 2006, and 2007 is shown in *Figure 8*.

5.2.2 Valencia Commerce Center Study Area

SFVS was first detected at the VCC study area in 2001. Seven polygons and approximately 4,600 individuals were observed in the VCC study area (FLx 2002b). SFVS was not observed during surveys conducted in the VCC study area in 2002. In 2003, a total of 27 polygons and

Spineflower Conservation Plan December 2007

approximately 170,181 individuals were observed in the VCC study area (Dudek and Associates 2004b). In 2004, 24 polygons containing 1,471 individuals were detected. In 2005, 45 polygons containing 223,155 individuals were detected. In 2006, 46 polygons containing 204,405 individuals were detected. In 2007, eight polygons containing 60 individuals were detected. The distribution of SFVS from 2003, 2004, 2005, 2006, and 2007 is shown on *Figure 9*.

5.2.3 Entrada Study Area

SFVS was first detected at the Entrada study area in 2000. Three polygons representing 1,000 to 2,000 individuals were mapped (FLx 2004). Surveys conducted in May, June, and September 2002 identified 20 SFVS individuals in two polygons. Surveys conducted in 2003 identified approximately 1,183,504 individuals within 29 polygons (Dudek and Associates 2004c). In 2004, 26 polygons containing 45,733 individual were observed. In 2005, 29 polygons containing 750,482 individuals were detected. In 2006, 39 polygons containing 229,174 individuals were detected. In 2007, eight polygons containing 258 individuals were detected. The distribution of SFVS from 2002, 2003, 2004, 2005, 2006, and 2007 is shown on *Figure 10*.

5.3 Habitat at Project Study Area

5.3.1 Vegetation

On the Newhall Land property, SFVS sites occur predominantly within openings in sparsely vegetated California sagebrush, California buckwheat, and grassland communities. Approximately 89% of 2003 SFVS polygons on the Newhall Land property occur within California sagebrush scrub (62%) or California annual grassland (27%), while 11% of SFVS polygons occur within coast live oak woodland, mixed chaparral, chaparral, disturbed land, Great Basin scrub, valley oak grassland, and alluvial scrub. Similarly, approximately 93% of 2005 SFVS polygons on the Newhall Land property occur within California sagebrush scrub (67%) or California annual grassland (26%), while 7% of SFVS polygons occur within coast live oak woodland, mixed chaparral, chaparral, disturbed land, Great Basin scrub, valley oak grassland, and alluvial scrub. Characteristic site conditions include a low cover of grasses, herbs, and shrubs and a visible component of bare ground.

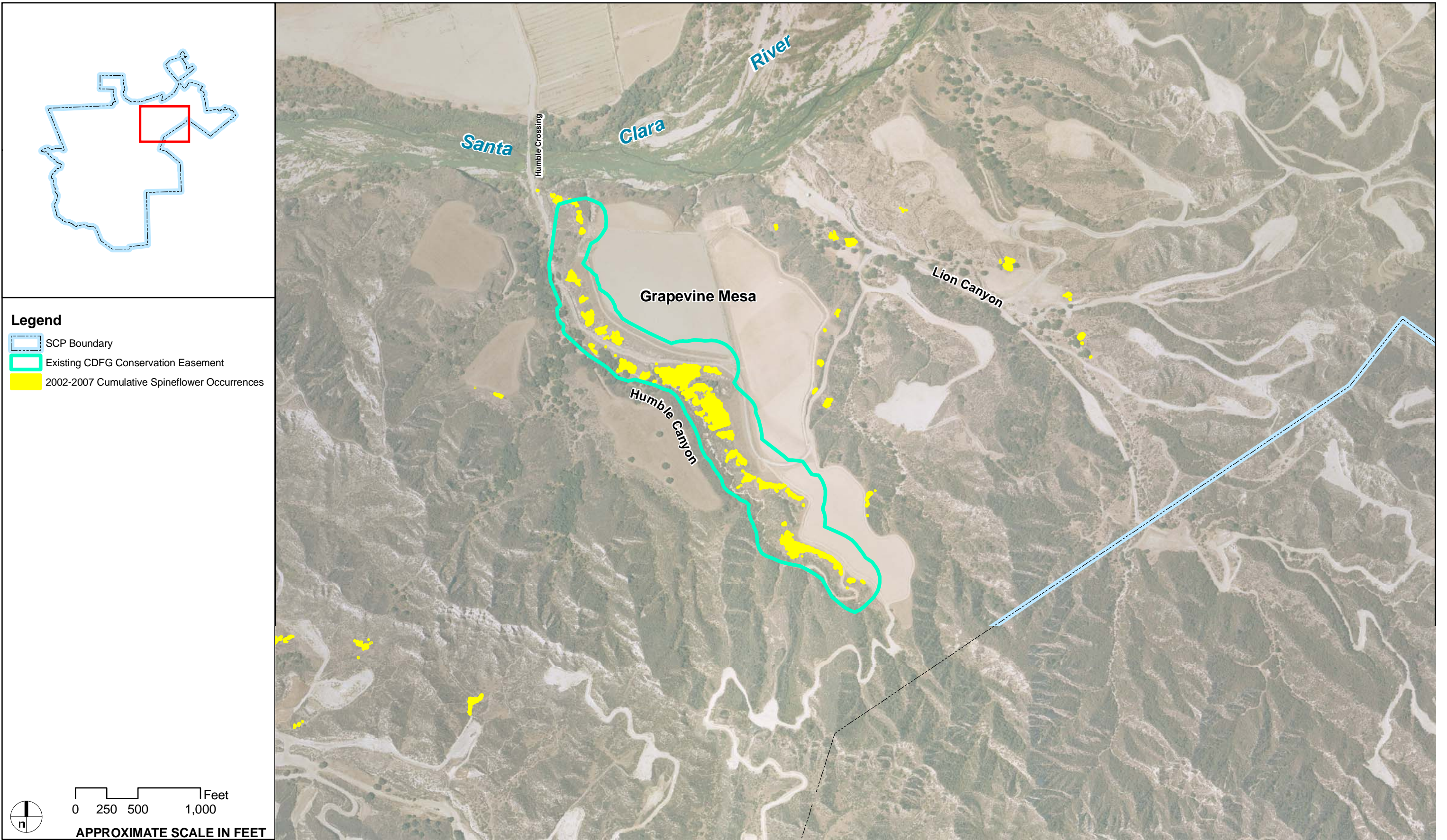
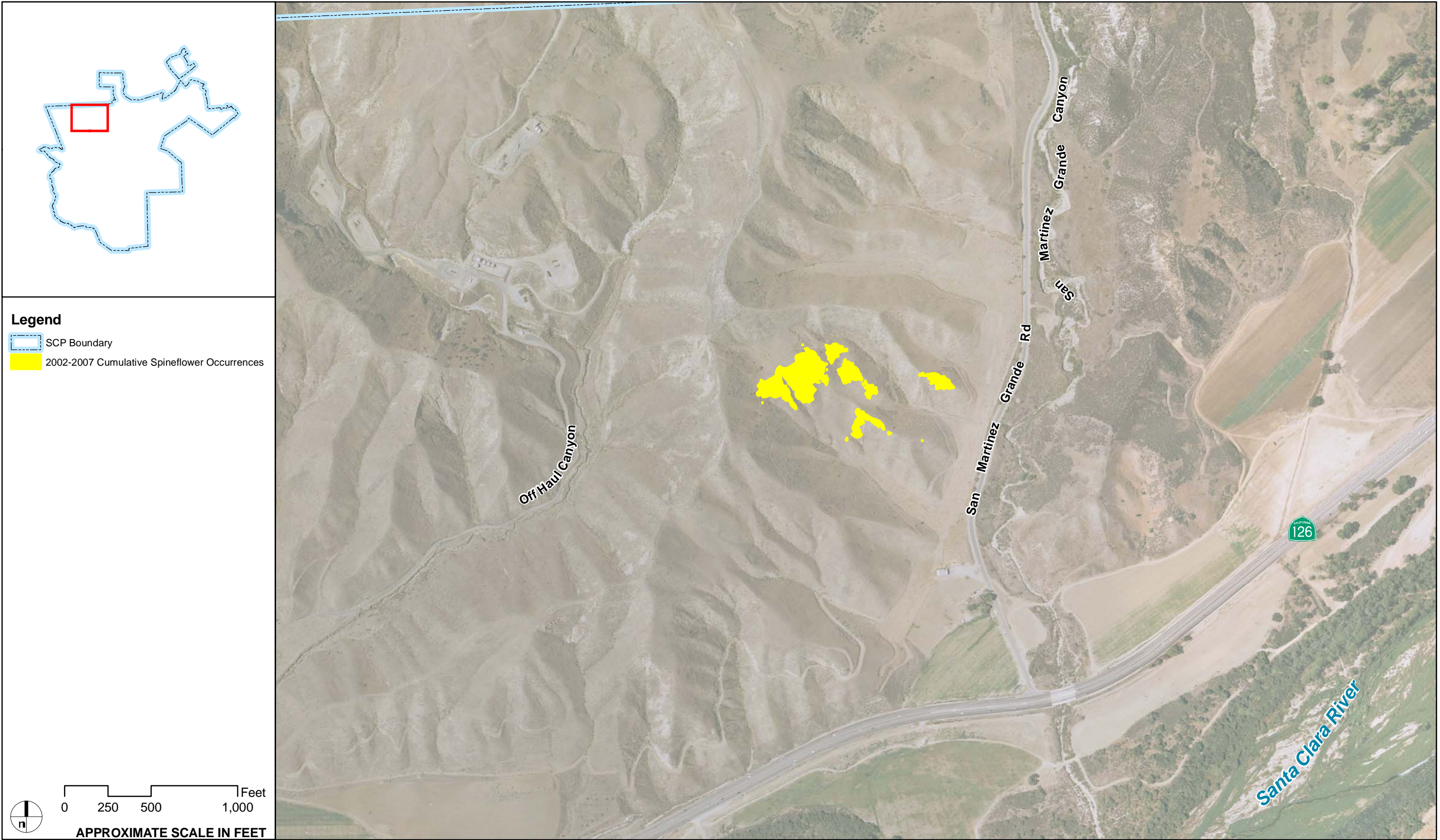


FIGURE 6

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - Grapevine Mesa

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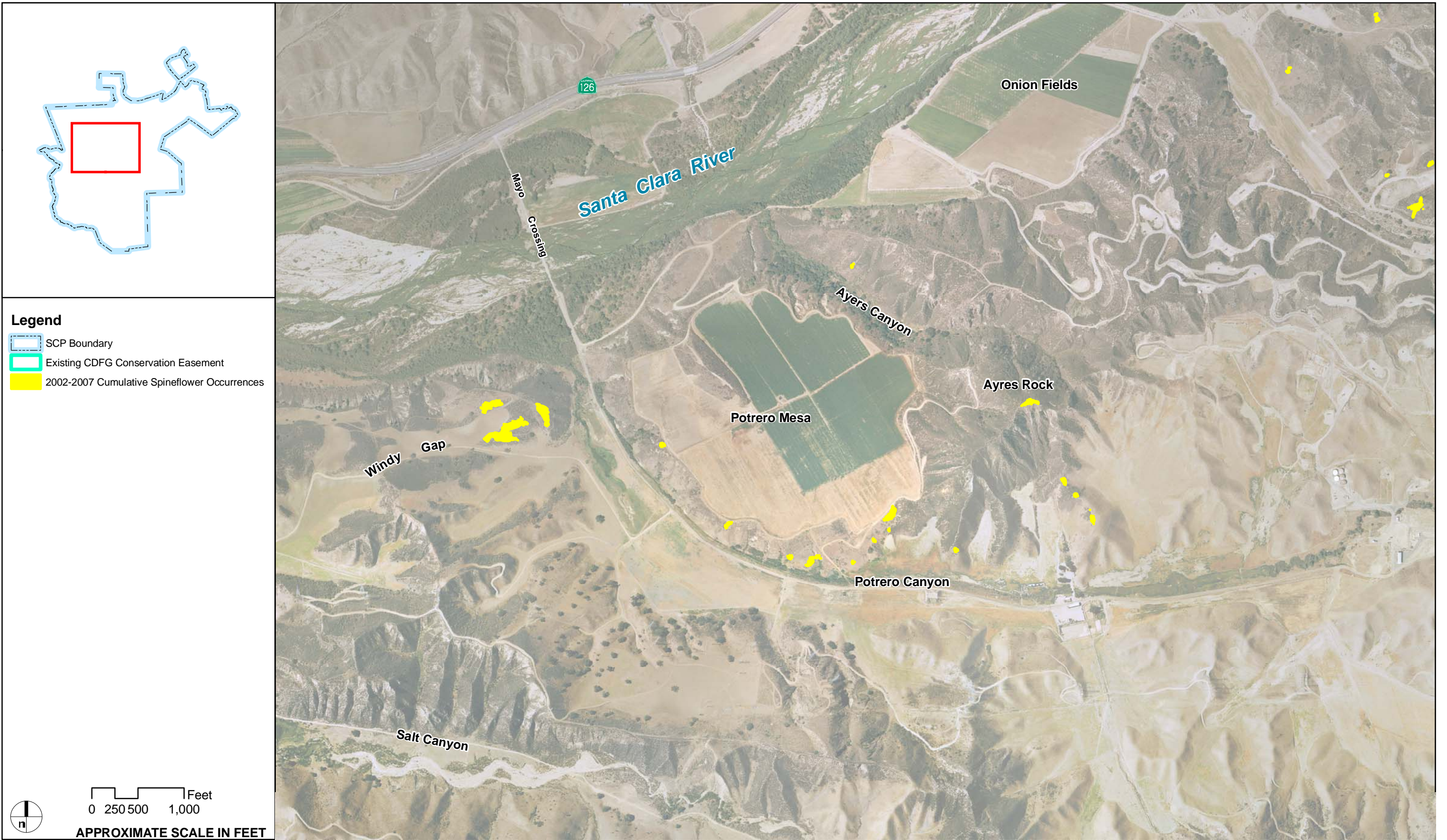
AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 7

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - San Martinez Grande Canyon

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AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 8

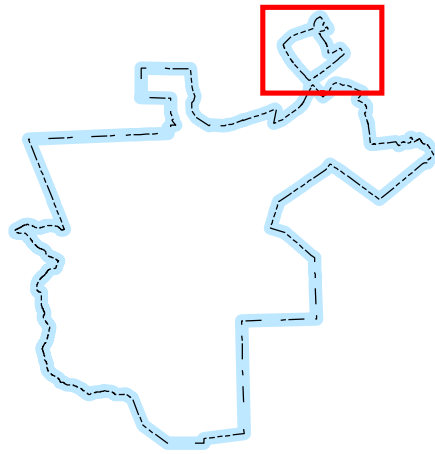
Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - Potrero Canyon



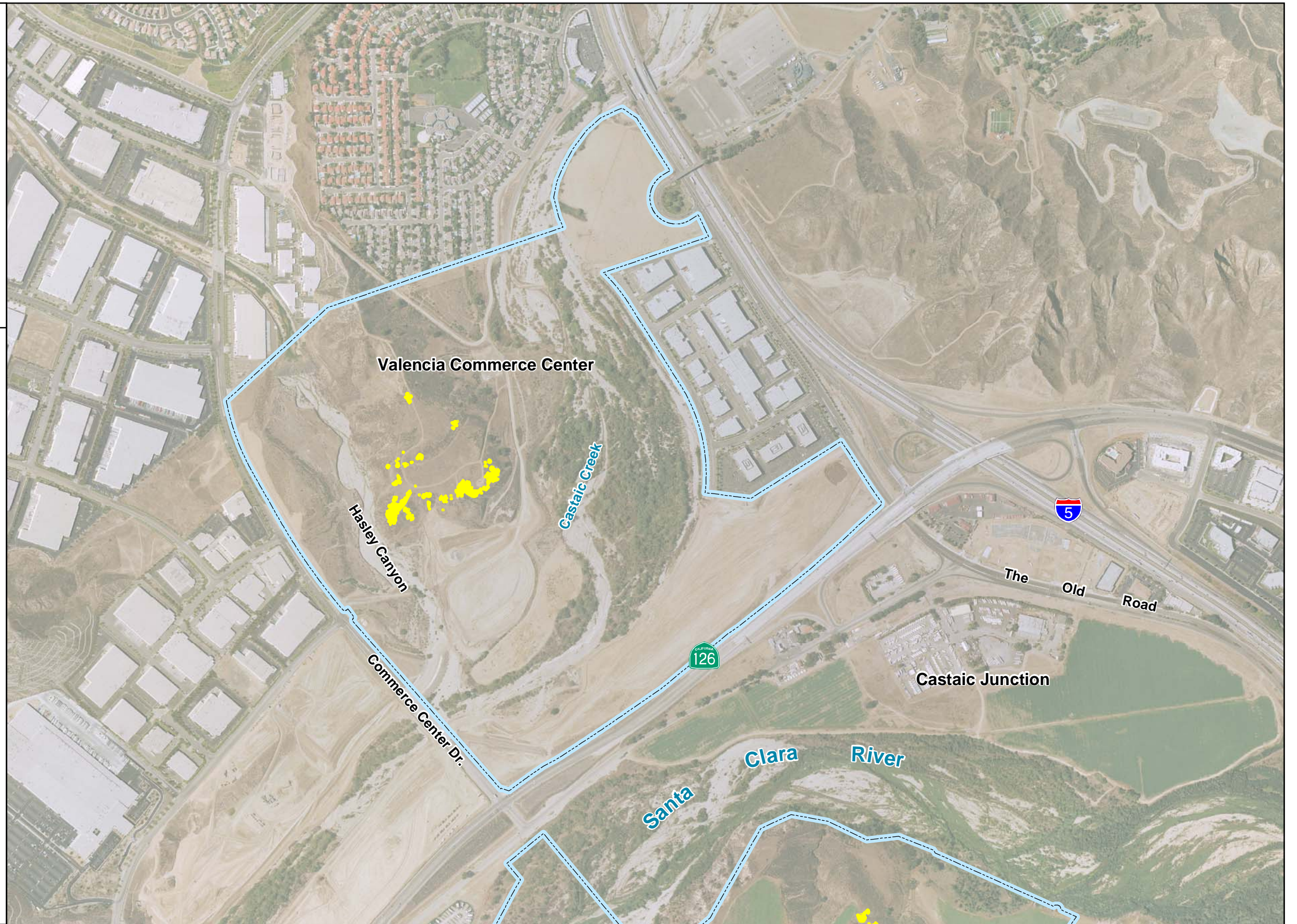
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Legend

- SCP Boundary
- Existing CDFG Conservation Easement
- 2002-2007 Cumulative Spineflower Occurrences



0 250 500 1,000 Feet

APPROXIMATE SCALE IN FEET

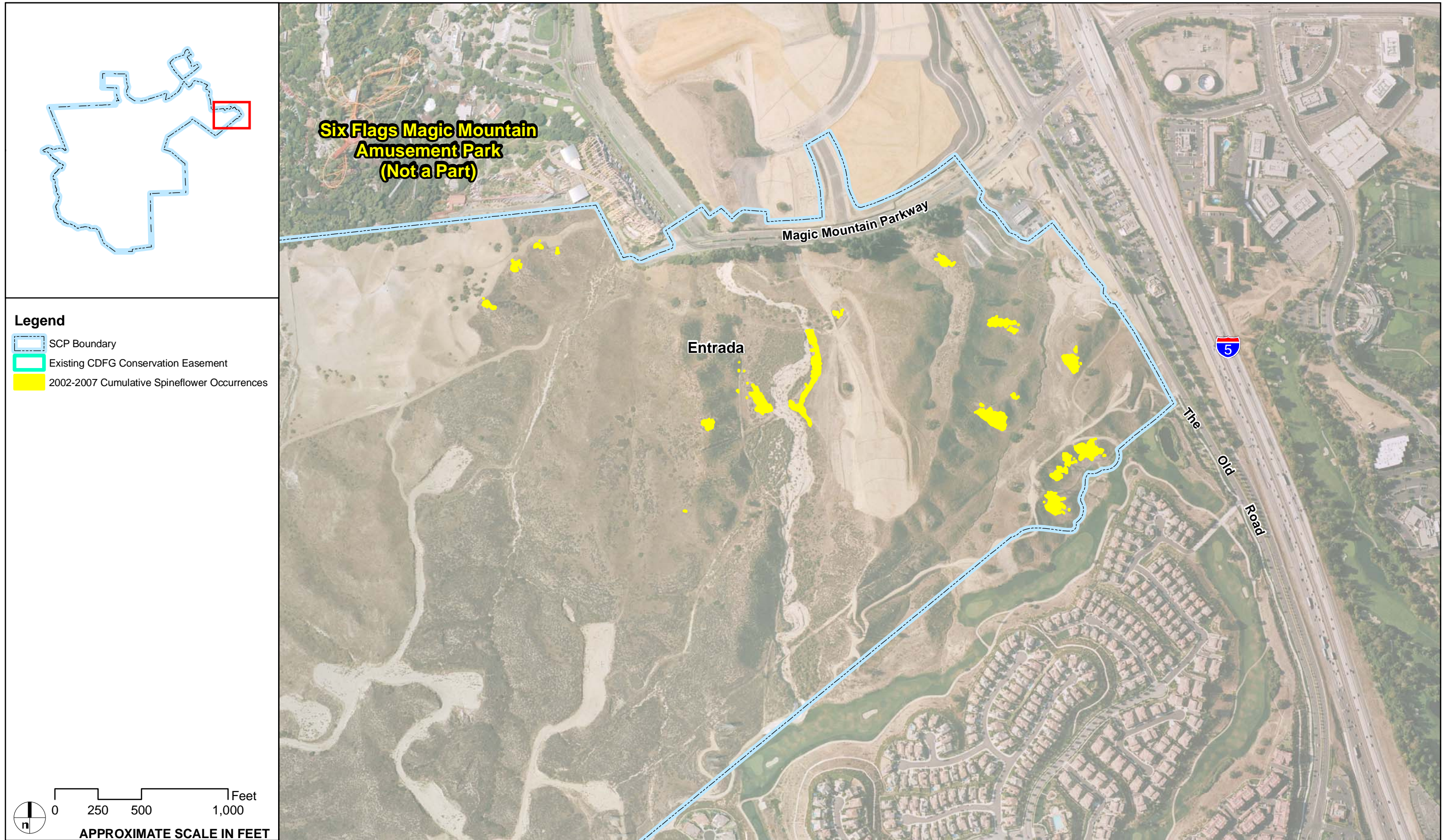
AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 9

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - Valencia Commerce Center

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AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 10

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences - Entrada

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5.3.2 Soils and Geology

Soils at SFVS sites varied among combinations of sandy and gravelly silt and clay loams. Approximately 89% of 2003 SFVS polygons occur on terrace escarpments, Zamora loam (2% to 9% slopes), Castaic-Balcom silty clay loams (30% to 50% slopes), Castaic-Balcom silty clay loams (30% to 50% slopes, eroded), and Saugus loam (30% to 50% slopes). Approximately 81% of 2005 SFVS polygons occur on terrace escarpments and Castaic-Balcom silty clay loams (30% to 50% slopes). Most of the plants at Grapevine Mesa and some at Airport Mesa are downslope of terrace surfaces capped by Zamora clay loam (2% to 9% slopes), with a few plants occurring on artificial fill or alluvium derived from adjacent terrace deposits. SFVS at San Martinez Grande Canyon occurs primarily on old landslide debris (Allan E. Seward 2002).

Soil chemistry was evaluated for 39 locations within the Specific Plan area, Entrada, and VCC sites (unpublished data). Twenty-seven of the locations were occupied by SFVS. The samples were taken using a shovel; multiple samples were taken at each location. Typically, the samples were taken from soil surface to a depth of 5 inches, between 1 and 2 inches deep, and between 6 and 12 inches deep. Each sample was assessed for 46 soil chemistry characteristics, including elements such as magnesium, nitrogen, phosphorus, calcium, and lead; soil texture categories such as sand, silt, and clay; and other characteristics such as moisture and pH. The data were evaluated using a forward, stepwise linear regression, which indicated that the following soil chemistry characteristics were significant indicators of a site being occupied by SFVS: magnesium, molybdenum, pH, lime, and tin. However, when these five characters were evaluated for occupied and unoccupied sample locations, there was overlap in the value ranges. Thus, it does not appear that soil chemistry is a good predictor of whether a site represents potentially suitable habitat for spineflower.

Soil texture was also evaluated at these 39 locations. The sand content at occupied spineflower sites ranged from 30% to 70%, with an average of 57%. The silt content ranged from 20% to 48%, with an average of 32%. The clay content ranged from 5% to 22%, with an average of 12%. The silt-to-clay ratio ranged from 1.82 to 5.79, with an average of 2.97 (Allan E. Seward 2004). Thus, it does not appear that soil texture will be useful in predicting whether a site represents potentially suitable habitat for spineflower.

Underlying geologic formations include artificial fill, Quaternary alluvium, Quaternary landslide, Quaternary older alluvium, Quaternary slopewash, Quaternary terrace deposits, undifferentiated terrace deposits, and undifferentiated Saugus Formation (Allan E. Seward 2004). The project study area is located within the Transverse Ranges geomorphic province of Southern California in the eastern portion of the Ventura depositional basin. This basin was produced by tectonic downwarping in the geologic past to produce a large-scale synclinal structure in which a thick

Spineflower Conservation Plan December 2007

sequence of Cenozoic sediments has accumulated. These sediments have been lithified into a sequence of sedimentary rock that has subsequently been uplifted, tilted, and tectonically deformed. They are cut by segments of the Del Valle and Salt Creek faults. Bedrock formations found on site include the Modelo, Towsley, Pico, Saugus, and Pacoima formations, as well as Quaternary terrace deposits. Surficial deposits include Quaternary alluvium, slopewash, soil, and artificial fill (Allan E. Seward 2002).

5.3.3 Elevation, Slope, and Aspect

The majority of 2003 and 2005 SFVS occurrences were found on gentle to moderate slopes with a south-facing aspect at elevations between 960 and 1,320 feet AMSL. More than 90% of 2003 SFVS occurrences and 98% of 2005 SFVS occurrences are on slopes with gradients between 0% and 25%. Approximately 50% of 2003 SFVS occurrences and 37% of 2005 SFVS occurrences occur on south-, southwest-, or southeast-facing slopes, with 10% of 2003 SFVS sites and 19% of 2005 SFVS sites on north-, northwest-, or northeast-facing slopes.

6.0 ENVIRONMENTAL SETTING AND LAND USE

This section describes the existing environmental setting in the project study area. In addition, the existing and planned land uses are described, including ongoing agricultural operations and planned land uses associated with the project study area.

6.1 Environmental Setting and Existing Land Uses

6.1.1 Newhall Ranch Specific Plan Area

Surrounding land uses to the north include rural residential uses in the Val Verde and San Martinez Grande Canyon areas, a landfill in Chiquito Canyon, commercial business parks at VCC, residential and commercial uses in the Castaic corridor, oil and natural gas production, and undeveloped land. To the west, land uses include agricultural operations, undeveloped land, and oil and natural gas production. To the east, land uses include commercial/recreational uses associated with Six Flags Magic Mountain Amusement Park (and associated hotels, restaurants, and gas stations), residential uses at Stevenson Ranch, the Valencia Water Reclamation Plant, a California Highway Patrol station, and undeveloped land. To the south, the land is undeveloped (County of Los Angeles 2003).

Native and naturalized habitats within the project study area are representative of those found in this region and include representative examples of those plant communities found in the Santa Susana Mountains and the Santa Clara River ecosystems. Upland habitats dominate the landscape within the Specific Plan area, both north and south of the Santa Clara River. The major

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upland plant communities include California sagebrush scrub, chamise and undifferentiated chaparral, southern coast live and valley oak woodlands, and California annual grassland. However, the site also contains valley oak/grass and California walnut woodland (Dudek and Associates 2006e). The Santa Clara River supports a variety of riparian plant communities, including southern cottonwood–willow riparian forest, southern willow scrub, mulefat scrub, arrow weed scrub, and herbaceous wetland. Intermittent and ephemeral drainages on site also provide habitat for alluvial and scalebroom scrubs.

The riparian habitat along the Santa Clara River has been designated as critical habitat by the USFWS for the state- and federally listed endangered least Bell's vireo (*Vireo bellii pusillus*) (59 FR 4845–4867) and provides habitat for the state- and federally listed endangered southwestern willow flycatcher (*Empidonax traillii extimus*). The River itself supports the state- and federally listed endangered and state fully protected unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*). There are two significant ecological areas (SEAs) in the Specific Plan area, including (1) diverse oak woodland habitats that function as a wildlife corridor/linkage between the San Gabriel Mountains and the Santa Monica Mountains (SEA 20) and (2) aquatic habitat within the Santa Clara River corridor that supports unarmored threespine stickleback (SEA 23) (County of Los Angeles 2003).

The Specific Plan area is topographically diverse, with slope gradients ranging from moderate to steep on the hillsides to very gentle in the Santa Clara River floodplain and in major tributary canyons. In addition, there are mesas adjacent to the Santa Clara River (e.g., Grapevine Mesa and Airport Mesa). Site elevations range from 825 feet AMSL in the Santa Clara River bottom at the Ventura County/Los Angeles County line to approximately 3,200 feet AMSL on the ridgeline of the Santa Susana Mountains along the southern boundary. The primary ridges are east-, west-, and northwest-trending, with secondary ridges trending north and south. There are many distinctive ridges in the Specific Plan area, including Sawtooth Ridge along the northeastern side of Long Canyon and Round Mountain at the northern edge of Potrero Canyon (County of Los Angeles 2003).

The applicant leases portions of the Specific Plan area for oil and natural gas production, as well as for cattle grazing, ranching, and agricultural operations (e.g., food crop production, dry land farming, honey farming). All such operations are currently ongoing. In addition, the applicant leases the site to the movie industry for set locations. Minor land uses include employee houses, an oil company office, and miscellaneous structures. In addition, there are several easements in the Specific Plan area, including oil, natural gas, electrical, telephone, and water easements (County of Los Angeles 2003). In particular, Southern California Edison and the Southern California Gas Company maintain distribution lines within on-site easements.

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Grazing activities and oil and natural gas production have had an effect on much of the natural habitat on site. Scrub habitats have been displaced by annual grasslands as a result of grazing, land clearing for agriculture, and other historical land uses. In addition, the site has been fragmented by dirt and asphalt roads; graded oil well pads and pipelines; and pumping, storage, and transmission facilities.

6.1.2 Valencia Commerce Center Planning Area

The VCC site is dominated by north-/south-trending ridges that lie north of Castaic Creek near the confluence with Hasley Canyon. Site elevations range from just under 1,000 feet AMSL in the Castaic Creek bottom to just over 1,500 feet AMSL at the top of the western ridge. The ridges are generally rounded at the top with slopes that vary from steep to gentle. Aside from the ridges, the two major wash areas on the VCC planning area, Castaic Creek and Hasley Canyon, contain numerous benches and braided channels with associated riparian and wash scrub habitats.

Native and naturalized habitats within the VCC planning area include representative examples of those plant communities found in the Santa Susana, Topatopa, and Liebre mountains and the Santa Clara River and Castaic Creek ecosystems. Upland habitats dominate the landscape within the VCC planning area (e.g., California sagebrush scrub, valley oak woodland, California annual grasslands); however, Castaic Creek and Hasley Canyon support a variety of riparian plant communities (e.g., southern willow scrub, southern cottonwood–willow riparian forest, mulefat scrub). No observations were made of any freshwater marsh or seep areas in the VCC planning area (Dudek and Associates 2006f).

Historically, the applicant leased portions of the site for sand and gravel production, cattle grazing, and agricultural operations; only agricultural operations are currently ongoing. In addition, there is commercial/industrial development on the site. All of these activities have had an effect on much of the natural habitat on site (i.e., scrub habitats have been displaced by annual grasslands). Southern California Edison and the Southern California Gas Company also have distribution lines and access roads within on-site easements.

6.1.3 Entrada Planning Area

The southern portion of the Entrada site is dominated by several north-/south-trending ridges. A narrow panhandle (roughly 100 meters wide) extends along the western portion of the site (east of Airport Mesa) to an agricultural field adjacent to the Santa Clara River. Site elevations range from approximately 1,000 feet AMSL along the Santa Clara River to approximately 1,550 feet AMSL on the ridges in the southwestern portion of the site.

Spineflower Conservation Plan December 2007

Slope gradients range from moderate to very steep in the hillside areas to very gentle within the Santa Clara River floodplain, drainages, and associated mesas. Distinctive geographic features include the north-/south-trending ridges on the southern portion of the site, a wash that drains north through the site to a concrete-lined drainage channel that passes through the Six Flags Magic Mountain Amusement Park, and the Santa Clara River on the northwestern portion of the site.

Native and naturalized habitats within the Entrada site are representative of those found in this region and include representative examples of those plant communities found in the Santa Susana Mountains and the Santa Clara River ecosystems. California sage scrub, chamise and mixed chaparral, valley oak and scrub oak woodlands, and native and annual grasslands are the major upland plant communities on the site. Ephemeral and intermittent drainages on site provide habitat for alluvial and scalebroom scrubs. The northeast portion of the site includes an agriculture field and some intact upland habitats. While upland habitats dominate the landscape within the site, immediately adjacent to the site are areas that support a variety of riparian plant communities. These include southern cottonwood–willow riparian forest, southern willow scrub, mulefat scrub, arrow weed scrub, and freshwater marsh and seeps (Dudek and Associates 2006g).

The applicant leases portions of the site for cattle grazing and agricultural operations. Grazing activities have had an effect on much of the natural habitat on site. Scrub habitats have been displaced by annual grasslands, apparently as a result of grazing. Southern California Edison and the Southern California Gas Company have transmission lines within easements along the southern portion of the site, all of which are actively maintained, pursuant to established utility easements. Maintenance activities may include, but are not necessarily limited to, recovery and repair of downed lines, towers, and poles; reconstruction/maintenance of access roads, observation footpaths, and tower footings; repair/replacement of buried gas lines or markers; maintenance of fencing; and response to regional and local emergencies. The Six Flags Magic Mountain Amusement Park is to the north of the site, and a residential development is located south of the site.

6.2 Planned Land Uses

The project study area is located within the Santa Clarita Valley Planning Area of the Los Angeles County General Plan (County of Los Angeles 1993). The Specific Plan area received final approvals in May 2003 (County of Los Angeles 2003). The VCC site, approved by the County of Los Angeles (the County) in 1990 (County of Los Angeles 1990), includes 12 million square feet of industrial/commercial buildings, and approximately 6 million square feet of buildings have been constructed to date. The Entrada site is planned for residential, commercial,

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non-residential, and open space uses; however, the County has not approved changes in the Entrada land use designations or zoning at this time.

This section addresses spineflower occurrences in the project study area in relation to approved and proposed development.

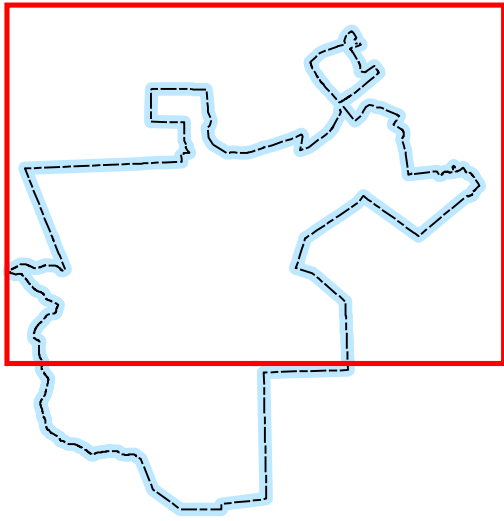
6.2.1 Newhall Ranch Specific Plan

The Specific Plan area contains approximately 11,999 acres. The acreages of the land uses within the Specific Plan area are listed in *Table 4* and shown in *Figure 11A*. The Specific Plan area includes residential (and associated school sites, parks, and other facilities), mixed-use development (e.g., commercial, residential, office), commercial development, business park uses, visitor-serving development, community facilities (e.g., fire stations, library, water treatment plant), and arterial roads and bridges on 3,763 acres. The 8,236 acres of open space includes the River Corridor Special Management Area (SMA), High Country SMA, Open Area, and spineflower preserves (Dudek 2008).

Table 4
Acreage of Each Approved Land Use in the Specific Plan Area

Approved Land Use	Acres
Open Area/River Corridor/Open Space	8,236
Residential/Commercial/Non-Residential Development	3,763
Total	11,999

Source: Dudek 2008.




Legend

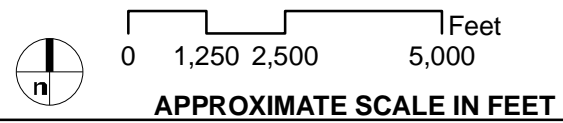
 SCP Boundary

Impacts

 Direct Permanent

 Direct Temporary

 Indirect Permanent



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 11A

Spineflower Conservation Plan

Newhall Ranch Specific Plan Approved Land Uses

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Spineflower Conservation Plan December 2007

6.2.2 Valencia Commerce Center Planning Area

The VCC planning area consists of approximately 333 acres. This planning area is the remaining undeveloped portion of the VCC commercial/industrial complex currently under development by the applicant. VCC was the subject of an EIR certified by Los Angeles County in April 1990 (County of Los Angeles, 1990). The applicant has recently submitted to Los Angeles County the last tentative parcel map (Tentative Parcel Map No. 18108) needed to complete build-out of the remaining portion of the VCC planning area. The County will require preparation of a subsequent EIR in conjunction with the parcel map and related project approvals; however, the County has not yet issued a Notice of Preparation (NOP) of the subsequent EIR or released the subsequent EIR for the remaining portion of the VCC planning area. The acreages of the approved land uses for the VCC planning area are listed in *Table 5* and shown in *Figure 11B*.

Table 5
Acreage of Each Approved Land Use in VCC

Approved Land Use	Acres
Open Space	154.3
Commercial	72.5
Industrial	91.5
Public Facilities	14.5
Total	332.8

Source: Dudek 2008.

6.2.3 Entrada Planning Area

The Entrada planning area consists of approximately 392 acres. The applicant is seeking approval from Los Angeles County for planned residential and nonresidential development within the Entrada planning area. The applicant has submitted to Los Angeles County Entrada development applications, which cover the portion of the Entrada planning area facilitated by the SCP. As of this writing, the County has not yet issued an NOP of an EIR or released an EIR for Entrada. As a result, there is no underlying local environmental documentation for the Entrada planning area at this time. The acreages of the proposed Entrada land uses are listed in *Table 6* and shown in *Figure 11C*. It is projected that approximately 138 acres of land will be preserved as open space. The remaining 252.4 acres are proposed for residential, commercial, and public facility uses.

Spineflower Conservation Plan December 2007

Table 6
Acreege of Each Projected Land Use in Entrada

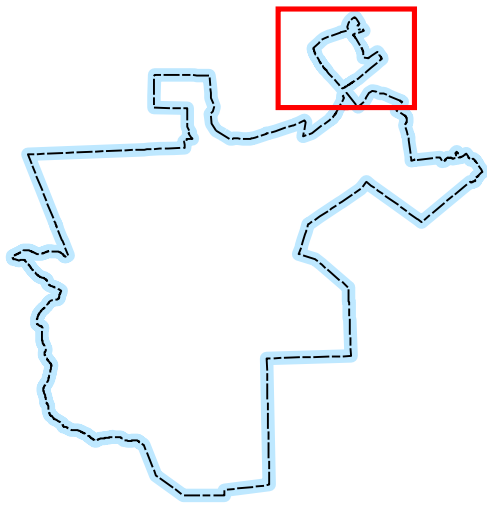
Projected Land Use	Acres
Open Space	138.3
Residential	
Single-Family	56.4
Multifamily	78.6
Commercial	45.6
Public Facility	71.8
Total	390.7

Source: Dudek 2008.

7.0 PRESERVE DESIGN APPROACH AND METHODOLOGY

This section describes the approach and methods used to identify and design the five proposed spineflower preserve areas within the Newhall Land project study area. This section discusses spineflower distribution data, habitat suitability, and ecological indicators. It also addresses accommodating fluctuations in spineflower populations and preserve connectivity. For purposes of this discussion, CDFG indicated that ecological indicators, such as soils, pollinators, and vegetation, would be informative in designing the proposed preserve areas.

A habitat suitability index (HSI) was used to evaluate the entire project study area and was based on frequency distributions of spineflower using the following ecological indicators: vegetation, soils, geology, elevation, slope, and aspect. The HSI did not produce statistically suitable data. As a result, an alternative method of evaluating the five identified preserve areas—a representative model—was selected. Both approaches are discussed in more detail below.

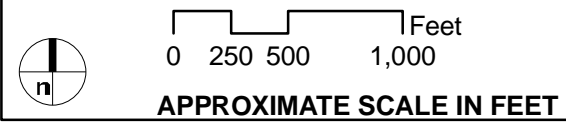


Legend

SCP Boundary

VCC Land Use

- Development
- Open Space Man Made
- Open Space Natural
- Water



AERIAL SOURCE: DigitalGlobe, 2007

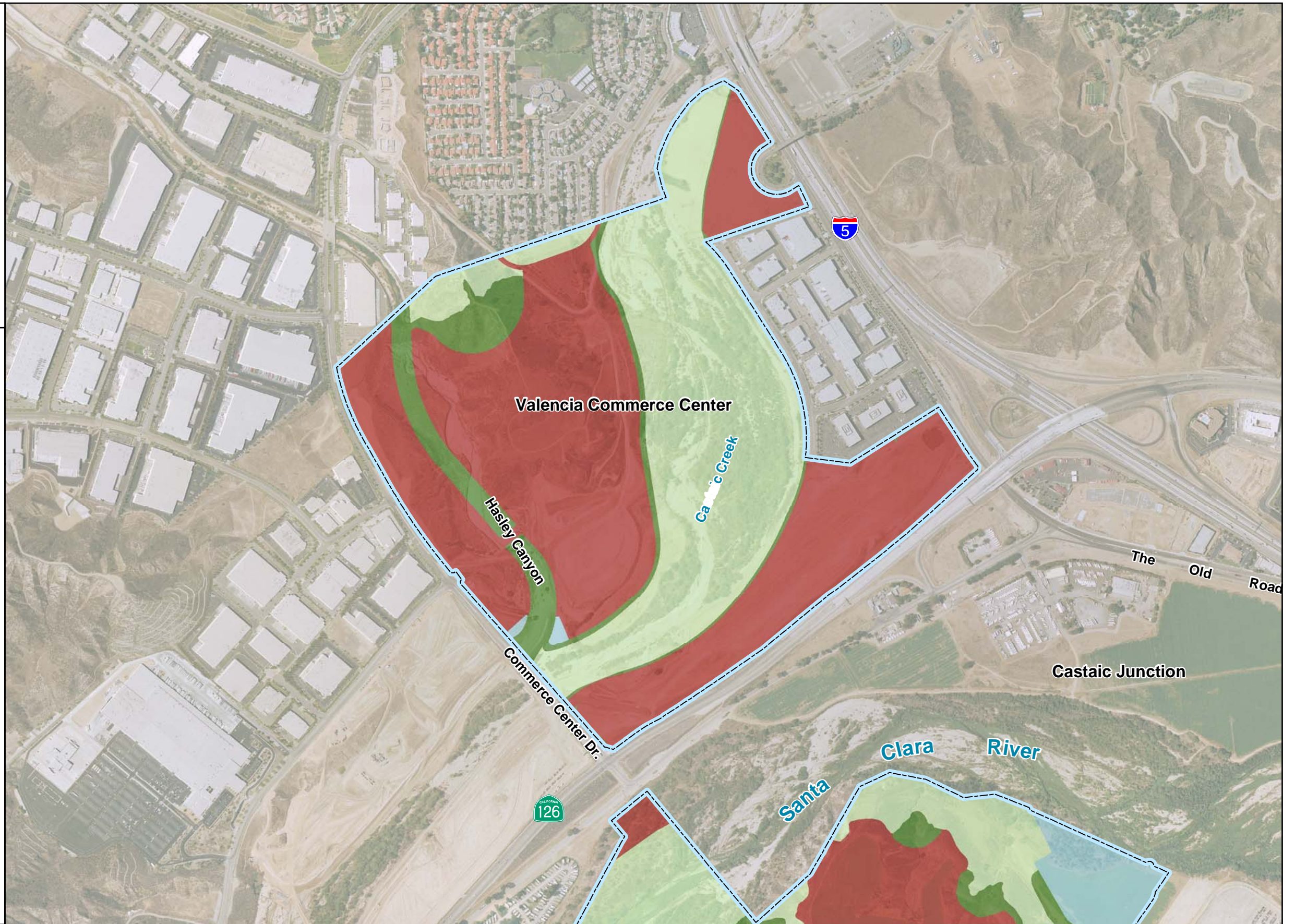
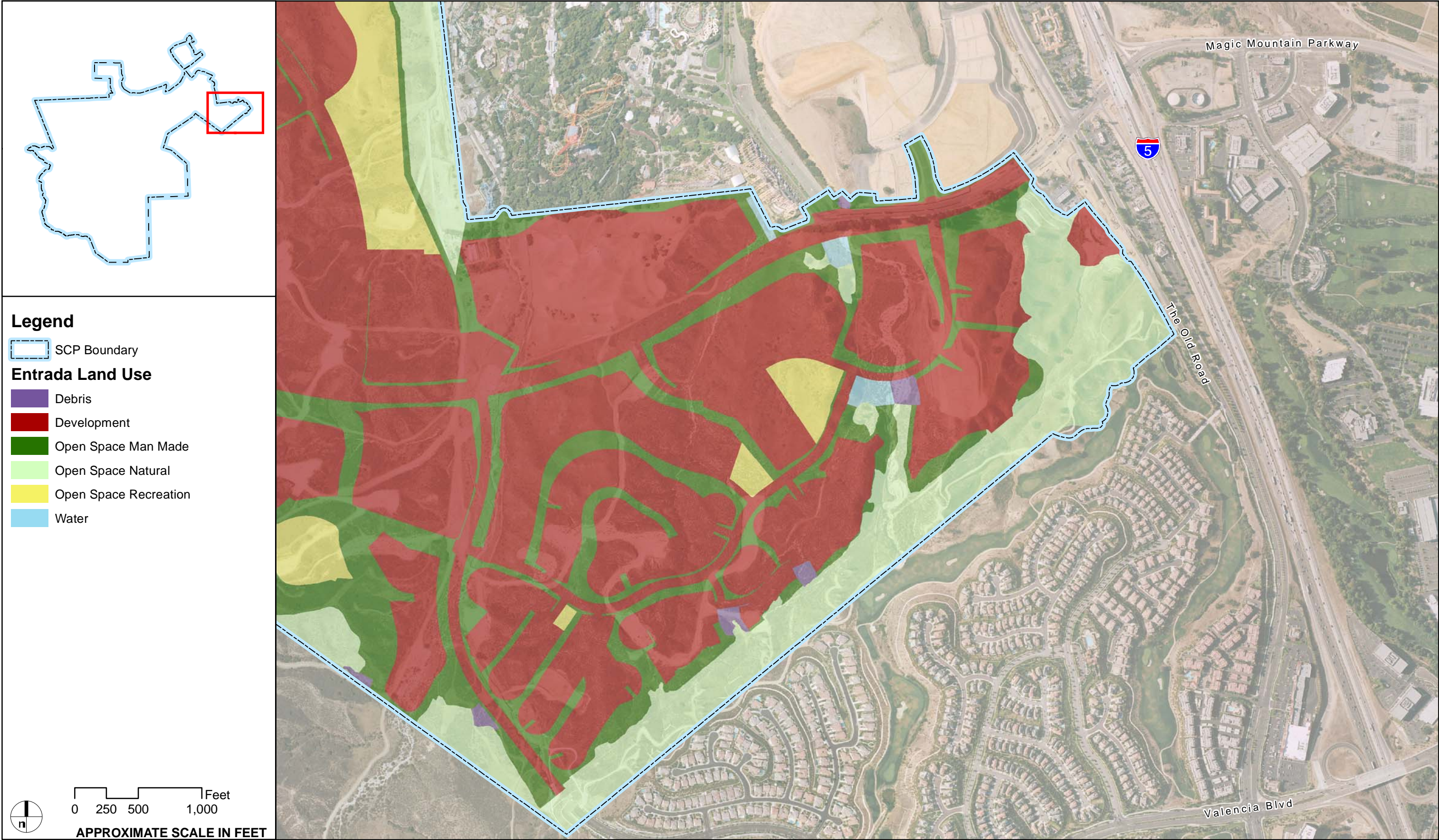


FIGURE 11B

Spineflower Conservation Plan

Valencia Commerce Center Land Use Map

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Legend

SCP Boundary

Entrada Land Use

- Debris
- Development
- Open Space Man Made
- Open Space Natural
- Open Space Recreation
- Water

0 250 500 1,000 Feet

APPROXIMATE SCALE IN FEET

AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 11C
 Spineflower Conservation Plan
Entrada Land Use Map



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Spineflower Conservation Plan

December 2007

7.1 Habitat Suitability Index for the Entire Project Study Area

The HSI was computed using the following data sets: vegetation, soils, geology, elevation, slope, and aspect. The vegetation data set for the Specific Plan area was obtained in digital form from FORMA. The vegetation data set for Entrada and VCC was mapped by Dudek on February 13, 2004, on a 2002 aerial base and digitized into a geographic information system (GIS) format. At that time, Dudek also updated the vegetation mapping within and adjacent to the proposed preserves, including percent bare ground. The Soil Survey Geographic Base (SSURGO), which is designed for natural resource planning and management, was downloaded from the Soil Conservation Service web site. The statewide geologic data set was purchased from the California Geologic Survey, originally digitized from the 1977 geologic map of California by Charles W. Jennings. A Digital Elevation Model (DEM) was computed from the U.S. Geological Survey (USGS) 40-foot contours using ArcGIS spatial analyst. From that DEM, slope and aspect coverages were derived.

Each of the six data layers was intersected with the 2003 spineflower occurrence data to determine the number of spineflower individuals within each individual attribute of each data set (vegetation, soils, geology, elevation, slope, and aspect).

Dudek performed a categorical regression for the six data sets using the entire spineflower occurrence. The intent was to then use the weights of the individual attributes within each data set and the relative weights of each data set to generate an HSI. The R-squared value for the categorical regression is 0.14 (adjusted R-squared value of 0.07). That means that the category weighting explains only 7% of the variation of the SFVS occurrence data within the project study area. The category weighting does not account for the other 93% of the variation in the occurrence data. Due to the low R-squared value, Dudek attempted to increase resolution within the geology data set using an updated geologic layer produced by Allan E. Seward Engineering Geology, Inc. (Seward) for Newhall Land. Due to the significant efforts of transforming the new geology point data into polygons, it was decided to use a subset of the project study area for a first comparison. Thus, Seward created a new geology data set for a 430-acre area, including Airport Mesa, within the Specific Plan area. The new Seward geology layer had six geology categories for the 430-acre area, while the older California Geologic Survey had two geology categories for the same 430-acre area. Dudek ran two new categorical regressions for the 430-acre area using the original vegetation, soils, elevation, slope, and aspect data sets with the new geology layer and the old geology layer. The R-squared value for the categorical regression using the new geology layer was 0.40 (adjusted R-squared value 0.283) and the R-squared value for the categorical regression using the old geology layer was 0.46 (adjusted R-squared value 0.33). As the new geology layer actually decreased the R-squared value, it did not seem that the creation of a new geology layer for the entire project study area was warranted.

Spineflower Conservation Plan December 2007

Given the low R-squared values for the weighted data sets (0.14 not adjusted; 0.07 adjusted), it did not seem prudent to use the data sets to produce an HSI to assist in the evaluation of the five proposed preserve areas or to develop management and monitoring recommendations and techniques within the preserve areas.

The results of this effort indicate that either existing habitat data may be too coarse to resolve the actual habitat features that SFVS selects or that habitat features are not predictive of spineflower occurrence. It is possible that further studies at a finer scale may better refine the various habitat parameters differentiating occupied SFVS habitat from unoccupied areas.

7.2 Representative Model for the Preserve Areas

Dudek utilized a representative model to evaluate the proposed preserve areas and compared the distribution of the individual attributes within each data set for the entire project study area and for the five proposed preserve areas.

As shown in *Table 7*, the five proposed preserves would conserve approximately 68.6% of the cumulative SFVS occupied area. The following five tables (*Tables 8 through 12*) show the total area, in acres, of suitable spineflower habitat preserved according to each data set.

Spineflower Conservation Plan December 2007

**Table 7
2002–2007 Cumulative Spineflower Occupied Area by Vegetation Type**

Vegetation Type	Number of Acres					
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved	Preserved Population as Percent of Existing Population	Percent Conserved by Vegetation
Agricultural	0.04	0.19	0.01	0.03	0.04	22.27
Burned California Sagebrush Scrub	1.54	7.61	1.54	0.00	7.61	100.00
Big Sagebrush Scrub	0.40	1.99	0.00	0.40	0.00	0.00
California Annual Grassland	4.31	21.29	3.81	0.50	18.83	88.41
Undifferentiated Chaparral	2.81	13.90	2.33	0.48	11.54	83.00
California Sagebrush Scrub	7.71	38.11	4.09	3.62	20.21	53.04
California Sagebrush Scrub–Artemesia	0.03	0.14	<0.01	<0.03	0.01	4.15
California Sagebrush Scrub–Black Sage	0.10	0.48	0.00	0.10	0.00	0.00
California Sagebrush Scrub–California Buckwheat	0.49	2.41	0.11	0.38	0.56	23.12
California Sagebrush Scrub/Undifferentiated	0.11	0.56	0.02	0.09	0.11	20.16
California Sagebrush Scrub–Purple Sage	0.90	4.45	0.87	0.03	4.30	96.61
Disturbed California Sagebrush Scrub–Purple Sage	0.45	2.23	0.45	0.00	2.23	100.00
Disturbed Land	0.78	3.85	0.35	0.43	1.74	45.14
Coast Live Oak Woodland	0.29	1.41	0.15	0.13	0.75	53.40
River Wash	0.10	0.50	0.09	0.02	0.42	84.59
Valley Oak/Grass	0.18	0.88	0.05	0.13	0.25	28.13
Total	20.24	100	13.88	6.36	68.6%	

The majority (73%) of 2002 through 2007 cumulative spineflower occupied area (*Table 7*) occurred in California sagebrush scrub, undifferentiated chaparral, and California annual grassland. Approximately 53% of the area occupied would be preserved within California sagebrush scrub, 83% of area occupied would be preserved within undifferentiated chaparral, and 89% of area occupied would be preserved in the California annual grassland. The remaining 13 vegetation types contain approximately 27% of the occupied area. The proposed preserve areas would conserve, on average, 44% of the occupied area within these vegetation types.

As described in *Table 8*, the majority (43%) of 2002 through 2007 cumulative spineflower occupied area occur in Castaic-Balcom silty clay loams (30% to 50% slopes). Terrace escarpments account for 20% of occupied area. Castaic-Balcom silty clay loams (30% to 50% slopes eroded) account for 13% of the occupied area. Zamora loam (2% to 9% slopes) accounts for 8% of the occupied area. The proposed preserve areas would include approximately 68.6% of cumulative spineflower occupied area. By area, Castaic-Balcom silty clay loams (30% to 50%

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slopes), combining the eroded and non-eroded category, and terrace escarpments contain 80% of the occupied area. The proposed preserve areas would conserve 73% of the occupied area in these three soil types.

Table 8
2002–2007 Cumulative Spineflower Occupied Area by Soil Type

Soil Type	Number of Acres					
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved	Preserved Population as Percent of Existing Population	Percent Conserved by Soils
Castaic and Saugus Soils, 30% to 65% Slopes, Severely Eroded	0.63	3.11	0.00	0.63	0.00	0.00
Castaic-Balcom Silty Clay Loams, 30% to 50% Slopes	8.79	43.43	5.39	3.40	26.65	61.36
Castaic-Balcom Silty Clay Loams, 30% to 50% Slopes, Eroded	2.62	12.93	2.29	0.33	11.32	87.55
Hanford Sandy Loam, 2% to 9% Slopes	0.58	2.87	0.58	0.00	2.87	100.00
Metz Loam, 2% to 5% Slopes	0.56	2.79	0.01	0.56	0.03	0.98
Metz Loamy Sand, 2% to 9% Slopes	0.05	0.27	0.00	0.05	0.00	0.00
River Wash	<0.01	0.01	<0.01	0.00	0.01	100.00
Saugus Loam, 30% to 50% Slopes	1.08	5.34	1.02	0.06	5.05	94.48
Saugus Loam, 30% to 50%, Eroded	0.20	0.99	0.00	0.20	0.00	0.00
Sorrento Loam, 2% to 5% Slopes	<0.01	0.01	0.00	<0.01	0.00	0.00
Terrace Escarpments	4.11	20.30	3.59	0.52	17.74	87.37
Yolo Loam, 0% to 2% Slopes	0.01	0.05	0.00	0.01	0.00	0.00
Zamora Loam, 2% to 9% Slopes	1.60	7.90	1.00	0.60	4.93	62.42
Total	20.24	100	13.88	6.36	68.60%	

As depicted in *Table 9*, the majority (68%) of 2002 through 2007 cumulative spineflower occupied area occurs between 1,080 and 1,200 feet AMSL. The proposed preserve area would conserve 79% of this area. Each of the other elevation categories account for less than 1% to 10% of the area occupied. Conservation in these categories ranges from 0% to 100% and averages 47%.

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Table 9
2002–2007 Cumulative Spineflower Occupied Area by Elevation

Elevation (in feet AMSL)	Number of Acres				Preserved Population as Percent of Existing Population	Percent Conserved by Elevation
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved		
920–960	<0.01	<0.01	<0.01	0.00	<0.01	100.00
960–1,000	0.23	1.11	0.20	0.02	1.00	89.88
1,000–1,040	1.93	9.54	1.20	0.73	5.94	62.28
1,040–1,080	1.51	7.48	0.71	0.81	3.48	46.58
1,080–1,120	3.60	17.81	2.94	0.67	14.51	81.48
1,120–1,160	6.23	30.80	5.59	0.64	27.63	89.71
1,160–1,200	3.87	19.12	2.29	1.58	11.29	59.06
1,200–1,240	1.83	9.03	0.45	1.38	2.20	24.41
1,240–1,280	0.82	4.07	0.40	0.42	2.00	49.07
1,280–1,320	0.11	0.53	0.11	0.00	0.53	100.00
1,320–1,360	<0.01	<0.01	0.00	0.00	0.00	0.00
1,360–1,400	0.01	0.07	0.00	0.01	0.00	0.00
1,400–1,440	0.09	0.44	0.00	0.09	0.00	0.00
Total	20.24	100%	13.88	6.36	68.60%	

As depicted in *Table 10*, 2002 through 2007 cumulative spineflower occupied area overlaps three geologic strata. The most common geologic substrate for spineflower occupied area is Plio-Pleistocene nonmarine, Pliocene nonmarine, accounting for 46% of the occupied area; 67% of this area would be conserved. The two remaining geologic substrates—Alluvium Quaternary nonmarine and marine and Pliocene marine—account for 38% (65% conservation) and 16% (81% conservation) of the occupied area, respectively.

As described in *Table 11*, the majority (94%) of 2002 through 2007 cumulative spineflower occupied area occurred on slopes of 20% or less. The preserves would conserve 67% of the occupied area in these categories. The three remaining slope ranges represented 6% of spineflower occupied area. The proposed preserves would conserve over approximately 89% of the occupied area for these remaining slope ranges.

Spineflower Conservation Plan December 2007

Table 10
2002–2007 Cumulative Spineflower Occupied Area by Geology

Geology Type	Number of Acres					
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved	Preserved Population as Percent of Existing Population	Percent Conserved by Geology
Alluvium Quaternary nonmarine and marine	7.62	37.63	4.97	2.65	24.55	65.24
Pliocene marine	3.27	16.14	2.66	0.61	13.14	81.42
Plio-Pleistocene nonmarine, Pliocene nonmarine	9.36	46.23	6.25	3.10	30.91	66.85
Total	20.24	100%	13.88	6.36	60.8%	

As described in *Table 11*, the majority (94%) of 2002 through 2007 cumulative spineflower occupied area occurred on slopes of 20% or less. The preserves would conserve 67% of the occupied area in these categories. The three remaining slope ranges represented 6% of spineflower occupied area. The proposed preserves would conserve over approximately 89% of the occupied area for these remaining slope ranges.

Table 11
2002–2007 Cumulative Spineflower Occupied Area by Slope

% Slope	Number of Acres					
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved	Preserved Population as Percent of Existing Population	Percent Conserved by Slope
0–5	4.67	23.09	2.97	1.70	14.69	63.64
5–10	7.08	34.99	4.31	2.77	21.32	60.92
10–15	3.55	17.53	2.12	1.43	10.49	59.81
15–20	3.66	18.10	3.34	0.32	16.49	91.13
20–25	1.19	5.88	1.07	0.12	5.29	89.96
25–30	0.07	0.33	0.05	0.02	0.24	72.13
30–35	0.02	0.07	0.02	0.00	0.07	100.00
Total	20.24	100%	13.88	6.36	68.6%	

As described in *Table 12*, the majority (59%) of 2002–2007 cumulative spineflower occupied area occurred on slopes facing southwest, southeast, and west. The proposed preserve areas would conserve 74% of the occupied area on slopes with these aspects. Each of the remaining six

Spineflower Conservation Plan December 2007

aspect categories represent 11% or less of the occupied area. Between 23% and 91% of occupied area in these remaining six aspect categories would be included within the preserve areas.

Table 12
2002–2007 Cumulative Spineflower Occupied Area by Aspect

Aspect	Number of Acres					
	Acres in Project Study Area	Percent of Existing Population	Preserved	Not Preserved	Preserved Population as Percent of Existing Population	Percent Conserved by Aspect
East	2.21	10.93	1.45	0.76	7.16	65.57
Flat	1.15	5.68	0.67	0.48	3.31	58.25
North	0.55	2.72	0.50	0.05	2.48	90.95
Northeast	0.90	4.47	0.21	0.69	1.05	23.56
Northwest	2.00	9.89	1.44	0.56	7.12	71.93
South	1.38	6.84	0.67	0.71	3.31	48.42
Southeast	4.15	20.51	2.30	1.85	11.38	55.46
Southwest	4.00	19.79	3.24	0.76	16.02	80.99
West	3.88	19.17	3.39	0.49	16.77	87.44
Total	20.24	100%	13.88	6.36	68.6%	

The level of conservation across the environmental conditions described in the above tables (*Tables 7 to 12*) is considered to address a primary goal of this plan, which is to provide for the long-term persistence of spineflower within the project study area, and, in particular, this level of conservation addresses Goal 3, as described in *Section 3.0*.

7.3 Accommodating Population Fluctuation within Preserve Areas

The preserve areas have been designed to accommodate fluctuations in spineflower population levels over time. *Table 13* depicts the cumulative acreage (combined data from annual surveys conducted from 2002 through 2007) occupied by spineflower, and the cumulative acreage in the proposed preserves that is not occupied spineflower habitat. The proposed preserves will include 13.88 acres of occupied spineflower habitat and 153.68 acres of unoccupied habitat that may or may not be suitable for spineflower. Not all acres that are currently unoccupied should be defined as “buffer areas.” In order to minimize edge effects and certain indirect impacts from development areas, a buffer zone has been incorporated within each preserve area. As shown in *Table 13*, 110.77 acres of that unoccupied habitat would be considered “buffer area.” Unoccupied area not designated “buffer area” is considered “expansion area,” and totals 42.90 acres. *Figure 12* depicts a typical preserve design with core habitat area, expansion area, and

Spineflower Conservation Plan December 2007

buffer area. Individual buffer distances are discussed for each preserve in *Section 8.0*. It should be noted that buffer widths vary by location due to site-specific factors, mitigating factors, site design, and management techniques.

Table 13
Cumulative Area Occupied by Spineflower within Preserves

Preserve	Area Occupied by Spineflower (Acres)	Buffer Area Provided (Unoccupied by Spineflower) (Acres)	Expansion Area Provided (Unoccupied by Spineflower) (Acres)
Airport Mesa	5.22	18.82	20.94
Grapevine Mesa	4.02	37.33	4.99
Potrero	1.32	10.43	3.05
San Martinez Grande	2.29	26.17	5.95
Entrada	1.03	18.02	7.97
Total	13.88	110.77	42.90

As described in *Section 7.1*, it is not possible at this time to identify suitable habitat for the spineflower, based on the unsatisfactory results of the HSI, which utilized currently available information. Further analysis is needed to better characterize the spineflower's physical and biological habitat requirements at a fine scale. As described in *Appendix A*, a spineflower Habitat Characterization Study will be implemented to quantify this information.

The Spineflower Monitoring Program described in *Section 11.2* is designed to track the distribution and abundance of spineflower populations within the preserves and will document population expansion events that may occur in the future. Implementing the general management measures described in *Section 9.2* will improve growing conditions within the preserves and create opportunities for existing spineflower populations to expand into currently unoccupied portions of the preserves. Restoring damaged, cultivated, or disked habitats, which may have previously supported spineflower, is planned for some locations and could allow future population expansion if conditions suitable for spineflower can be created.

Dry FMZ

Width varies from 0 to 100 feet

Wet FMZ

Width varies from 50 to 150 feet

Open Space

Legend

Core Habitat Area

Spineflower

Preserve

Expansion Area

Buffer Area

FMZ = Fuel Modification Zone

FIGURE 12

Spineflower Conservation Plan

Typical Spineflower Preserve Design

**Spineflower Conservation Plan
December 2007**

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Spineflower Conservation Plan December 2007

7.4 CONNECTIVITY BETWEEN THE PRESERVE AREAS

Maintaining connectivity between the five preserve areas addresses the ecosystem goals and objectives (Goal 3) of this plan. Figure 13 depicts the five preserve areas in relation to open space areas. The Potrero and Grapevine Mesa Preserve Areas each connect to the Santa Clara River corridor through lands designated as open areas. The Airport Mesa Preserve Area connects to Open Area via a wildlife-movement arched culvert under Street GG. There is no direct connectivity linking the San Martinez Grande Preserve Area to natural habitat areas. A 50- to 100-foot-wide band of proposed development along San Martinez Grande Road separates the San Martinez Grande Preserve Area from a narrow open area located east of the road along the stream corridor. It is not known whether pollinators or dispersal agents would be able to cross developed lands to reach this preserve area.

The Entrada Preserve Area is connected to a 175-foot-wide utility easement corridor that runs southwest toward the off-site Legacy Village open space area, which, in turn, connects to the Newhall Ranch open space areas and the Santa Clara River corridor.

Open areas may include undeveloped land, passive and active use parks, and trails. Development plans are not currently available for open areas, and, therefore, open area land uses adjacent to the proposed spineflower preserves are not known at this time.

8.0 DESCRIPTION OF THE PRESERVES

This section provides a discussion of the proposed preserve areas, including location, size, and setting; the number and distribution of occurrences; and various ecological indicators, such as aspect, slope, soils, vegetation, and potential pollinators present.

The proposed Airport Mesa, Grapevine Mesa, Potrero, San Martinez Grande, and Entrada Preserve Areas would conserve spineflower locations at five out of the six known occurrences within Newhall Land property holdings in the project study area. The five preserve areas total approximately 167.56 acres and include approximately 68.6% of the 2002 through 2007 cumulative spineflower occupied area.






The sections below include a general evaluation of the potential for spineflower within each preserve area. Figures 14 through 18 depict the proposed preserve areas with existing vegetation and 2002 through 2007 cumulative spineflower occupied area.

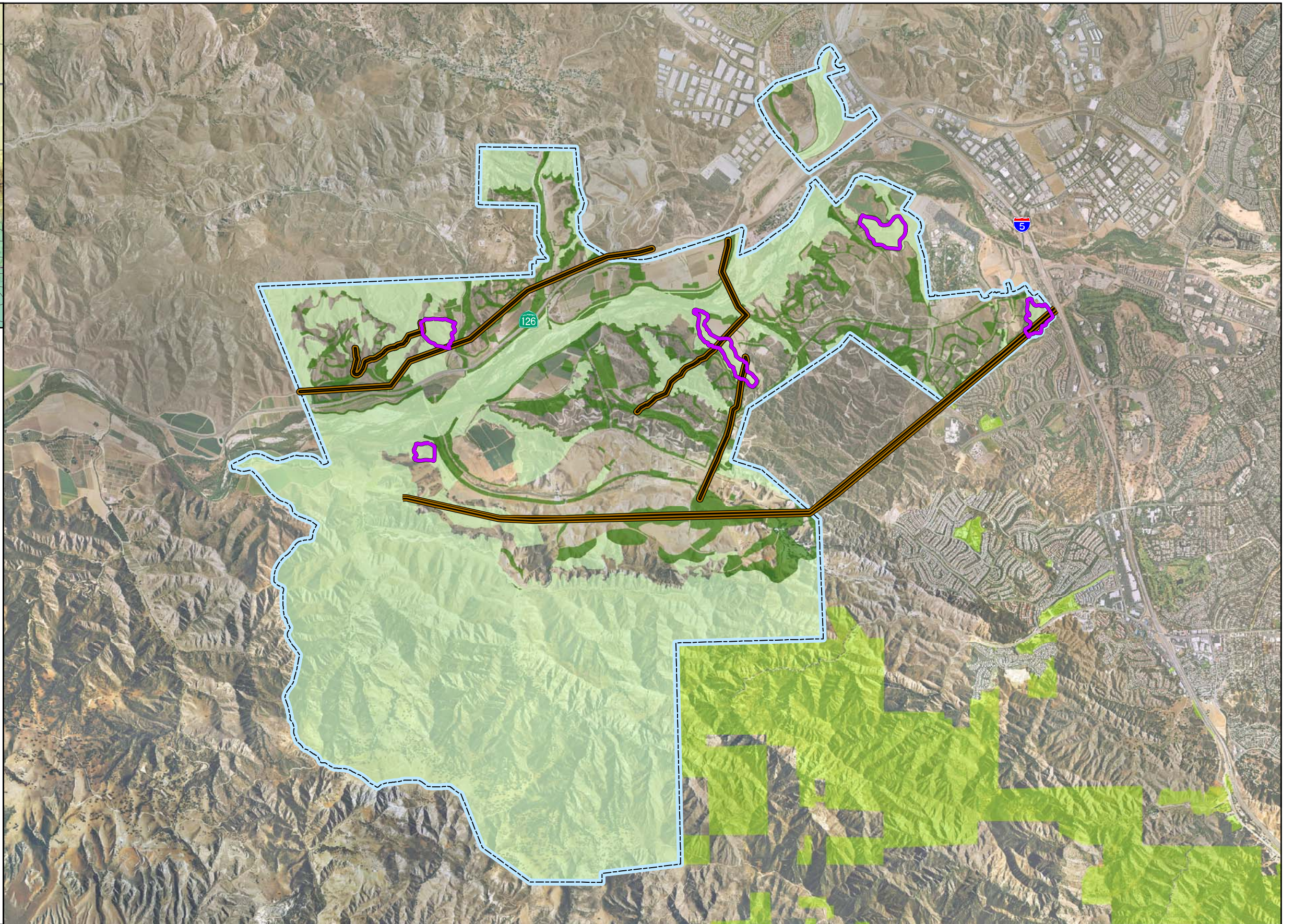
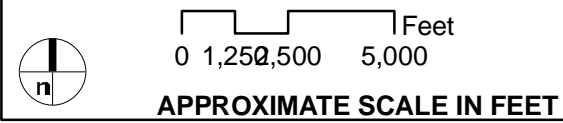
**Spineflower Conservation Plan
December 2007**

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Legend

-  SCP Boundary
-  Utility Easement
-  Off-Site Public Lands
- Land Use**
-  Open Space Man Made
-  Open Space Natural



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 13

Spineflower Conservation Plan
Proposed Open Space

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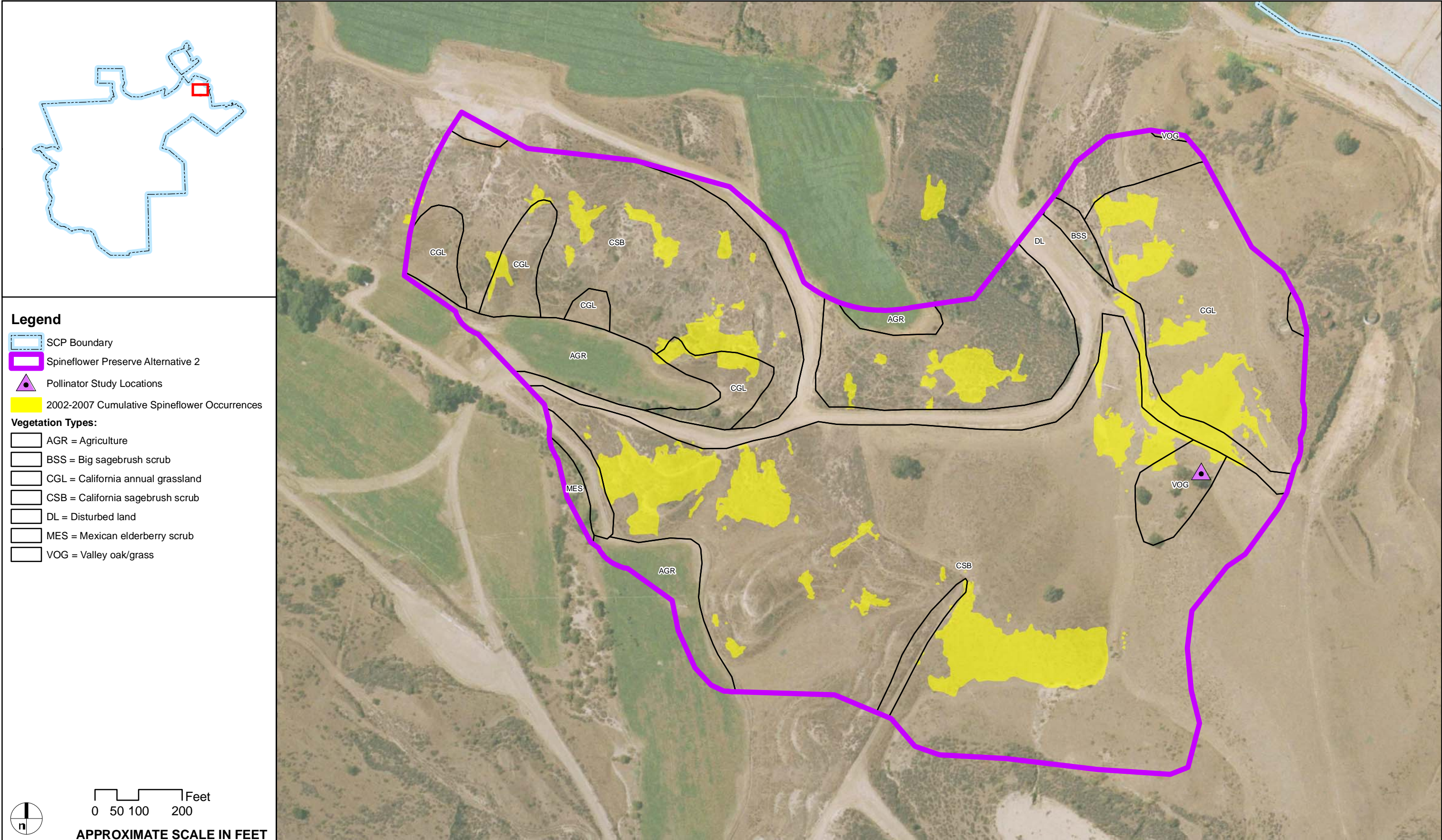


FIGURE 14

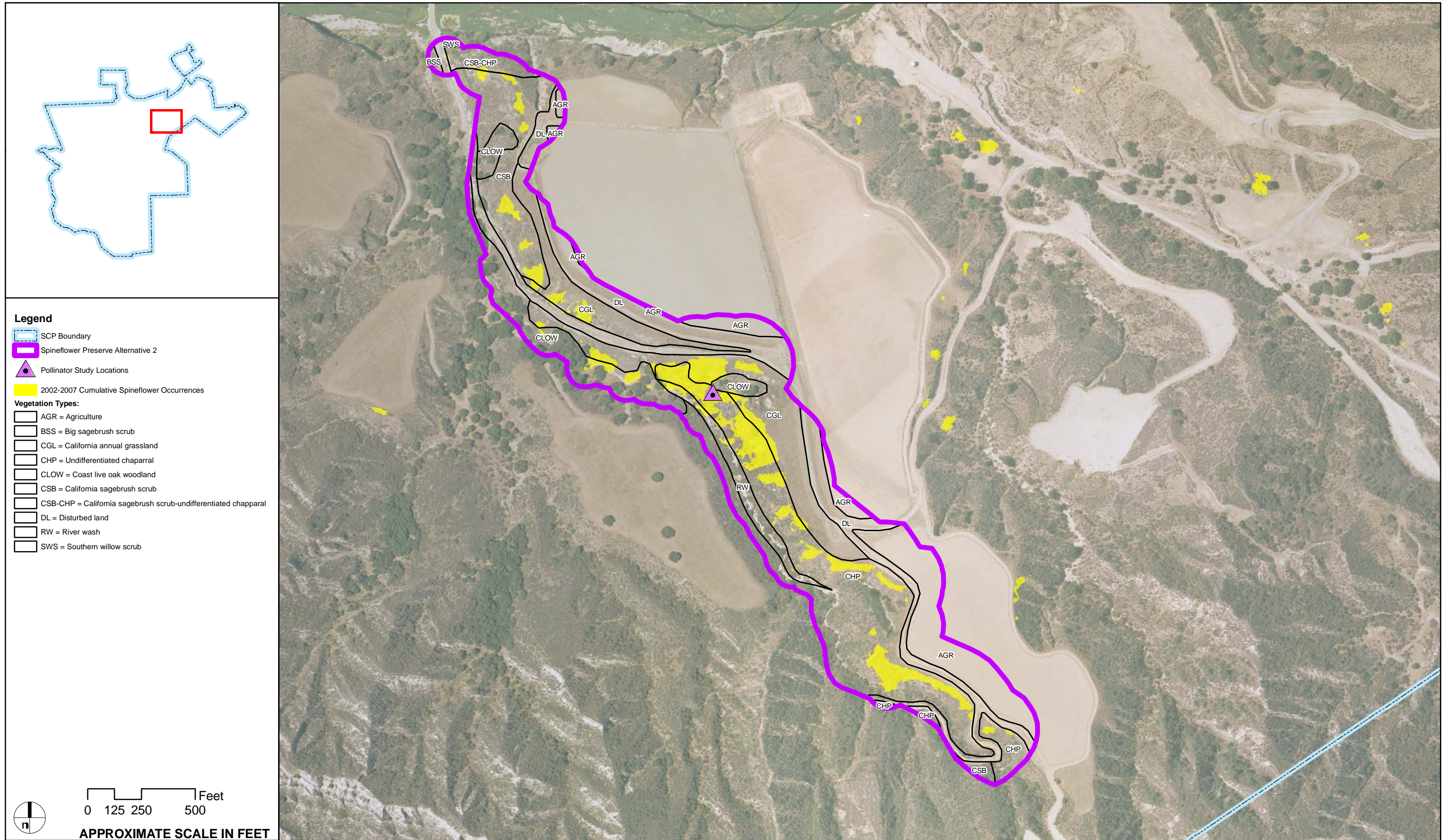
Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences with Vegetation Communities - Airport Mesa



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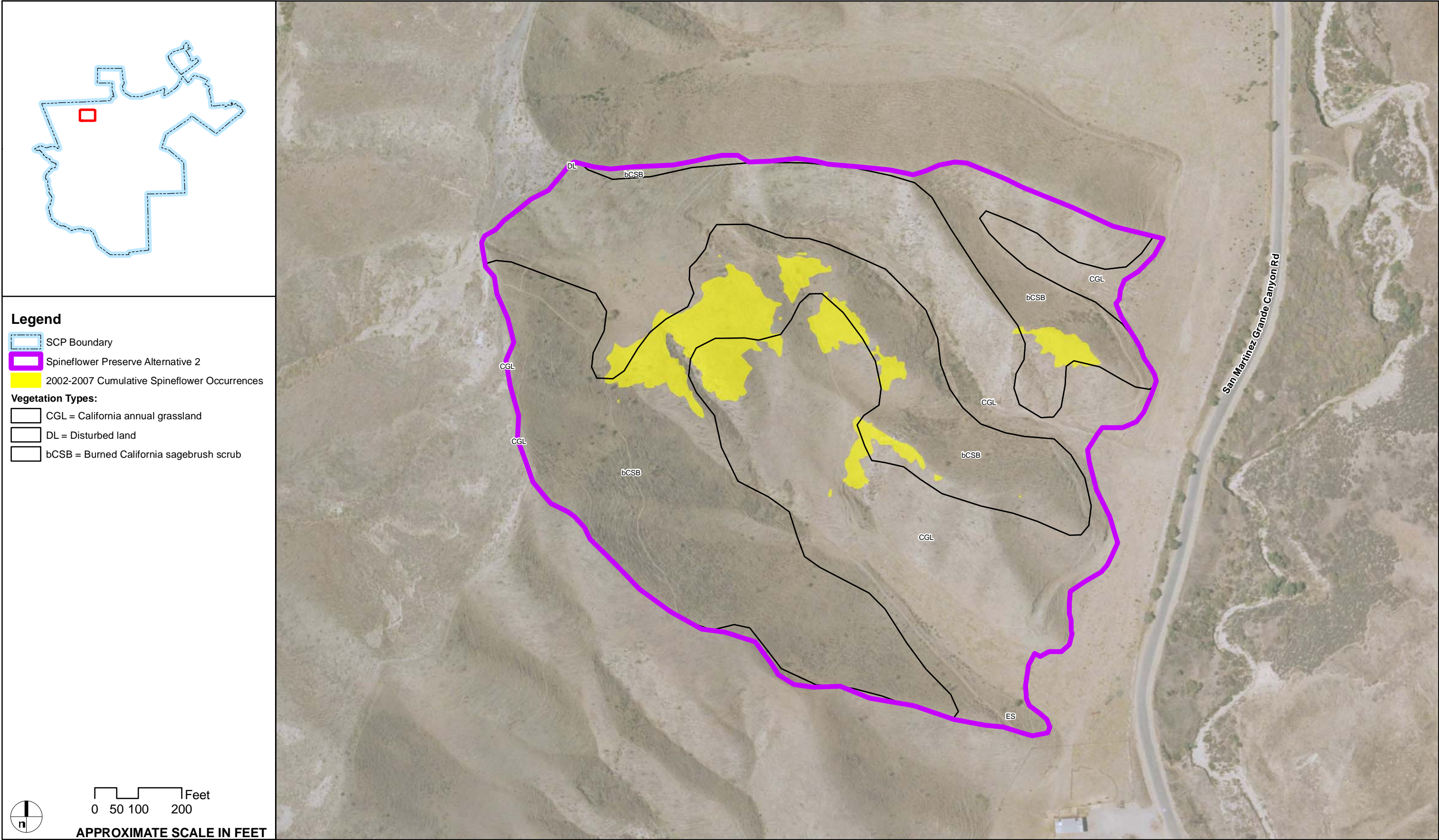
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FIGURE 15

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences with Vegetation Communities - Grapevine Mesa

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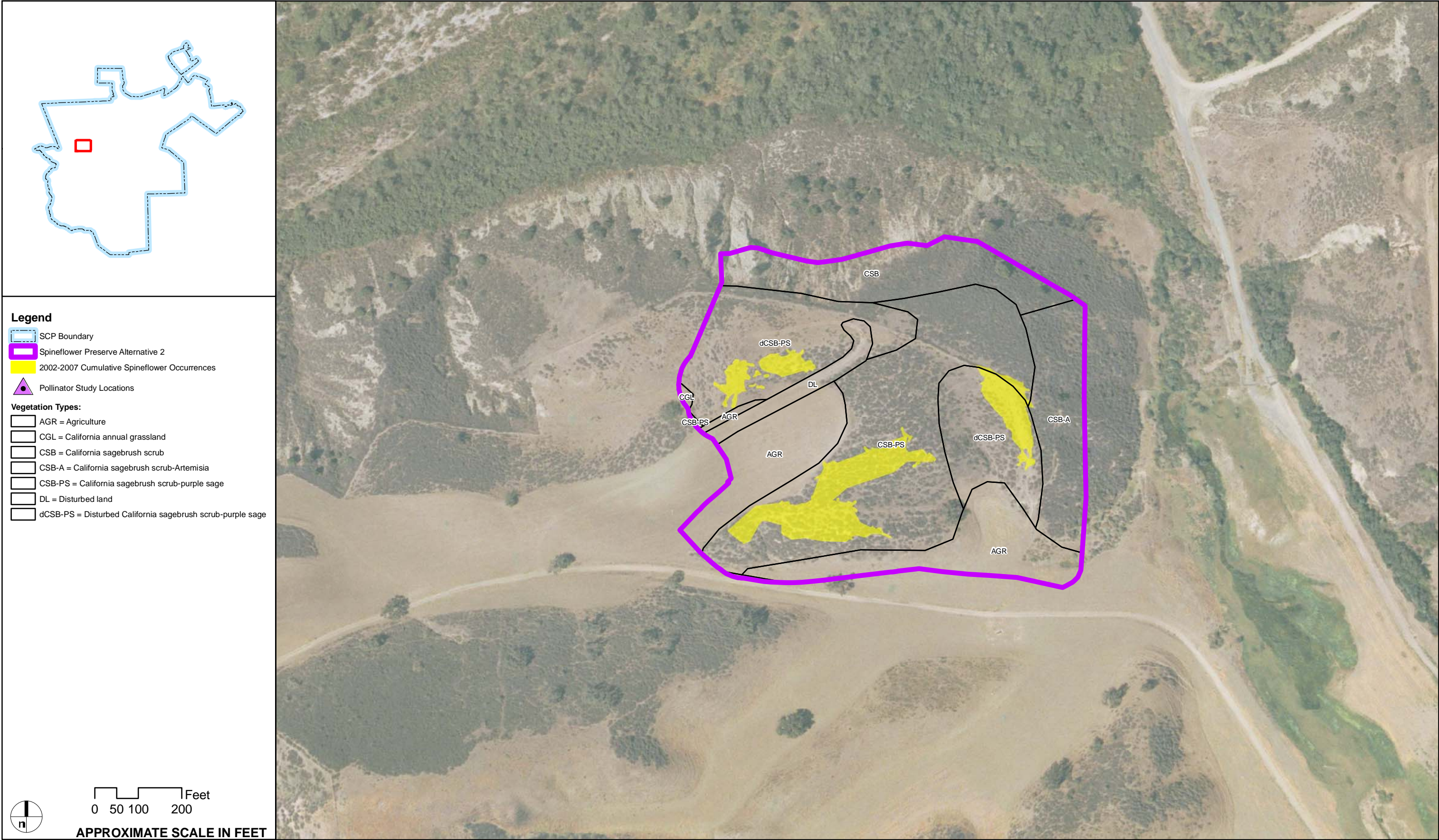


AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 16

Spineflower Conservation Plan

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Legend

- SCP Boundary
- Spineflower Preserve Alternative 2
- 2002-2007 Cumulative Spineflower Occurrences
- ▲ Pollinator Study Locations

Vegetation Types:

- AGR = Agriculture
- CGL = California annual grassland
- CSB = California sagebrush scrub
- CSB-A = California sagebrush scrub-Artemisia
- CSB-PS = California sagebrush scrub-purple sage
- DL = Disturbed land
- dCSB-PS = Disturbed California sagebrush scrub-purple sage

0 50 100 200 Feet
 APPROXIMATE SCALE IN FEET

AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 17

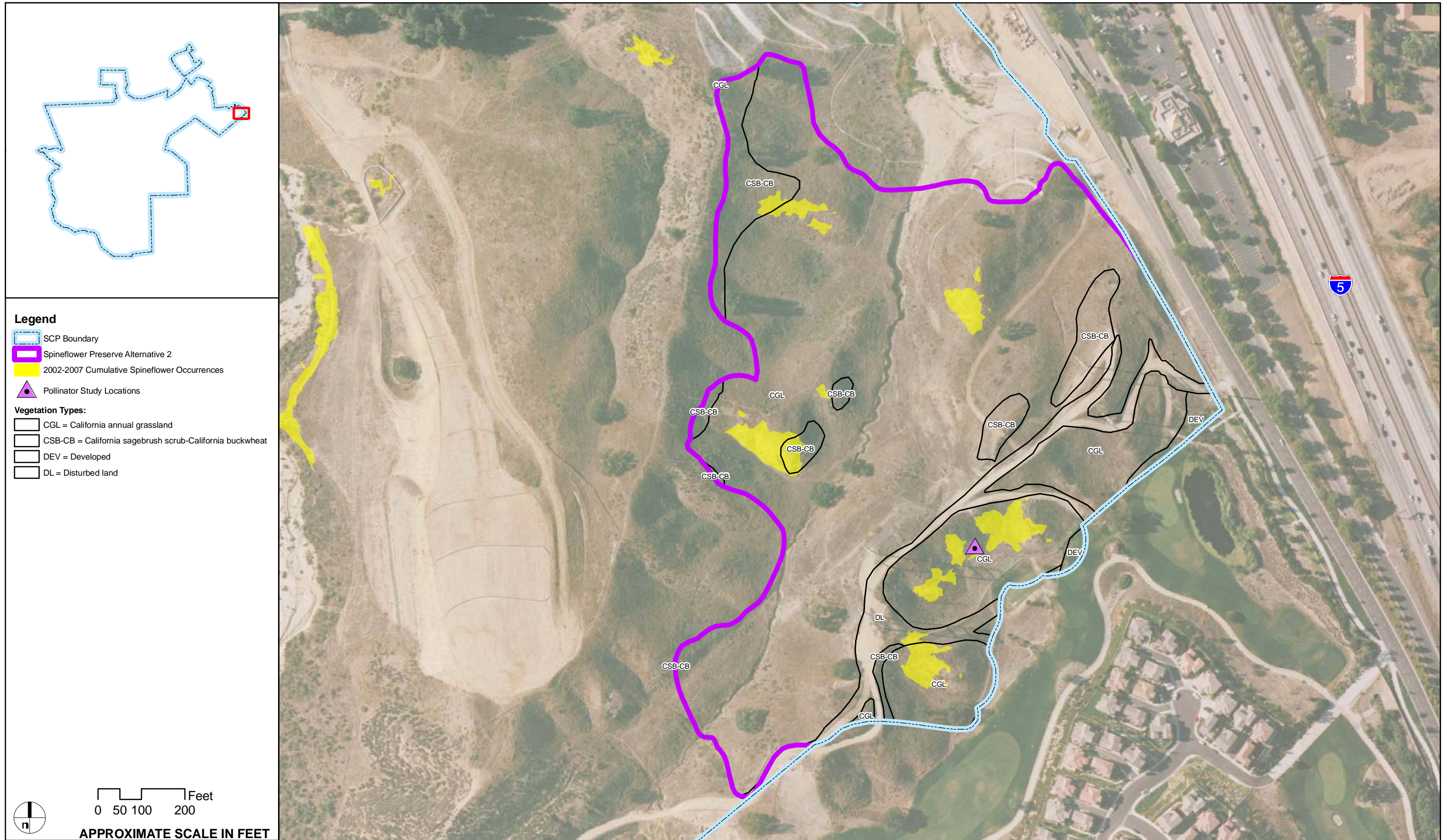
Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences with Vegetation Communities - Potrero Canyon



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AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 18

Spineflower Conservation Plan

San Fernando Valley Spineflower Occurrences with Vegetation Communities - Entrada

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Spineflower Conservation Plan December 2007

8.1 Airport Mesa Preserve Area

The Airport Mesa Preserve Area is located toward the eastern end of the Specific Plan area, to the west of the Six Flags Magic Mountain Amusement Park and south of the Santa Clara River (*Figure 14*). The preserve includes 44.98 acres dominated by California annual grassland and California sagebrush scrub communities along south- and west-facing slopes surrounding Airport Mesa. The preserve extends along the north side of Middle Canyon to the existing gated access road on the east side of the mesa.

Ecological Indicators (Vegetation, Soils, Geology, Slope, Aspect, Elevation)

Vegetation communities and 2002 through 2007 cumulative spineflower occupied area within the Airport Mesa Preserve Area are listed in *Table 14*. There are 5.22 acres of cumulative spineflower occupied area within the Airport Mesa Preserve Area.

Table 14
Vegetation Communities and Land Covers within the Airport Mesa Preserve Area

Vegetation Type	Acres in Preserve	Cumulative 2002–2007 SFVS Occupied Acres
Agriculture	2.73	0.01
Big Sagebrush Scrub	0.23	0.00
California Annual Grassland	6.68	1.14
California Sagebrush Scrub	30.60	3.70
Disturbed Land	3.85	0.32
Mexican Elderberry	0.18	0.00
Valley Oak/Grass	0.71	0.05
Total	44.98	5.22

California sagebrush scrub and California annual grassland are the dominant vegetation communities within the Airport Mesa Preserve Area. There are approximately 30.60 acres of California sagebrush scrub and approximately 6.68 acres of California annual grassland. Although California sagebrush scrub and California annual grassland are generally the primary habitat for spineflower, it does occur within areas that experienced surface grubbing and/or mass soil grading in the recent past, and seed bank was presumably present in the vicinity prior to disturbance. Spineflower also occurs on the margins of infrequently used dirt roadbeds, especially where populations occur upslope and are producing seed. Besides California annual grassland and California sagebrush scrub, spineflower has been observed on agricultural land, disturbed land, and valley oak/grass. Other vegetation communities and land covers within the Airport Mesa Preserve Area include big sagebrush scrub and Mexican elderberry; no spineflower occurrences were recorded on such land. Agricultural land and disturbed land will be restored as described in *Section 9.2.10*.

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The Airport Mesa Preserve Area soils include Castaic-Balcom silty clay loams (30% to 50% slopes), terrace escarpments, and Hanford sandy loam (2% to 9% slopes). Out of the three geologic units that occur within the project study area, two are present within the Airport Mesa Preserve Area: (1) alluvium (mostly Holocene, some Pleistocene) Quaternary non-marine and marine and (2) Plio-Pleistocene non-marine, Pliocene non-marine.

Slopes within the Airport Mesa Preserve Area are gentle to moderate, with 91% of the preserve area occurring on slopes less than 10° and 100% of the preserve area occurring on slopes less than 20°. Approximately 78% of the slopes in the preserve area have a southwest-, northwest-, or west-facing aspect. Elevations range from 1,080 to 1,160 feet AMSL.

Adjacent Land Uses

The areas surrounding the Airport Mesa Preserve Area (*Figure 19*) have been historically used for agriculture (irrigated row crops and dry-farmed row crops) and grazing. Currently, adjacent land uses include staging for agricultural operations on the graded mesa-top above the preserve area and active cultivation in the canyon bottom below the preserve area. Open space along the Santa Clara River corridor is located to the north of the preserve area, while the Six Flags Magic Mountain Amusement Park is located to the southeast of the preserve area. Planned land uses adjacent to the Airport Mesa Preserve Area include mixed use primarily to the north and south, and high-density residential development to the southwest of the preserve area. Undeveloped areas along the Santa Clara River corridor northwest of the preserve area would remain in open space, as would open space areas to the east and northeast. The preserve would be connected to open space by a culvert under Street GG.

Buffer Areas within Airport Mesa Preserve Area

Where the Airport Mesa Preserve Area is adjacent to development, spineflower occurrences would generally be separated from development by 80 to 200 feet or more. Where the preserve would be upslope of the adjacent mixed-use development, the distance from the nearest spineflower occurrence to the preserve boundary is approximately 80 feet. Where the preserve would be downslope of the adjacent mixed-use development, the distance from the nearest spineflower occurrence to the preserve boundary varies from 80 to 200 feet or more. In combination with these buffer widths, implementing the management measures described in *Section 9.0*, and developing new management measures as a part of the adaptive management process described in *Section 10.0*, the proposed preserves are designed to address various stressors and threats from adjacent changes in land use and contribute to achieving the biological goals and objectives of this plan.

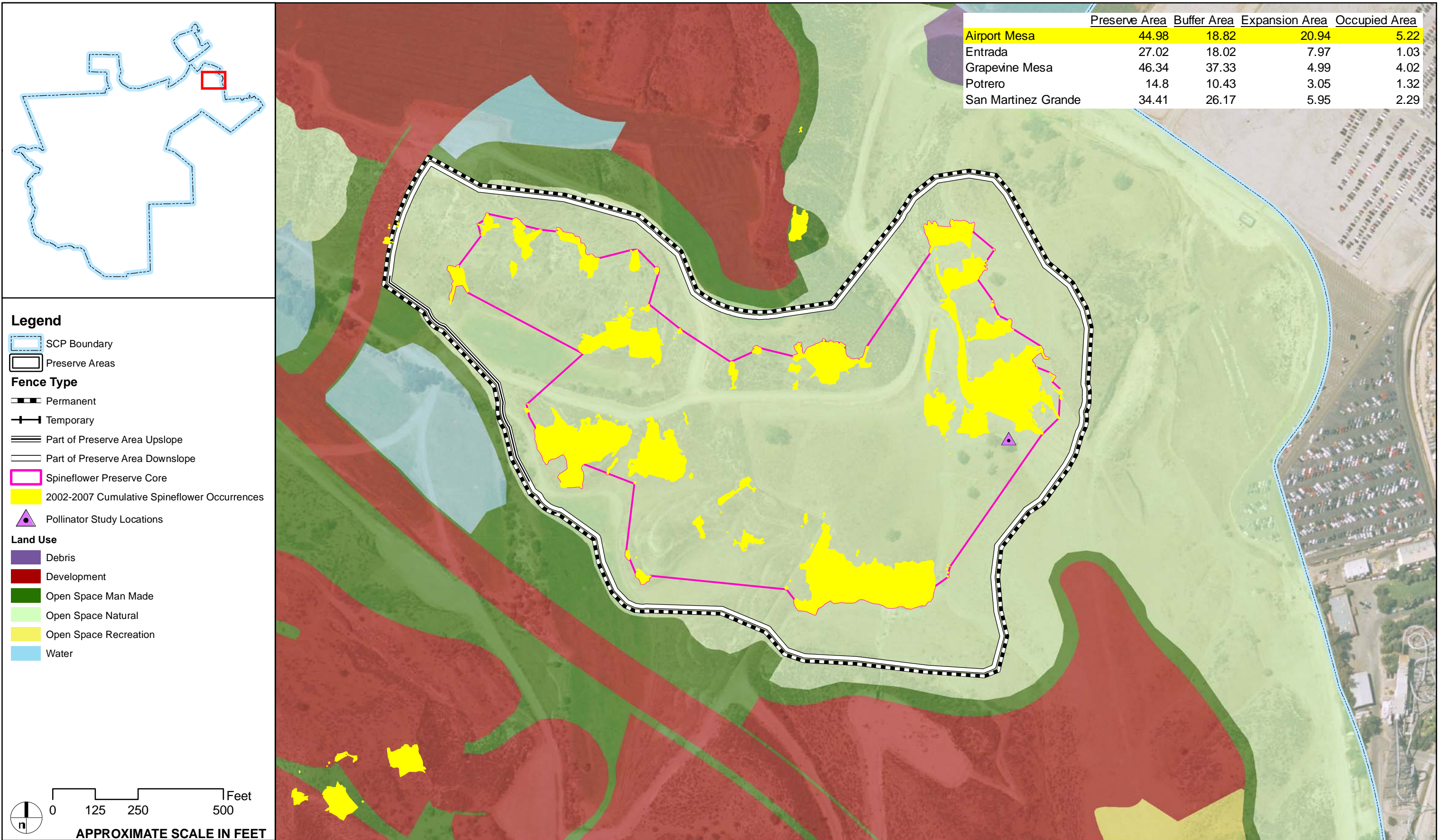


FIGURE 19

Spineflower Conservation Plan

Airport Mesa Preserve with Adjacent Land Use

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Pollinators Present

Flies and beetles were the dominant visitors to spineflower populations at Airport Mesa during the mid-season survey (April 23–25, 2004). There were 633 visits during the mid-season survey. Flies, ants, and beetles were the dominant visitors during the late-season survey (May 7–9, 2004). There were 372 visits during the late-season survey. However, insect visitors to spineflower populations were very diverse at all three survey locations (Airport Mesa, Grapevine Mesa, and Entrada) and reflected the relative abundance of insects in the community (Jones et al. 2004). Seven orders of insects were observed visiting spineflower populations, including Hymenoptera (bees and ants), Coleoptera (beetles), Homoptera (cicadas), Diptera (flies), Hemiptera (true bugs), Mantodea (mantids), and Lepidoptera (moths). The California sagebrush scrub, alluvial scrub, valley oak grassland, and California annual grassland within the preserve may continue to provide habitat for the above-described insects, especially flies, ants, and beetles.

8.2 Grapevine Mesa Preserve Area

The Grapevine Mesa Preserve Area encompasses 46.34 acres dominated by agricultural land (irrigated row crops), disturbed land, California annual grassland, and chaparral on south- and west-facing slopes along the western margin of Grapevine Mesa (*Figure 15*). The preserve varies in width from approximately 250 to 600 feet and is 1 mile in length, extending from the Santa Clara River in the north to the southern end of Grapevine Mesa. The eastern margin of the preserve area includes agricultural lands along the mesa-top, but the majority of the preserve area occurs on slopes surrounding the mesa that are dominated by California sagebrush scrub and chaparral. Humble Canyon drainage, a tributary to the Santa Clara River, occurs along the western boundary of the preserve area.

Ecological Indicators (Vegetation, Soils, Geology, Slope, Aspect, Elevation)

Vegetation communities and 2002 through 2007 cumulative spineflower occupied area within the Grapevine Mesa Preserve Area are listed in *Table 15*. There are 4.02 acres of cumulative spineflower occupied area within the Grapevine Mesa Preserve Area. Of the cumulative spineflower occurrence area, 0.33 acre (approximately 8% of the total occupied area within the Grapevine Mesa Preserve Area) is within the utility easement.

While chaparral is the primary habitat for spineflower within the Grapevine Mesa Preserve Area, spineflower also occurs in fairly high numbers within California annual grassland and California sagebrush scrub; limited occurrences are located within disturbed land, river wash, and coast live oak woodland. Other vegetation communities and land covers within the Grapevine Mesa

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Preserve Area include agricultural land, big sagebrush scrub, and southern willow scrub; no spineflower occurrences were recorded on such land. The agricultural land and disturbed land would be restored as described below, in accordance with *Section 9.2.10*.

Table 15
Vegetation Communities and Land Covers within the
Grapevine Mesa Preserve Area

Vegetation Type	Acres in Preserve	Cumulative 2002–2007 SFVS Occupied Acres
Agriculture	5.61	0.00
Big Sagebrush Scrub	0.12	0.00
California Annual Grassland	7.93	1.02
California Sagebrush Scrub	4.74	0.39
California Sagebrush Scrub/Undifferentiated	0.83	0.02
Coast Live Oak Woodland	4.49	0.15
Disturbed Land	8.18	<0.01
River Wash	1.36	0.09
Southern Willow Scrub	0.07	0.00
Undifferentiated Chaparral	13.00	2.33
Total	46.34	4.02

The Grapevine Mesa Preserve Area soils consist mostly of Zamora loam (2% to 9% slopes) and terrace escarpments but also include severely eroded Castaic and Saugus soils (30% to 65% slopes). The majority of the preserve area consists of Plio-Pleistocene non-marine, Pliocene non-marine deposits. There are less than 2 acres of alluvium (mostly Holocene, some Pleistocene) Quaternary non-marine and marine deposits within the preserve area.

Slopes within the preserve area are gentle to moderate, with more than 90% of the preserve area occurring on slopes less than 20°. More than 80% of the slopes in the preserve area are west-, southwest-, or northwest-facing. Elevations range from 1,000 to 1,320 feet AMSL, with a relatively even distribution of elevations occurring throughout the preserve area.

Adjacent Land Uses

Existing land uses adjacent to the Grapevine Mesa Preserve Area are limited to ongoing agricultural activities located on Grapevine Mesa within and above the preserve area. Open space within the Santa Clara River corridor is located to the north of the preserve area, and additional undeveloped land occurs to the south and west.

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Adjacent to the northern portion of the Grapevine Mesa Preserve Area, planned land uses include medium-density residential uses to the northeast of the preserve area, low- to medium-density residential uses and existing undeveloped land to the northwest, and open space along the Santa Clara River corridor to the north (*Figure 20*). In the southern portion of the Grapevine Mesa Preserve Area, planned adjacent land uses include commercial development to the east and west of the preserve area and high-density residential uses to the south of the preserve area.

Buffer Areas within Grapevine Mesa Preserve Area

Where the Grapevine Mesa Preserve Area is adjacent to development, spineflower occurrences would generally be separated from development by 80 to 200 feet or more. Where the Grapevine Mesa Preserve Area is adjacent to open space in the northwest, the preserve is upslope, and the distance between the nearest spineflower occurrence and the preserve boundary varies from 80 to approximately 200 feet. On the east side of the preserve, the distances between spineflower occurrences and the preserve boundary (and adjacent development) vary from 105 feet to over 200 feet. On the west side of the preserve, the distances between spineflower occurrence and the preserve boundary (and adjacent development) vary from 80 to 170 feet. In combination with these buffer widths, implementing the management measures described in *Section 9.0*, and developing new management measures as a part of the adaptive management process described in *Section 10.0*, the proposed preserves are designed to address various stressors and threats from adjacent changes in land use and contribute to achieving the biological goals and objectives of this plan.

Pollinators Present

Flies, beetles, and ants were the dominant visitors to spineflower populations at Grapevine Mesa during the mid-season survey (April 23–25, 2004). The number of visits during the mid-season survey was 2,021. Flies and beetles were the dominant spineflower visitors during the late-season survey (May 7–9, 2004). The number of visits during the late-season survey was 1,483. However, insect visitors to spineflower populations were very diverse at all three survey locations (Airport Mesa, Grapevine Mesa, and Entrada) and reflected the relative abundance of insects in the community (Jones et al. 2004). Seven orders of insects were observed visiting spineflower populations, including Hymenoptera (bees and ants), Coleoptera (beetles), Homoptera (cicadas), Diptera (flies), Hemiptera (true bugs), Mantodea (mantids), and Lepidoptera (moths). The California sagebrush scrub, chaparral, Great Basin scrub, alluvial scrub, coast live oak woodland, and California annual grassland within the preserve may continue to provide habitat for the above-described insects, especially flies and beetles.

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8.3 San Martinez Grande Preserve Area

The San Martinez Grande Preserve Area encompasses 34.41 acres dominated by burned California sagebrush scrub and California annual grassland communities on slopes below the primary north-/south-trending ridgeline on the west side of San Martinez Grande Canyon (*Figure 16*). This preserve area would conserve one of the two known occurrences of spineflower on Newhall Land property that are located north of the Santa Clara River.

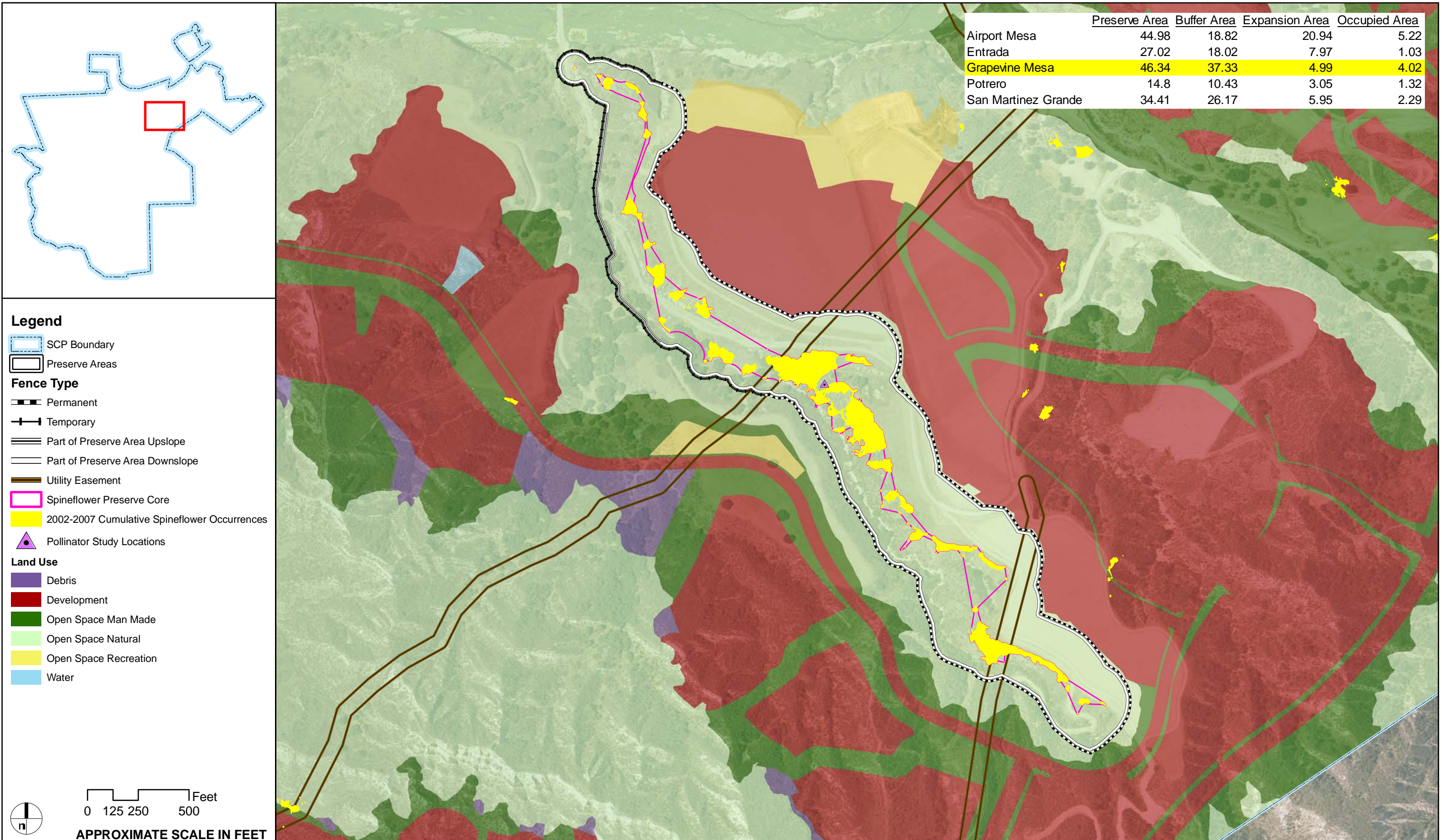
Ecological Indicators (Vegetation, Soils, Geology, Slope, Aspect, Elevation)

Vegetation communities and 2002 through 2007 cumulative spineflower occupied area within the San Martinez Grande Preserve Area are listed in *Table 16*. There are 2.29 acres of cumulative spineflower occupied area within the San Martinez Grande Preserve Area.

Table 16
Vegetation Communities and Land Covers within the
San Martinez Grande Preserve Area

Vegetation Type	Acres in Preserve	Cumulative 2002–2007 SFVS Occupied Acres
California Annual Grassland	17.29	0.75
Burned California Sagebrush Scrub	17.12	1.54
Disturbed Land	<0.01	0.00
Total	34.41	2.29

Prior to burning in the fall of 2003, vegetation consisted mostly of California annual grassland and California sagebrush scrub. Although approximately 95% of the preserve area burned, the area was observed to be quickly re-vegetating in the spring of 2004 with filaree (*Erodium* spp.), giant ryegrass (*Leymus condensatus*), and slender mariposa lily (*Calochortus clavatus* var. *gracilis*).



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 20

Spineflower Conservation Plan

Grapevine Mesa Preserve with Adjacent Land Use

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The San Martinez Grande Preserve Area soils are almost entirely Castaic-Balcom silty clay loams (30% to 50% slopes, eroded). Yolo loam (2% to 9% slopes), Hanford sandy loam (2% to 9% slopes), and Castaic-Balcom silty clay loams (50% to 60% slopes, eroded) also occur but make up less than 5% of this preserve area. Geology within the preserve area is limited to Pliocene marine deposits. A portion of the occupied habitat area is located on landslide debris.

Slopes within the preserve area are moderate to steep, with approximately 68% of the preserve area occurring on slopes between 10° and 30°. Approximately 94% of the spineflower in the preserve occurs on slopes ranging from 15° to 25°, and 97% occurs on slopes ranging from 10° to 30°. As the San Martinez Grande Preserve Area occurs on the east-facing side of a north-/south-trending ridgeline, the majority of slopes within the preserve have a southeastern or eastern aspect. Elevations range from 920 to 1,360 feet AMSL, with the majority of the preserve area occurring between elevations of 960 and 1,120 feet AMSL.

Adjacent Land Uses

Historically, areas in the vicinity of the San Martinez Grande Preserve Area have been used for agriculture and grazing. Currently, a single-family residence and a barn used for hay storage are located to the south of the preserve area on the west side of San Martinez Grande Canyon Road. The Santa Clara River and SR-126 are located to the south of the San Martinez Grande Preserve Area, and San Martinez Grande Canyon Road is located to the east. Undeveloped areas occur to the north and west of the preserve area.

Buffer Areas within San Martinez Grande Preserve Area

The preserve area would be surrounded on all sides by estate and low-density residential development, with the exception of a small sliver of Open Area on the east boundary between the spineflower preserve and the roadway. The buffer varies from 100 feet to more than 600 feet. Open space along San Martinez Grande Canyon is located approximately 100 feet to the east but not immediately next to the preserve (*Figure 21*). Where the preserve is downslope of adjacent land uses, the minimum distance between spineflower occurrences and the preserve boundary is 200 feet, with a maximum buffer of approximately 600 feet. Where the preserve is upslope of adjacent land uses (the east side of the preserve), the minimum distance between spineflower occurrences and the preserve boundary is 100 feet, with a maximum buffer of over 600 feet. In combination with these buffer widths, implementing the management measures described in *Section 9.0*, and developing new management measures as a part of the adaptive management process described in *Section 10.0*, the proposed preserves are designed to address various stressors and threats from adjacent changes in land use and contribute to achieving the biological goals and objectives of this plan.

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8.4 Potrero Preserve Area

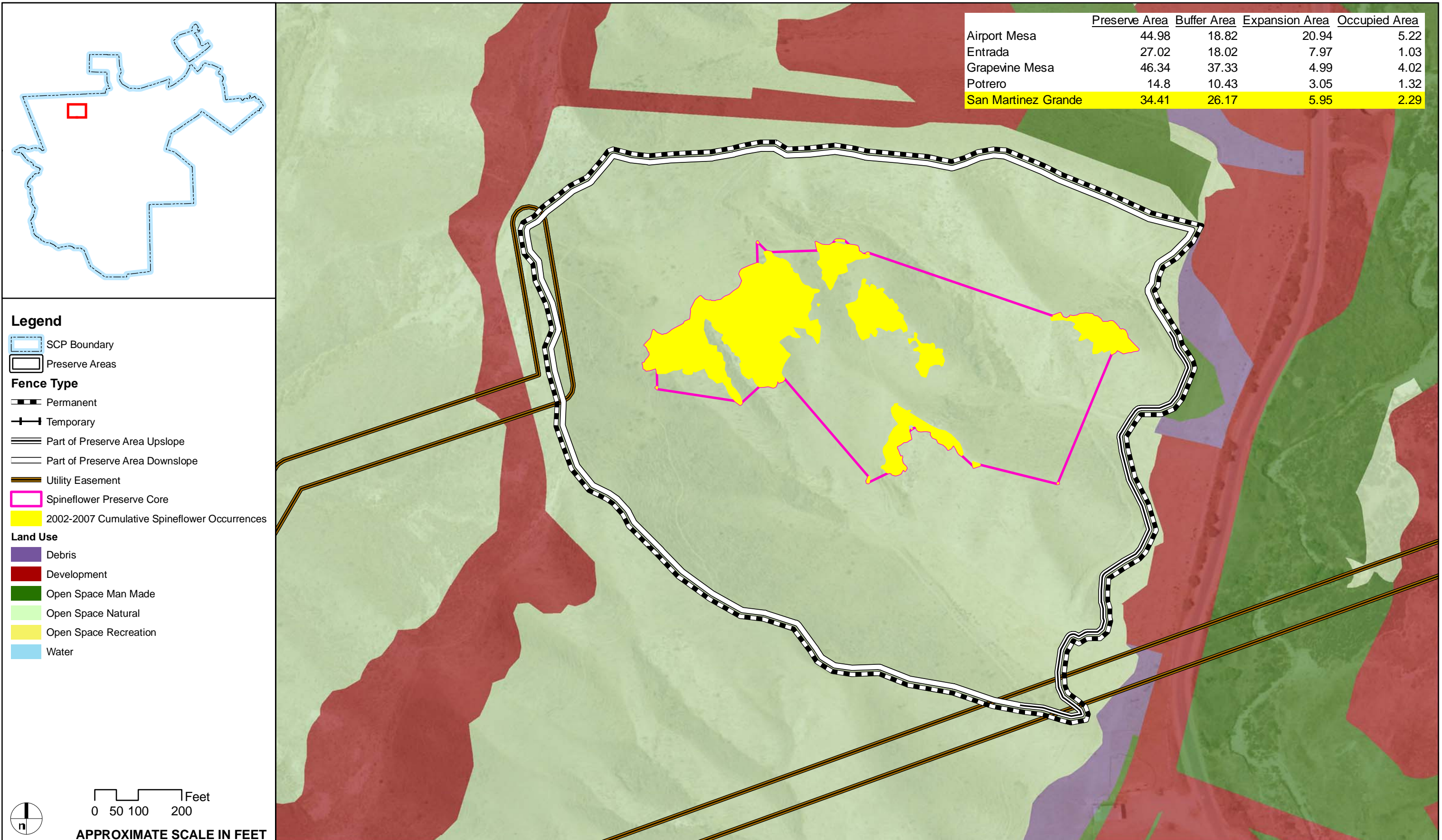
The Potrero Preserve Area is located at the mouth of Potrero Canyon in the southwestern portion of the Specific Plan area (*Figure 17*) and contains the westernmost population of spineflower within the Newhall Land property holdings in the project study area. The preserve area is 14.80 acres, dominated by California sagebrush scrub–purple sage, disturbed California sagebrush scrub–purple sage, and agricultural land and is located on the west side of Potrero Canyon near Windy Gap.

Ecological Indicators (Vegetation, Soils, Geology, Slope, Aspect, Elevation)

Vegetation communities and 2002 through 2007 cumulative spineflower occupied area within the Potrero Preserve Area are listed in *Table 17*. There are 1.32 acres of cumulative spineflower occupied area within the Potrero Preserve Area.

Table 17
Vegetation Communities and Land Covers within the Potrero Preserve Area

Vegetation Types	Acres in Preserve	Cumulative 2002–2007 SFVS Occupied Acres
Agriculture	2.87	0.00
California Annual Grassland	0.03	0.00
California Sagebrush Scrub	1.74	0.00
California Sagebrush Scrub–Artemisia	1.45	<0.01
California Sagebrush Scrub–Purple Sage	4.81	0.87
Disturbed California Sagebrush Scrub–Purple Sage	3.49	0.45
Disturbed Land	0.43	0.00
Total	14.80	1.32



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 21

Spineflower Conservation Plan

San Martinez Grande Preserve with Adjacent Land Use

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The Potrero Preserve Area soils are predominantly Castaic-Balcom silty clay loams (20% to 50% slopes, eroded). Terrace escarpments and Yolo loam (2% to 9% slopes) also occur within this preserve but account for only 14% and 2% of the preserve area, respectively. Geology within the Potrero Preserve Area is roughly two-thirds alluvium (mostly Holocene, some Pleistocene) Quaternary non-marine and marine and one-third Pliocene marine.

The majority of slopes in the Potrero Preserve Area are gentle to moderate, with approximately 79% of the slopes having an incline of less than 20°. Slopes in this preserve area are predominantly southeast-, east-, and south-facing. Elevations range from 820 to 1,080 feet AMSL, with the majority of the preserve area occurring between 1,000 and 1,080 feet AMSL.

Adjacent Land Uses

Current land uses within Potrero Canyon include ongoing agricultural and ranching operations. Immediately adjacent to the preserve area are actively farmed fields. Open space along the Santa Clara River corridor is located to the north of the preserve area, while additional undeveloped areas along the slopes and ridges of Potrero Canyon are in open space to the east of the preserve area.

Buffer Areas within Potrero Preserve Area

The Potrero Preserve Area is currently adjacent to open area on the north and east. To the south and west of the Potrero Preserve Area, planned land uses include low- and low-medium-density residential development; estate residential development would occur farther to the southwest (*Figure 22*). The Santa Clara River corridor and the mouth of Potrero Canyon would remain in open space to the north, while planned uses farther up the canyon include medium-density residential development and a community/neighborhood park. The preserve area is entirely upslope of adjacent lands. The minimum distance between the nearest spineflower occurrences and the preserve boundary is 80 feet, with a maximum buffer of 400 feet. However, the open space to the north and east extends several hundred feet beyond the preserve boundaries. In combination with these buffer widths, implementing the management measures described in *Section 9.0*, and developing new management measures as a part of the adaptive management process described in *Section 10.0*, the proposed preserves are designed to address various stressors and threats from adjacent changes in land use and contribute to achieving the biological goals and objectives of this plan.

California sagebrush scrub–purple sage, disturbed California sagebrush scrub–purple sage, and agricultural land are the primary vegetation communities within the Potrero Preserve Area. Disturbed California sagebrush scrub occurs when the primary constituents of a California

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sagebrush scrub community are present, but the overall cover of non-native vegetation exceeds 20%. The predominance of non-native species within California sagebrush scrub in the preserve area is likely a combination of disturbance from past grazing activities and proximity to ongoing agricultural activities in adjacent areas. Spineflower occurrences within the Potrero Preserve Area are located predominantly within disturbed and undisturbed California sagebrush scrub—purple sage; California sagebrush scrub—*Artemisia* also contains a small amount of spineflower. Spineflower has not been observed within the other vegetation communities—disturbed land, California sagebrush scrub, California annual grassland, and agricultural land—that occur within the preserve area. Acreages of vegetation communities and land covers within the Potrero Preserve Area are listed in *Table 17*. The disturbed land and disturbed California sagebrush scrub will be restored as described below, in accordance with *Section 9.2.10*.

8.5 Entrada Preserve Area

The Entrada Preserve Area includes the easternmost occurrence of spineflower on Newhall Land property holdings within the project study area (*Figure 18*). This preserve area encompasses 27.02 acres located in the southeastern corner of the Entrada planning area. The Old Road and I-5 are located to the east of the preserve area, and the existing Westridge golf course is located to the south of the preserve area.

Ecological Indicators (Vegetation, Soils, Geology, Slope, Aspect, Elevation)

Vegetation communities and 2002 through 2007 cumulative spineflower occupied area within the Entrada Preserve Area are listed in *Table 18*. There are 1.03 acres of cumulative spineflower occupied area within the Entrada Preserve Area.

Table 18
Vegetation Communities and Land Covers within the Entrada Preserve Area

Vegetation Types	Acres in Preserve	Cumulative 2002–2007 SFVS Occupied Acres
California Annual Grassland	23.07	0.89
California Sagebrush Scrub–California Buckwheat	1.96	0.11
Developed Land	0.31	0.00
Disturbed Land	1.68	0.02
Total	27.02	1.03

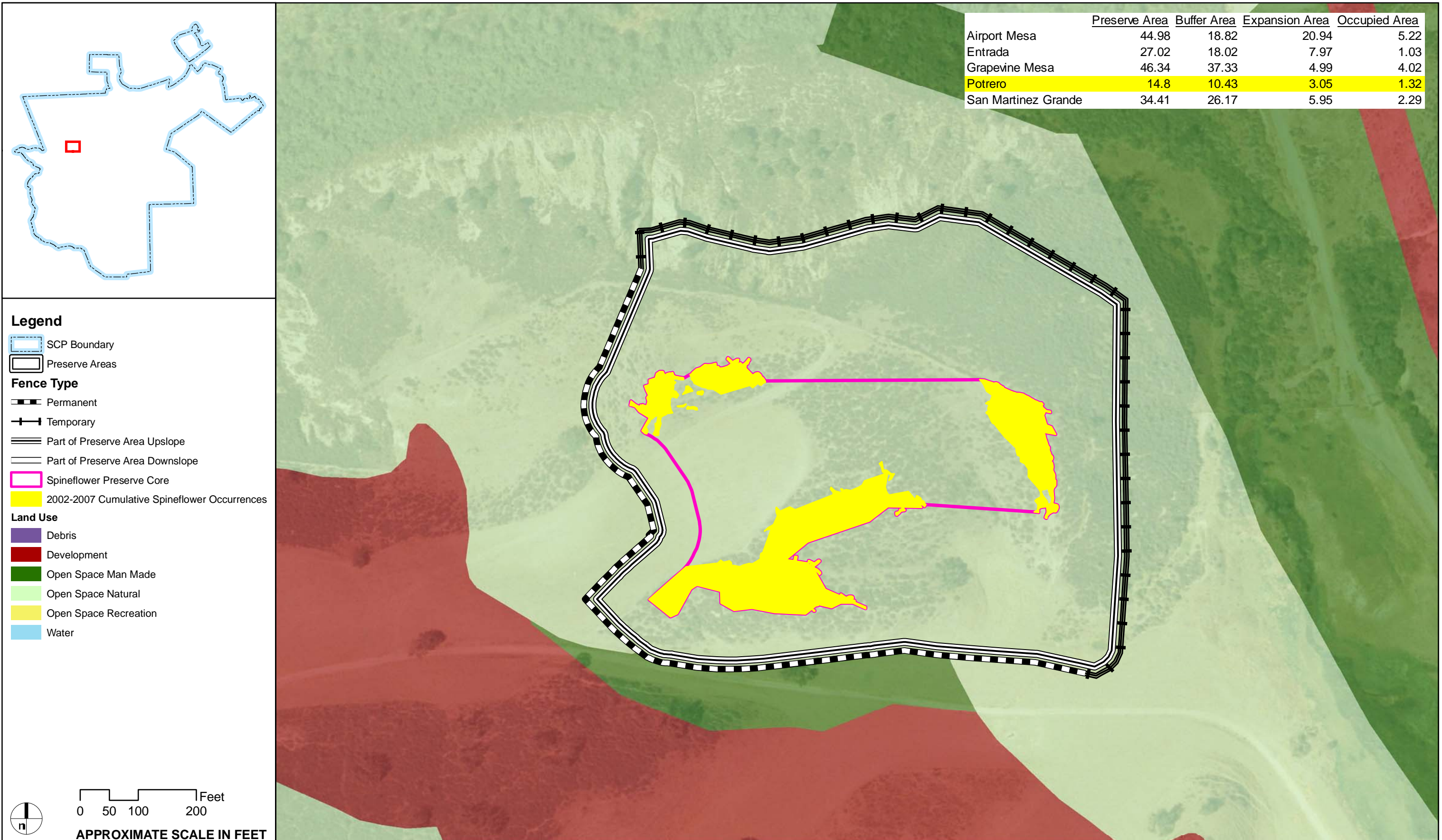


FIGURE 22

Spineflower Conservation Plan

Potrero Preserve with Adjacent Land Use

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The Entrada Preserve Area consists of approximately 23.07 acres of California annual grassland, while California sagebrush scrub–California buckwheat, developed land, and disturbed land account for approximately 1.96 acres, 0.31 acres, and 1.68 acres, respectively. The predominance of non-native species within California sagebrush scrub in the preserve area is likely a combination of disturbance from past grazing activities and ongoing physical disturbances in adjacent areas (e.g., maintenance of access roads). Acreages of vegetation communities and land covers within the Entrada Preserve Area are listed in *Table 18*. Approximately 5 acres within the preserve lie within an existing utility easement, of which approximately 0.25 acre (less than 25% of the total occupied area within the Entrada Preserve Area) is occupied by spineflower. The developed land and disturbed land will be restored, as described in accordance with *Section 9.2.10*.

The Entrada Preserve Area soils are predominantly Saugus loam (30% to 50% slopes). Approximately 5% of the preserve consists of Hanford sandy loam (2% to 9% slopes), Metz loam (2% to 5% slopes), and Yolo loam (0% to 2% slopes). Geology within the preserve area includes alluvium (mostly Holocene, some Pleistocene) Quaternary non-marine and marine.

Slopes are gentle to moderate, with none of the preserve area occurring on slopes greater than 15°. More than half of the preserve area includes northeast- and east-facing slopes, with flat areas and north-facing slopes accounting for approximately one-third of the preserve area. Elevations range from 1,080 to 1,240 feet AMSL, with the majority of the preserve area occurring between 1,160 and 1,200 feet AMSL.

Adjacent Land Uses

Existing land uses adjacent to the Entrada Preserve Area include a golf course to the south of the preserve area, The Old Road and I-5 to the east, undeveloped land to the west, and the Six Flags Magic Mountain Amusement Park to the north. In addition, Southern California Edison and Southern California Gas Company transmission lines run along the southeastern boundary inside of the proposed preserve area, and these companies actively maintain dirt roads and utility facilities through the preserve area.

Buffer Areas within Entrada Preserve Area

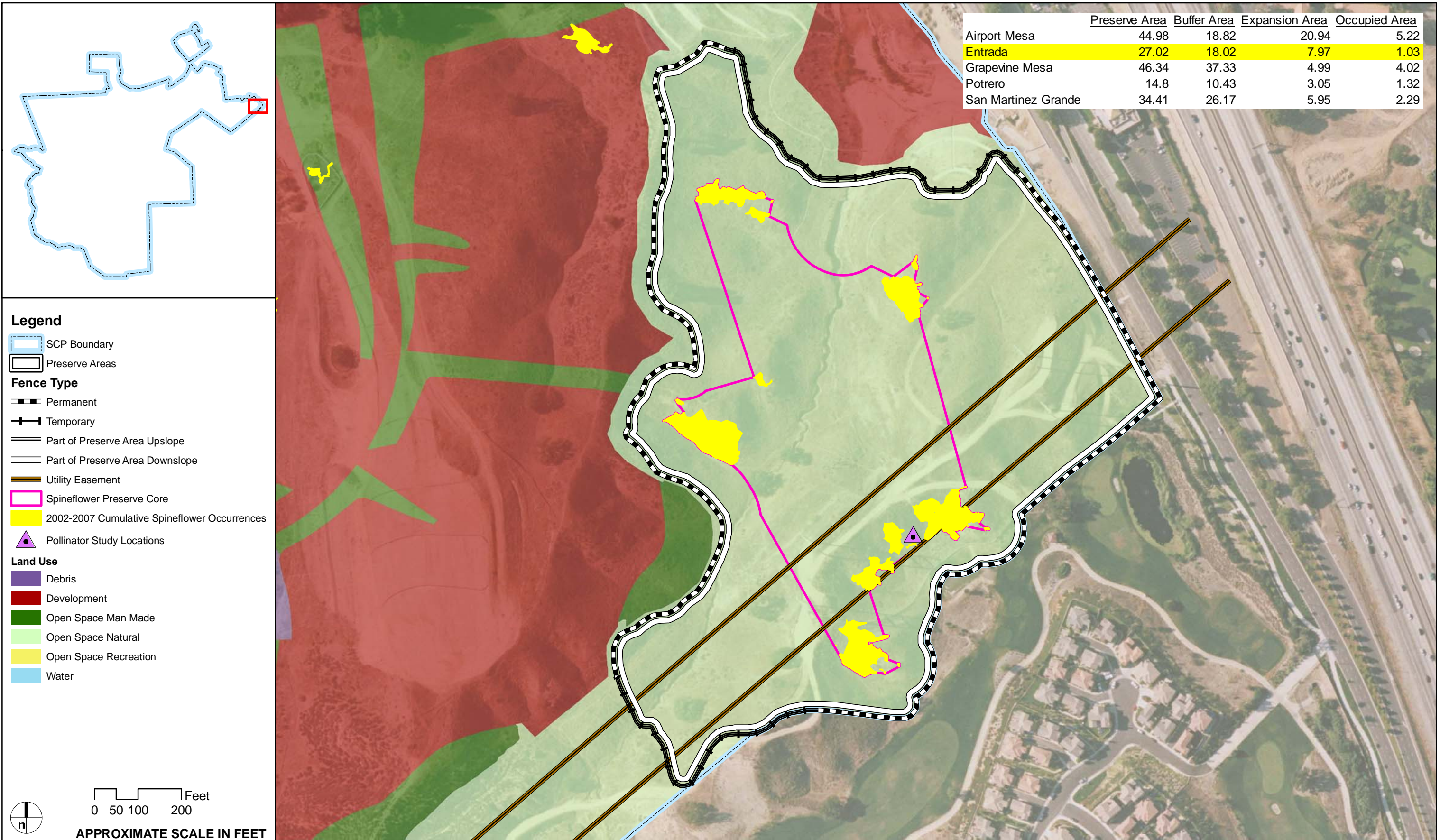
Planned land uses adjacent to the Entrada Preserve Area include residential uses to the west and open space to the north and southwest. Areas immediately to the south of the preserve area would remain as existing golf course, while the planned westward extension of Magic Mountain Parkway would be located several hundred feet to the north of the preserve area (*Figure 23*).

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The entire preserve area is located downslope of adjacent lands. Where adjacent to the proposed residential development, the buffer varies from 80 to 100 feet. Where adjacent to open space, the minimum buffer is 80 feet. Where adjacent to the existing golf course, the minimum distance between spineflower occurrences and the adjacent land use is 80 feet. In combination with these buffer widths, implementing the management measures described in *Section 9.0*, and developing new management measures as a part of the adaptive management process described in *Section 10.0*, the proposed preserves are designed to address various stressors and threats from adjacent changes in land use and contribute to achieving the biological goals and objectives of this plan.

Pollinators Present

In contrast to spineflower visitors observed at Airport Mesa and Grapevine Mesa, ants and beetles (rather than flies and beetles) were the dominant visitors to spineflower populations at the Entrada planning area during the mid-season survey (April 23–25, 2004). There were 2,488 visits during the mid-season survey. During the late-season survey (May 7–9, 2004), ants were more dominant among spineflower visitors, while bees, beetles, and flies occurred with relatively similar frequency among spineflower visitors during the late season. There were 1,009 visits during the late-season survey. However, insect visitors to spineflower populations were very diverse at all three survey locations (Airport Mesa, Grapevine Mesa, and Entrada) and reflected the relative abundance of insects in the community (Jones et al. 2004). Seven orders of insects were observed visiting spineflower populations, including Hymenoptera (bees and ants), Coleoptera (beetles), Homoptera (cicadas), Diptera (flies), Hemiptera (true bugs), Mantodea (mantids), and Lepidoptera (moths). The California sagebrush scrub and California annual grassland within the preserve may continue to provide habitat for the above-described insects, especially ants and beetles.



AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 23

Spineflower Conservation Plan

Entrada Preserve with Adjacent Land Use

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9.0 MANAGEMENT ACTIVITIES

The management activities outlined herein have been designed to minimize or eliminate various risk factors from adjacent changes in land use and contribute to achieving the biological goals and objectives of this Plan. This will be achieved in part by implementing the measures listed in *Sections 9.1 and 9.2*, all of which are based on the adopted Newhall Ranch Specific Plan EIR mitigation measures (County of Los Angeles 2003). *Section 9.1* identifies general management measures that are to be implemented for spineflower populations adjacent to agricultural areas and during project development and construction activities. *Section 9.2* describes general long-term management measures for permanent spineflower preserve areas, and *Section 9.3* describes specific management measures for each preserve.

A preserve manager will be contracted with and paid for by Newhall Land to perform environmental monitoring, oversee the spineflower preserve areas, and ensure that the monitoring and management activities outlined herein are carried out. The preserve manager will be a qualified botanist or land management entity/biological firm with qualified botanists on staff, approved by the County and CDFG (in accordance with Newhall Ranch Specific Plan EIR (County of Los Angeles 2003) Mitigation Measures SP-4.6-66 and SP-4.6-77). For the purposes of this report, a qualified botanist shall have a bachelor's degree or higher in biology, botany, or a similar field; be intimately familiar with spineflower ecology, local plant communities, invasive plant and animal control methods, and biological data collection and assessment; and have verifiable experience (a minimum of 3 years) performing similar types of environmental monitoring, reporting, and natural lands management. The preserve manager will be responsible for submitting the reports indicated herein, and will have the authority to stop work and to take reasonable steps to avoid the take of, and minimize the disturbance to, spineflower populations within the preserve(s).

9.1 General Management Measures

9.1.1 Management Measures for Existing Agricultural Areas

Agriculture is defined for purposes of this Plan as the practice of cultivating the soil, producing irrigated and non-irrigated crops, and raising livestock. Grazing has occurred and/or is occurring within the project study area. Spineflower populations located adjacent to and within existing agricultural areas will be protected and preserved, as outlined in this section, to help ensure a successful coexistence of agricultural activities and spineflower populations. *Figures 14 through 18* show where spineflower populations occur within and adjacent to agricultural areas. Potential threats to spineflower from adjacent agricultural activities include physical intrusion (i.e., damage by equipment and agricultural personnel), introduction of opportunistic pest plants

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(weeds), insect pests, irrigation runoff, fertilizer runoff, pesticide runoff or drift, farm animal grazing, trash accumulation, and artificially accelerated erosion processes. A decline in pollinators due to poorly performed insecticide spraying or trapping is possible, although there is limited data available to substantiate such effects at this time. Agricultural activities within the VCC planning area are expected to cease at the time of project construction, which is expected to occur within 10 years, while agricultural activities within the Specific Plan area and the Entrada area are expected to cease at the time of full build-out, which is expected to occur within 25 years. Regular and ongoing consultation must be maintained with the County and CDFG in connection with ongoing agricultural operations in order to avoid or minimize significant direct impacts to the spineflower. Additionally, 30 days advance written notice shall be provided to the County and CDFG of the proposed conversion of its ongoing rangeland operations on Newhall Ranch to more intensive agricultural uses. The purpose of the advance notice requirement is to allow the applicant, or its designee, to coordinate with the County and CDFG to avoid or minimize significant impacts to the spineflower prior to the applicant's proposed conversion of its ongoing rangeland operations to more intensive agricultural uses. This coordination component will be implemented by or through the County's Department of Regional Planning and/or the Regional Manager of CDFG. Implementation will consist of the County and/or CDFG conducting a site visit of the proposed conversion area(s) within the 30-day period, and making a determination of whether the proposed conversion area(s) would destroy or significantly impact spineflower population in or adjacent to those areas. If it is determined that the conversion area(s) do not destroy or significantly impact spineflower populations, then the County and/or CDFG will authorize such conversion activities in the proposed conversion area(s). However, if it is determined that the conversion area(s) may destroy or significantly impact spineflower populations, then the County and/or CDFG will issue a stop work order to the applicant, or its designee. If such an order is issued, the applicant, or its designee, shall not proceed with any conversion activities in the proposed conversion area(s). However, the applicant, or the designee, may take steps to relocate the proposed conversion activities to an alternate conversion area(s). In doing so, the applicant, or its designee, shall follow the same notice and coordination provisions identified above. This conversion shall not include ordinary pasture maintenance and renovation or dry land farming operations consistent with rangeland management.

Agricultural Management Practices

Certain limited uses related to agricultural activities have been authorized within existing agricultural areas within and adjacent to the spineflower preserves, provided that such uses do not significantly impair, interfere with, or adversely affect the conservation values of the property. This will be ensured in part by requiring Newhall Land representatives to meet with existing tenants to specifically educate them about these limitations on activities within existing

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agricultural areas within and adjacent to the spineflower preserves. The following limited uses may be allowed within existing agricultural areas within and adjacent to the spineflower preserves:

- Watering
- Use of fertilizers, pesticides, biocides, herbicides or other agricultural chemicals
- Weed abatement activities
- Fire protection activities, which will be limited to the areas on the Property that (i) are subject to existing agricultural activities, (ii) do not exceed the existing water uses to support those agricultural activities, and (iii) will not be expanded or intensified for any reason.

Newhall Land representatives will provide instruction to ensure that the use and application of fertilizers, etc., do not exceed the area subject to existing agricultural activities. Newhall Land's duty to prepare an erosion control plan for the agricultural operations shall specifically include provisions that preclude any excessive water runoff from the areas subject to existing agricultural activities.

Limiting the agricultural operations in these ways will ensure that spineflower populations are not adversely affected by ongoing agricultural activities.

9.1.2 Management Measures during Construction

Construction Plans and Specifications

Spineflower preserve temporary fencing shall be shown on construction plans and installed prior to initiating construction clearing and grubbing activities within 200 feet of spineflower preserves. The spineflower preserve manager or qualified biologist shall monitor fence installation. Clearing for fence installation shall be minimized to what is necessary to install the fence, and, where possible, shall leave the roots of native plants in place to allow regrowth. As necessary, native vegetation will be restored and weed management shall be performed in the preserve areas, buffer areas, and open space connections following fence installation to ensure that temporarily cleared native plant areas do not become weed dominated after installation. Revegetation seed mix shall be reviewed and approved by the County and CDFG. General project clearing and grubbing within 200 feet of the fence may commence upon verification by the spineflower preserve manager or the qualified biologist that protective fencing is in place and is adequate. Appropriate best management practices (BMPs) shall be installed at the edge of development manufactured slopes, when the spineflower preserve is within 200 feet and downslope of proposed development.

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Construction documents shall indicate that the grading contractor is responsible for protecting spineflower during construction work. The construction documents shall indicate that the contractor is responsible for informing all employees and subcontractors of the environmentally sensitive areas and the proper conduct of work when working near (e.g., within 100 feet of) these areas. The construction documents shall require a pre-construction meeting to perform an “environmental education session” with the grading contractor/contractor’s employees, subcontractors, and equipment operators, prior to commencing construction work within 100 feet of the spineflower preserves. The environmental education session shall be conducted by the spineflower preserve manager or qualified biologist and focus on informing workers of the location and sensitivity of the spineflower and the requirements to protect it. The construction documents shall indicate that the grading contractor shall be responsible for mitigating any impacts to spineflower due to the negligence of the grading contractor/contractor’s employees, subcontractors, or equipment operators. If accidental take occurs during construction, the loss shall be addressed in accordance with the section 2081 Permit issued by CDFG.

Construction plans shall include necessary design features and construction notes to demonstrate consistency of development in the vicinity of spineflower preserves with the Spineflower Conservation Plan. In addition to applicable erosion control plans and performance under South Coast Air Quality Management District (SCAQMD) Rule 403d dust control (SCAQMD 2005), the Project stormwater pollution prevention plan (SWPPP) shall include the following minimum BMPs. Together, the implementation of these requirements shall ensure that spineflower populations are protected during construction. At a minimum, the following measures/restrictions shall be incorporated into the SWPPP, and noted on construction plans where appropriate, to avoid impacting spineflower during construction:

- Avoid planting or seeding invasive species in development areas within 200 feet of spineflower preserve areas.
- Do not use erosion control devices that may contain weeds, such as hay bales, etc., within 100 feet of spineflower preserves.
- Do not windrow or stockpile soil along spineflower preserve boundaries.
- Do not locate staging areas, maintenance, or concrete washout areas adjacent to or upstream of spineflower preserves.
- Do not store toxic compounds, including fuel, oil, lubricants, paints, release agents, or any other construction materials that could damage spineflower if spilled near spineflower areas, upstream of spineflower preserves or along spineflower preserve boundaries.
- Provide location and details for any fencing for temporary and permanent access control along preserve boundaries.

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- Provide location and details for any dust control fencing along preserve boundaries.
- Provide location and details for any stormwater run-on controls/BMPs coming from development area to spineflower preserve.

The spineflower preserve manager, or qualified biologist, shall review construction plans and specifications, SWPPP, and, where appropriate, erosion control plans and implementation of SCAQMD Rule 403d dust control measures (SCAQMD 2005), prior to construction within 200 feet of spineflower preserves for compliance with the SCP and associated permits and project-related environmental documents.

Construction Fencing and Signage

Spineflower preserves shall be protected prior to clearing and during construction with temporary construction fencing and prohibitive signage. Openings shall be included in the fence when located within wildlife corridors and vegetation communities connectivity areas, to allow for the safe passage of wildlife. The spineflower preserve manager or qualified biologist shall indicate the location and width of each of these openings. The fencing shall be a three-strand non-barbed wire fence or bright orange U.V.-stabilized, polyethylene construction “snow” fencing, attached to metal t-posts that extend at least 4 feet above grade or equivalent. Protective fencing shall be maintained in good condition until completion of project construction. Where construction activities occur within 200 feet of a spineflower preserve, the spineflower preserve manager or qualified biologist shall review fencing weekly during construction monitoring visits and note any fencing that is in need of repair. Repairs shall be completed within 3 days of notification by the spineflower preserve manager or qualified biologist. The areas behind the temporary fencing shall not be used for the storage of any equipment, materials, construction debris, or anything associated with construction activities.

Dust Control

Development areas shall have dust control measures implemented and maintained to prevent dust from impacting vegetation within the spineflower preserve areas. Dust control shall be implemented during construction in compliance with SCAQMD Rule 403d (SCAQMD 2005). Where construction activities occur within 100 feet of a spineflower location, chemical dust suppression shall not be utilized. Where determined necessary by the spineflower preserve manager, a screening fence (i.e., a 6-foot-high chain link fence with green fabric up to a height of 5 feet) shall be installed to protect spineflower locations.

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Water Control and Erosion Control

Development areas shall have water-control measures implemented and maintained to minimize changes in surface water flows to the spineflower preserve areas and to avoid and minimize indirect impacts to the spineflower during construction. Watering of graded areas will be controlled to prevent discharge of construction water into the spineflower preserve areas and on ground sloping toward the preserve areas. Diversion ditches will be constructed to redirect stormwater flows from graded areas away from the spineflower preserve areas. To the extent practicable, grading of areas adjacent to the preserves will be limited to spring and summer months (May through September), when the probability of rainfall is lower. Both irrigation plans and a stormwater flow redirection plan will be prepared and submitted for approval to the County prior to the initiation of grading operations. Also prior to issuance of a grading permit, the Project applicant, or its designee, shall submit plans and specifications that ensure implementation of the following design measures, for approval to the County:

- During construction activities, drainage ditches, piping, or other approaches will be put in place to convey excess stormwater and other surface water flows away from the Newhall Ranch spineflower preserve(s) and connectivity/preserve design/buffers.
- Final grading and drainage design that do not change the current surface and subsurface hydrologic conditions within the spineflower preserve areas will be developed.

Construction Monitoring and Reporting

The spineflower preserve manager or qualified biologist shall perform weekly construction monitoring for all construction activities within 200 feet of spineflower preserve areas. The spineflower preserve manager or qualified biologist's construction monitoring tasks shall include reviewing and approving protective fencing, dust control measures, and erosion control devices before construction work begins, conducting a contractor education session at the pre-construction meeting, and reviewing the site weekly (minimum) during construction to ensure that the fencing, dust control and BMP measures are in place and functioning correctly, and that work is not directly or indirectly impacting spineflower plants. Each site visit shall be followed up with a summary monitoring report sent electronically to Newhall Land indicating the status of the site. Monthly monitoring reports, as needed, shall be submitted to the County. Monitoring reports shall include remedial recommendations when necessary.

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9.2 General Management Measures for Preserve Areas

9.2.1 Easements

To ensure long-term protection, the proposed spineflower preserve areas shall be offered to CDFG as a permanent conservation easement, within 1 year after issuance of the requested spineflower section 2081(b) Incidental Take Permit. The conservation easement shall be to the CDFG and contain appropriate funding and restrictions to help ensure that the spineflower preserve lands are protected in perpetuity.

9.2.2 Management Entities

The spineflower preserves shall be managed by Newhall Land and their preserve manager and/or natural lands management organization(s) (NLMO). Newhall Land shall submit a statement of qualifications for their proposed preserve manager(s)/NLMO(s) for approval by CDFG.

9.2.3 Landscape Planting Adjacent to Preserves

Plant palettes proposed for use on landscaped slopes, street medians, park sites, and other public landscaped and fuel modification zone areas within 100 feet shall be reviewed by the spineflower preserve manager or qualified biologist to ensure that the proposed landscape plants will not naturalize and cause maintenance or vegetation community degradation in the spineflower preserve and buffer areas. Container plants to be installed within public areas within 200 feet of the spineflower preserves shall be inspected by the spineflower preserve manager or qualified biologist for the presence of disease, weeds, and pests, including Argentine ants. Plants with pests, weeds, or diseases shall be rejected. In addition, landscape plants shall not be on the California Invasive Plant Council (Cal-IPC) California Invasive Plant Inventory (most recent version) or on the list of Invasive Ornamental Plants listed in *Appendix B* of this Plan. The current Cal-IPC list can be obtained from the Cal-IPC web site (<http://www.cal-ipc.org/ip/inventory/index.php>).² See *Appendix C* for a discussion of Argentine ants, associated threats, preserve design, and mitigation and management measures.

9.2.4 Access

In order to help ensure the preservation of the spineflower, as well as the other native plant communities and wildlife, all portions of the spineflower preserves shall be closed, with the

² At the time of this Plan's publication, the most recent information is contained in "New Weeds Added to Cal-IPC Inventory" (Cal-IPC 2007), an update to the *California Invasive Plant Inventory* (Cal-IPC 2006), which is an updated version of *Exotic Pest Plants of Greatest Ecological Concern in California* (CalEPPC 1999).

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exception of pre-identified existing dirt roads and utility easements. The pre-identified existing dirt roads and utility easement access roads shall function as access for the spineflower preserve manager, spineflower preserve maintenance personnel, utility personnel, and emergency services vehicles (e.g., police, fire, and medical). The dirt roads shall be gated and locked at the outside edges of the buffer zone. Signs discouraging unauthorized access shall be posted. The only persons or entities issued gate keys shall be the spineflower preserve manager and their employees, easement holding utility companies, emergency services, Newhall Land or its designee, and CDFG.

9.2.5 Fencing

Fencing shall be installed along the outside edge of the spineflower preserve and buffer areas adjacent to proposed developments, parks, golf courses, or other “active land uses” to prevent unauthorized access to the preserve areas. Specific areas that are adequately protected by steep terrain (1.5:1 or steeper) and/or dense vegetation may not require fencing but would require signage. The determination of the need for fencing in these areas will be subject to the approval of the County or qualified biologist. If monitoring determines that slope and/or vegetation is not effective at deterring unauthorized access, the preserve manager or qualified biologist may require that additional fencing be installed. Fencing is not required in areas bordered by large parcels of dense native vegetation (subject to monitoring by the parcel manager and/or CDFG), conserved natural open space areas, or the Santa Clara River riparian corridor, as installing fencing in these areas would be unnecessary and damaging to existing vegetation and wildlife corridors.

Fencing must extend a minimum of 4 feet above grade and include wood-doweled split rail fencing, exterior-grade heavy-duty vinyl three-railed fencing, three-strand non-barbed wire (subject to limitations and electrical grounding requirements near power lines), or similar. Fencing, installed adjacent to native habitat and natural open space areas, will allow for the passage of animals.

9.2.6 Signage

Outdoor, all-weather signs measuring approximately 12 by 16 inches shall be posted on all spineflower preserve access gates and along spineflower preserve fencing at approximately 800 feet on center, except adjacent to road crossings, where signs will be posted. The placement will take topography into account, emphasizing placement on ridgelines where they will be visible to emergency fire personnel and others. Signs shall state in English and Spanish that the area is a biological preserve that hosts a state-listed endangered and federal candidate plant species and that trespassing is prohibited (in accordance with Newhall Ranch Specific Plan EIR Mitigation

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Measure SP-4.6-68). Signs shall indicate that fuel modification and management work is not allowed within the spineflower preserve or buffer areas. Signage at trailheads shall describe the spineflower preserve, its purpose, and the applicable rules of conduct within the spineflower preserve. The signage shall state that people not abiding by these rules or who damage the protected species will be subject to prosecution, including fines and/or imprisonment. All signage shall include emergency contact information and shall be reviewed and approved by the spineflower preserve manager or qualified biologist.

9.2.7 Water Control

Project-specific design measures will be implemented in order to minimize changes in surface water flows to the spineflower preserve areas. Roadways will be constructed with slopes that convey water flows within the roadway easements and away from spineflower preserve areas. French drains will be installed along the edge of any roadways and fill slopes that drain toward the preserve areas. Where manufactured slopes drain toward the preserve(s), a temporary irrigation system would be installed to the satisfaction of the County in order to establish the vegetation on the slope area(s). This system shall continue only until the slope vegetation is established and self sustaining. Underground utilities, other than existing buried utilities (e.g., The Gas Company), will not be located within or through the preserve areas. Drainage pipes installed within the preserve areas away from spineflower populations to convey surface or subsurface water away from the populations will be aligned to avoid the preserve areas to the maximum extent practicable. Fencing or other structural-type barriers that will be installed to reduce intrusion of people or domestic animals into the preserve areas shall incorporate footing designs that minimize moisture collection. Access roads for utilities located within preserve areas shall be maintained, and road runoff shall be directed away from spineflower areas or otherwise managed to prevent erosion of occupied spineflower areas.

Storm Drains

Storm drain outfalls from proposed development areas shall only be installed within spineflower preserve areas where necessary to retain pre-construction hydrologic conditions within the spineflower preserves, sustain existing riparian and wetland vegetation communities, and/or allow for the restoration of currently disturbed areas to native riparian/alluvial vegetation community. When located in a spineflower preserve area, storm drains must meet the following criteria:

- Storm drains must not impact spineflower either directly or indirectly.
- Storm drains may only daylight at the bottom of slopes within spineflower preserve areas.

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- Under no circumstances shall storm drains daylight onto steeply sloped areas or other areas that would cause erosion.

Any surface water entering a spineflower preserve area from development areas is required to pass through BMP measures, which will be described in the SWPPP. Storm drain outlets must contain adequate energy dissipaters to prevent downstream erosion and stream channel down-cutting. Additionally, storm drain outlets must be designed based on pre- and post-construction hydrologic studies (in accordance with Newhall Ranch Specific Plan EIR Mitigation Measure SP-4.6-69). Storm drains and permanent structural BMPs shall be designed by a licensed civil engineer. Required BMPs, where applicable, shall be incorporated into the facility design and shall be subject to approval by the spineflower manager or qualified biologist. Long-term maintenance of storm drain BMPs will be the responsibility of the designated maintenance entity.

9.2.8 Fuel Modification

Limited fuel modification activities within the spineflower preserves would be restricted to selective thinning with hand tools, to allow the maximum preservation of spineflower populations, and to the extent necessary to protect utility structures within or adjacent to preserve areas. No other fuel modification or clearance activities shall be allowed in the spineflower preserve areas. All fuel modification zones associated with the adjacent development shall be located outside of proposed spineflower preserves. Controlled burning may be allowed in the future within the Newhall Ranch preserve areas and buffers, provided that it is based upon a burn plan approved by the County Fire Department and CDFG. Annual maintenance of adjacent fuel modification zones, such as the removal of undesirable non-native plants and other activities that ensure the long-term survival of spineflower, will be the responsibility of the preserve manager. The homeowners' association (HOA) or utility company, as applicable, will be responsible for any fuel modification that occurs in designated fuel modification zones outside the spineflower preserves.

9.2.9 Argentine Ants

Argentine ants are a high priority for management within and adjacent to the preserves, as invasions by Argentine ants have the potential to impact the demographic performance of spineflower populations. Argentine ants are likely to displace native ants and other arthropod species that may provide important ecological functions for spineflower, including pollination and seed dispersal, as well as for other native plant species (Holway et al. 2002). Argentine ants are not currently known to occur within the proposed preserve areas (Jones et al. 2004), but are known to occur at Middle Canyon Spring at the mouth of Middle Canyon. Argentine ants, which

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are attracted to moist habitats, frequently invade disturbed areas and, sometimes, undisturbed areas adjacent to urban developments, and it is assumed that they will occur within development areas and Open Areas adjacent to the preserves in the future.

Invasion of native areas by Argentine ants has been shown to reduce or displace native ants and other arthropods, which could function as pollinators and seed dispersers. The extent to which this may directly impact the spineflower has not been studied directly and remains uncertain, but the impact is assumed to be adverse. Studies by Jones et al. (2004) found reduced seed set in spineflower where pollinators were excluded (i.e., through self-pollination), suggesting that open, uninhibited pollination results in the production of considerably more seed. Further discussion on Argentine ants and their potential biological effects is provided in *Appendix C*.

The goal of management is to preclude the invasion of Argentine ants into the preserves and their associated buffers. Controls will be implemented using an Integrated Pest Management (IPM) approach and will likely require a combination of methods. The primary management strategy focuses on prevention by maintaining an inhospitable habitat condition in the buffer between the development edge and the preserve. Argentine ants are sensitive to moisture gradients and are more likely to invade mesic areas and avoid xeric areas. Menke and Holway (2006) noted that the abundance of Argentine ants changes dramatically across soil moisture gradients. They suggest that interception and diversion of urban runoff from naturally xeric areas could restrict invasions by Argentine ants and that “even small reductions in urban runoff may act to limit *L. humile* in areas that are otherwise too dry” (Menke and Holway 2006, p. 374). Thus, a “dry zone” between urban and natural habitats, where there is naturally little moisture, may act as a barrier for the ants and inhibit them from invading the natural areas.

The following project design features and management measures will be implemented to prevent the invasion of Argentine ants in the preserves:

1. Providing “dry zones” between urban development and spineflower populations, where typical soil moistures are maintained at levels below about 10% soil saturation, which will deter the establishment of nesting colonies of ants; and providing dry zone buffers of sufficient width to reduce the potential for Argentine ant activity within core habitat areas
2. Ensuring that landscape container plants installed within 200 feet of preserves are ant-free, to reduce the chance of colonies establishing in areas close to the preserves
3. Maintaining natural hydrologic conditions in the preserves through the project design features for roadways, French drains, irrigation systems, underground utilities,

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drainage pipes and fencing, storm drains, and any other BMP measures that apply to surface water entering the preserve areas

4. Using drought-resistant plants in fuel modification zones and minimizing irrigation to the extent feasible.

Although the project design features described above will help control Argentine ant invasion into the spineflower preserves, there is still a potential for invasions to occur where typical soil moisture increases above about 10% saturation. Invasions by Argentine ants, if they occur, are reversible under appropriate conditions. Menke and Holway (2006) demonstrated that Argentine ant abundance systematically declined in experimentally irrigated areas over a few months once the irrigation was terminated. If soil moisture can be restored to 10% saturation or less, Argentine ant abundances will decrease. In areas where Argentine ant invasions have occurred, soil moisture will be required to be reduced to 10% saturation or less.

The threat of Argentine ants and the associated control measures are discussed in more detail in *Appendix C*. Monitoring will be implemented to evaluate the effectiveness of the proposed project design features and management activities. Monitoring activities related to management of Argentine ants is described in *Section 11.5*.

9.2.10 Restoration Activities within Preserve Areas

Disturbed portions (i.e., agricultural lands, disturbed lands, and developed lands) of the preserves will be restored through revegetation with native plant communities. In summary, areas that have greater than 30% absolute cover by weeds (not including annual grasses) will be restored to have at least 70% absolute cover by native species. In addition, Cal-IPC List A and B plants that are present within the preserve will be controlled. Restoration and enhancement efforts within the preserve areas shall be informed by the results of the Spineflower Habitat Characterization Study to be conducted. In addition, where suitable as an alternative to fuel modification, clear zones around utility structures may be revegetated with low-growing ground cover native plant communities. Spineflower shall not be negatively impacted directly or indirectly by restoration or enhancement. Therefore, proposed restoration and enhancement projects shall be reviewed by CDFG and will not be implemented without CDFG approval.

Restoration and enhancement projects shall utilize only locally indigenous plants appropriate to the habitat being restored or enhanced. Plants and seed shall be from the local region and from similar elevations; that is, no more than 20 miles from the site and no more than 300 feet elevational difference. Seed shall be tested prior to delivery to ensure it is free of problematic weeds, pests, and disease. Restoration efforts will focus on the use of seed and only include container plants when seed is not available or able to be collected in a reasonable amount of time

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or if germination of a particular species from seed is documented as difficult and/or typically requires specific conditions, such as fire, scarification, or acidification.

Habitat restoration sites may be temporarily irrigated to establish native plants and seed. If irrigation is utilized, it shall not alter pre-existing hydrologic conditions within the preserve areas and shall be programmed to eliminate runoff. In addition, the system shall be used to establish plants and be scheduled to acclimate them to natural rainfall cycles. Temporary irrigation systems, which will be subject to pre-approval by the CDFG, shall be removed after a maximum of 5 years. Temporary erosion-control devices may be used during restoration and enhancement work to prevent rills and gullies from forming and associated sedimentation and/or stream turbidity. Erosion-control devices may include native, locally indigenous hydroseed mix, fabric silt fences, biodegradable burlap sand bags, or other pre-approved devices. Hay and straw bales, wattles, and other devices that often host weed seeds shall be avoided. Erosion-control devices shall be removed once the site is adequately vegetated.

Habitat restoration and enhancement plans (including restoration plans) for areas within the preserves shall be prepared at the direction of the preserve manager by a qualified biologist and submitted to the County and CDFG for approval prior to implementation. Restoration and enhancement plans shall include the following information at a minimum:

1. Maps showing the exact location and acreage of the site
2. A description of the restoration project and proposed methodology
3. Project proponent
4. Name of biologist that prepared the plan
5. Map and description of the existing habitat, adjacent habitat, and proposed habitat
6. List of proposed plant and seed species
7. Plant origins
8. Container sizes
9. Species composition
10. Weed control
11. Fertilizers/nutrient immobilization
12. Installation schedule
13. Proposed monitoring and maintenance schedule and activities
14. Performance standards.

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Seeds shall meet the requirements indicated herein and container plants shall be inspected by the preserve manager for weeds, disease, and the presence of pests, including Argentine ants, prior to delivery to the site and during delivery. Plants with pests, weeds, or diseases shall be rejected and immediately removed from the site. Mycorrhizal inoculation shall be used in areas where the soil is damaged.

Performance Standards for Restoration Areas

- Percent cover by native species shall meet the following absolute cover criteria following restoration work:
 - Up to 30% herbaceous (less than 1 meter in height) cover and up to 50% bare ground by the end of year 1
 - Up to 30% herbaceous, 10% shrub (greater than or equal to 1 meter in height) cover, and up to 40% bare ground by the end of year 2
 - Up to 30% herbaceous, 20% shrub cover, and up to 30% bare ground by the end of year 3
 - Up to 30% herbaceous, 30% shrub cover, and up to 20% bare ground by the end of year 4
 - Up to 30% herbaceous, 40% shrub cover, and up to 10% bare ground by the end of year 5.
- Non-native annual grass cover shall be kept below 10% cover.
- Non-native vegetation (excluding annual grasses) must be kept below 10% cover.
- Thatch shall be kept below 10% cover.
- Each preserve shall be free of plant species on Cal-IPC List A and B, non-native plants listed by the U.S. Department of Agriculture (USDA) as noxious weeds, and any other highly invasive species that pose a direct threat to spineflower, as indicated by the preserve manager.

9.2.11 Management Response to Wildfire/Geologic Events

In the event that a preserve or a portion of a preserve burns in a wildfire or sustains mass movements (e.g., landslides, slope sloughing, or other geologic events), the preserve manager and Newhall Land shall promptly review the site and determine what action, if any, should be taken. The primary anticipated post-fire preserve management activity involves monitoring the site and controlling annual weeds that may invade burned areas following a fire event, especially when such weeds that were not previously present or not present in similar densities present an

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imminent threat to the survival of spineflower populations. If fire-control lines or other forms of bulldozer damage occur in the preserves, these areas would be repaired and revegetated to pre-burn conditions. An Emergency Fire Response Plan will be prepared prior to the establishment of the preserves and approved by CDFG and Los Angeles County Fire Department.

Management responses to wildlife and/or geologic events will be informed by the results of adaptive management activities related to non-native plants, fire suppression, fire exclusion, and the disruption of natural soil-disturbance regime. In general, however, a burned site will be left to recover naturally from wildfire or geologic events. The California sagebrush scrub habitat types within the preserve are well adapted to recover from wildfires, unless the fire frequency is artificially increased (Holland 1986). Therefore, burned areas shall not be seeded or sprayed with soil stabilizer, straw, or hay. The latter two items are usually contaminated with various problematic weed seeds and often include noxious weed seed. It should be noted that several species of weeds not considered to be noxious by the USDA may be considered noxious weeds in natural preserve areas and, if introduced, would be very expensive to control/eradicate. In addition, active post-fire revegetation and soil stabilization efforts interfere with natural post-fire successional species and vegetation development stages that should be allowed to occur for the habitat to properly recover and regenerate.

Erosion (including ash distribution) is an expected and naturally occurring event following a wildfire and is part of the ecological cycle. Therefore, erosion-control devices, including seeding, straw wattles, and soil tackifiers, should be avoided following a fire event for the aforementioned reasons. An exception to this would be fires that occur at a higher-than-average frequency, which may artificially accelerate erosion processes. This situation is to be evaluated by the preserve manager. Imminent and unavoidable threats to human health, safety, and welfare represent another exception to this passive management approach in post-fire conditions. Fire frequencies have a tendency to increase at the urban-wildland interface. If the preserves are subject to a greater-than-natural fire frequency, the guidelines outlined herein shall be followed to help ensure that the preserves recover to a natural state.

When deemed necessary for the aforementioned reason (i.e., fires that occur at a higher-than-average frequency that may artificially accelerate erosion processes) the preferred erosion-control devices to be used include fabric silt fencing, gravel or sand bags (made of biodegradable burlap), straw wattles certified as weed free (not just free of “USDA noxious weeds” but free of all weeds), and judicious seeding with locally indigenous native species free of weed seed. Seed shall be tested by a certified laboratory, and all weed seeds identified by species. The quantity of weed seed shall be indicated in units of quantity of weed seed per pound of native seed and sorted by size and weight to eliminate weed seeds determined to be noxious or problematic by the preserve manager. Items that often include problematic noxious or invasive weed seeds

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should be avoided. These include hay and straw bales; non-certified wattles; and non-native, non-locally indigenous seed species.

The same passive successional regeneration holds true for mass-movement, landslide, or slope-sloughing types of events. Some plant species, quite possibly including spineflower, have evolved and/or adapted to recruit into these types of geologically disturbed areas.

9.3 Specific Management Activities for Each Preserve

The specific management activities discussed in this section are designed to help achieve the goals and objectives identified in *Section 3.0*. *Table 19* summarizes the proposed specific management activities for each preserve area and lists the specific biological goals and objectives being addressed through management.

Table 19
Specific Management Activities and Related Biological Goals and Objectives

Management Activity	Preserves	Objectives
Converting existing disturbed areas (e.g., agricultural areas) to California sagebrush scrub	Airport Mesa Grapevine Mesa Potrero	Population: 1.1, 1.3 Community: 2.1, 2.2, 2.3 Ecosystem: 3.1
Reducing or preventing an increase in cover of non-native plants within existing native vegetation communities	Airport Mesa San Martinez Grande Entrada	Population: 1.1, 1.2, 1.3 Community: 2.1, 2.2, 2.3 Ecosystem: 3.1, 3.2
Management of non-native annual grass cover and thatch buildup	Airport Mesa San Martinez Grande Potrero	Population: 1.1, 1.2, 1.3, 1.5 Community: 2.1, 2.2, 2.3
Precluding invasion of Argentine ants from preserve and preserve buffers	Airport Mesa Grapevine Mesa San Martinez Grande Potrero Entrada	Population: 1.3 Community: 2.3
Maintaining or enhancing conditions for pollination, seed dispersal, and migration	Airport Mesa	Population: 1.3 Community: 2.2, 2.3 Ecosystem: 3.1
Preparing an Emergency Fire Response Plan	Airport Mesa Grapevine Mesa San Martinez Grande Potrero Entrada	Population: 1.3
Fencing, signage, access restrictions, easements, and other protections	Airport Mesa Grapevine Mesa San Martinez Grande	Population: 1.3

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Table 19 (Continued)

Management Activity	Preserves	Objectives
	Potrero Entrada	
Management and monitoring of the irrigation system	Airport Mesa	Population: 1.3 Community: 2.1, 2.2, 2.3 Ecosystem: 3.2
Installing storm drain outlets to retain existing hydrologic conditions and vegetation	Grapevine Mesa San Martinez Grande Entrada	Population: 1.3 Ecosystem: 3.2
Installing culvert to retain existing hydrologic conditions	Airport Mesa	Population: 1.3 Ecosystem: 3.2

9.3.1 Management of Airport Mesa Preserve Area

The specific management strategy for the Airport Mesa Preserve Area focuses on repair and restoration of previously disturbed areas within the preserve, management of non-native plants, and, in particular, management of non-native annual grass cover and thatch buildup. Much of the preserve supports habitats with considerable annual grass cover. If thatch levels build up over time and/or annual grass density and cover exceed the spineflower's tolerances, which have yet to be clearly defined, this could pose a threat to spineflower occurrence. The Spineflower Habitat Characterization Study is intended to quantify the habitat requirements of the spineflower and, among other things, will provide pertinent information about the tolerance of spineflower with respect to cover of annual grasses and thatch. Low levels of shrub cover on previously grubbed and/or terraced slopes and farm fields also may adversely affect pollinator habitat requirements. Therefore, management will also include enhancement in these areas by planting appropriate native species and restoring damaged soils. Proximity to adjacent development also is a threat to the preserve and will create management challenges. To help reduce threats from the adjacent development, fencing, signage, access restrictions, easements, and other protections shall be implemented as outlined in *Sections 9.2.1 through 9.2.10*.

To the west of the preserve, relatively small manufactured slopes and a fuel modification zone will lead up to Street GG, a mixed-use/commercial development area and water quality control basin. Immediately west of Street GG and the development area (off site), there is a large contiguous open space that leads to the Santa Clara River corridor. There is a culvert proposed to run below Street GG that will allow drainage from the preserve to continue west, which will help convey runoff and retain the existing hydrologic conditions within and downstream of the preserve. The culvert under Street GG will be sized to accommodate project storm flows.

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The southern, eastern, and northern boundaries of the preserve will be bordered by fuel modification zones leading down from development areas, as shown in *Figure 19*. Some habitat upslope from the preserved spineflower populations will therefore be removed and modified by development. In addition to the management measures described above, the fuel modification zones will be planted with native and non-native, non-invasive, drought-tolerant plant species that do not naturalize, as indicated in *Section 9.2.3*. These plants require only limited water, which, when combined with the brow ditches and swales, and the careful managing and monitoring of the irrigation system and program scheduling, will prevent irrigation runoff from entering into the preserves.

All plants and seeding proposed for use on manufactured slopes and other landscaped areas and fuel modification zones adjacent to the preserve areas are required to be in conformance with *Section 9.2.3*.

Non-native plants in the preserve will be managed in accordance with a Preserve System Non-Native Management Plan to be developed as part of the adaptive management program described in *Section 10.0*.

9.3.2 Management of Grapevine Mesa Preserve Area

The specific management strategy for the Grapevine Mesa Preserve Area focuses on restoring the previously cultivated farm field on the mesa top, while managing weeds and annual grasses within the adjacent natural habitat areas. Some habitat upslope from the preserved spineflower populations will therefore be removed and modified by development. This may threaten the downslope habitats by altering runoff, sheet flow, and sedimentation. Fencing, signage, access restrictions, easements, and other preserve protections will be implemented as outlined in *Sections 9.2.1 through 9.2.10* to address impacts associated with development of the surrounding western, eastern, and southern boundaries, as shown in *Figure 20*.

The northern boundary is adjacent to the Santa Clara River and associated dense riparian vegetation that protects this area and precludes the need for fencing and signage at this location.

The eastern boundary will be adjacent to a development area and associated fuel modification zone. To the southwest of the preserve, an open space band will separate the preserve from a proposed development area and associated fuel modification zone. The area located south and west of the preserve contains sizeable portions of the preserve's existing watershed area and, therefore, storm drain outlets will be needed to daylight in the preserve canyon bottom area in order to sustain the current hydrology and vegetation in that location. This will be assessed by the civil engineers and qualified biologist/preserve manager as the development plans become

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more definitive and will require approval by CDFG through the permitting processes. Any proposed storm drains to be daylighted in the preserve shall be designed in conformance with *Section 9.2.7*. Beyond the northwestern boundaries of the preserve, slopes will lead down to open space area.

The existing dirt road located within the preserve will function as a preserve maintenance access road and may be incorporated into a pedestrian-only trail system. Signage will be installed along the trail, as indicated in *Section 9.2.6*. Proposed trail locations will be subject to the review and approval of the County and CDFG.

Agricultural areas within the preserve will be restored to California sagebrush scrub, and restoration plans will address suppression of the weed seed bank, repair of soil micro-organisms, sequestering of nutrients, and other methods to achieve the restoration goals.

Non-native plants in the preserve will be managed in accordance with a Preserve System Non-Native Management Plan to be developed as part of the adaptive management program described in *Section 10.0*.

9.3.3 Management of San Martinez Grande Preserve Area

The specific management strategy for the San Martinez Grande Preserve Area focuses on management of annual grass cover, density and thatch, and weed management. Extensive areas dominated by annual grasses may be a threat if thatch levels buildup, and bare areas are reduced in extent. The adjacent development area is a significant threat with respect to edge effects and successfully managing and protecting the preserve. Most of the preserve perimeter will be downslope of development (*Figure 21*). Fencing, signage, access restrictions, easements, and other preserve protections will be implemented as outlined in *Sections 9.2.1* through *9.2.10*.

This preserve is surrounded by estate and low-density development and fuel modification zones. The area located north, south, and west of the preserve contains sizeable portions of the preserve's existing watershed area, and, therefore, storm drain outlets will be needed to daylight in the preserve canyon bottom area in order to sustain the current hydrology and vegetation in that location. This will be assessed by the civil engineers and qualified biologist/preserve manager as the development plans become more definitive and will require approval by CDFG through the permitting processes. Any proposed storm drains to be daylighted in the preserve shall be designed in conformance with *Section 9.2.7*.

Non-native plants in the preserve will be managed in accordance with a Preserve System Non-Native Management Plan to be developed as part of the adaptive management program described in *Section 10.0*.

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The preserve will be closed to the public. The preserve will be maintained and monitored as outlined in *Section 11.0*.

9.3.4 Management of Potrero Preserve Area

The specific management strategy for the Potrero Preserve Area focuses on restoring habitat damaged by past disking; performing weed management; and managing annual grass cover, density, and thatch. Development would occur along the western and southern boundaries, as shown on *Figure 22*. Preserve boundaries located adjacent to proposed development areas will have fencing, signage, access restrictions, easements, and other protections outlined in *Sections 9.2.1 through 9.2.10*.

The preserve is surrounded by open space to the east and north. The entire preserve is located at elevations above the development area, so the existing hydrologic regime within the preserve should be unchanged, and runoff from the development area will not reach the preserve.

Fencing and signage are not anticipated to be necessary along the northern and eastern preserve boundaries, due to dense vegetation and steep elevations. Fencing and signage will be installed along the western and southern boundaries, as outlined in *Sections 9.2.5 and 9.2.6*. There are no public access trails proposed within this preserve. The existing dirt road will be retained to function as a preserve maintenance access road only.

Non-native plants in the preserve will be managed in accordance with a Preserve System Non-Native Management Plan to be developed as part of the adaptive management program described in *Section 10.0*.

9.3.5 Management of Entrada Preserve Area

The specific management strategy for the Entrada Preserve Area addresses the open space area along the northern and southwestern boundaries, the proposed development area along the western boundary, the existing golf course located along the southern boundary, and Magic Mountain Parkway located along portions of the eastern boundary, as shown on *Figure 23*.

The existing and proposed development areas and Magic Mountain Parkway may result in adverse edge effects. Fencing, signage, access restrictions, easements, and other protections outlined in *Sections 9.2.1 through 9.2.10* are intended to address these adverse effects.

Fencing will extend along those portions of the preserve boundary that are adjacent to proposed and existing development and approximately 150 feet beyond the development areas to make a clear distinction between the fuel modification zone and the preserve boundary.

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The proposed development area includes portions of the watershed area of the preserve. Therefore, some storm drain outlets from the proposed development area may be necessary within the preserve to maintain pre-construction hydrologic conditions in the preserve. Hydrologic conditions will be maintained in conformance with *Section 9.2.7*.

This preserve contains a utility easement that is not under the control of Newhall Land, and, as described in *Section 6.1.3* above, maintenance activities may occur within the preserve boundary pursuant to existing utility easements. These activities include, but are not necessarily limited to, (1) recovery and repair of downed lines, including air-crane operations; (2) repair/replacement of towers and poles, including air-crane operations; (3) reconstruction/maintenance of access roads; (4) maintenance of fuel modification zones around tower footings; (5) maintenance of drainage from access roads; (6) erosion control; (7) cleaning, painting, coating, and debris removal from power lines, towers, or footings; (8) repair/replacement of buried gas lines or markers; (9) installation of retaining walls and maintenance of visual observation footpaths; (10) maintenance of fencing, if present; (11) maintenance of electrical grounding systems on towers and fencing, if necessary; and (12) Emergency Response operations. A good-faith effort will be made to coordinate with the easement holder to install non-barbed wire or similar fencing with appropriate signage around any existing spineflower locations within the easement. Newhall Land cannot be responsible for spineflower within an easement held by others.

Non-native plants in the preserve will be managed in accordance with a Preserve System Non-Native Management Plan to be developed as part of the adaptive management program described in *Section 10.0*.

10.0 ADAPTIVE MANAGEMENT PROGRAM

10.1 Development of the Adaptive Management Framework

Development of an adaptive management framework to support the conservation goal of this Plan began after preliminary attempts to develop management based upon performance standards and remedial-action triggers proved to be premature. The combination of natural variability inherent with spineflower populations and the lack of available information regarding the taxon's biology and ecology required the adoption of a more flexible, programmatic approach.

As described in *Section 4.0*, the spineflower is an annual, spring-blooming plant exhibiting dramatic fluctuations in aboveground populations apparently tied to annual climatic variability and other poorly understood stochastic (random) environmental variables. Population levels vary from very small numbers of plants in severe drought years to millions of plants when growing conditions are more favorable. From a management and monitoring perspective, therefore, the

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natural variability in the observed population levels can interfere with detecting the effects of non-natural factors. In particular, population declines due to anthropogenic factors can be very difficult to differentiate from the natural variability of the system. Furthermore, annual plant seed banks are difficult to study because a potentially large and significant portion of the population resides below ground in a seed bank that is otherwise difficult to directly quantify. The need to balance this natural uncertainty with the demands for developing scientifically based and timely conservation and management methods calls for a flexible adaptive management approach.

The adaptive management framework proposed in the Plan thus is designed to balance natural sources of uncertainty with the demands and finite timescale associated with the conservation planning process. The adaptive management planning team was expanded in 2007 with the addition of scientific experts Jodi McGraw, PhD, and John Willoughby to the existing team of resource agency staff, land managers, landowners, and consultants representing CDFG, the Center for Natural Lands Management (CNLM), and Newhall Land. Since that time, development of the adaptive management framework has proceeded steadily, through iterations of strategy and design, using available information.

10.2 The Concept of Adaptive Management

McEachern et al. (2006) provide a description of the concept of adaptive management. The description is provided in the context of multiple-species conservation planning, but it applies equally well to this situation, given the similar issues of uncertainty and incomplete information that are often inherent in the conservation planning process (McEachern et al. 2006, p. 18).

[Adaptive management] is an iterative process of strategy, design, implementation, monitoring, evaluation and adjusting management to maximize conservation success. It evaluates decisions or actions through carefully designed monitoring and proposed subsequent modification to management, threat abatement and monitoring. The modifications are in turn tested with an appropriate, perhaps redesigned, monitoring protocol. At each turn of the cycle, active learning through monitoring and evaluation reduces management uncertainty. Adaptive management is logical, can deal with uncertainty and data gaps, and is similar to the scientific process of hypothesis testing.

10.3 Components of the Adaptive Management Framework

Using the McEachern et al. (2006) description as a foundation, the proposed adaptive management framework includes the following key elements:

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- Biological goals and objectives (*Section 3.0*)
- Description of the programmatic approach (*Section 10.4*)
- Identification and evaluation of threats (*Section 10.4* and *Appendix D*)
- Reporting and plan adjustments (*Section 10.5*)
- Monitoring protocols (*Section 11.0*).

These key elements form the basis of the proposed adaptive management program and thus provide the framework that will be augmented and modified as the adaptive management program progresses.

10.4 Programmatic Approach

The proposed adaptive management framework is being developed as a stressor-based plan that focuses on managing anthropogenic threats. Monitoring will be tied directly to management actions (i.e., “effectiveness” monitoring), such that management can be evaluated as having the desired effect of maintaining or enhancing spineflower populations. Management actions are categorized as near-, intermediate-, and long-term (i.e., 0 to 1 year, 1 to 5 years, and 5 to 20 years; time frames are set based on the timing of Annual Program Review) and are linked to the characterization of threats as low, medium, or high priorities for management. For example, near-term actions would address high-priority threats, such as existing and anticipated invasion by non-native species. Annual review, near-term adjustment, long-range planning, and the development of annual work plans are incorporated as features of the adaptive management framework.

Adjustments to the annual work plans will rely on feedback from monitoring activities and on the newly available information (e.g., scientific research) to guide changes in management activities or overall strategy. Adjustments to management will also be made based upon the response of spineflower to experimentally designed small scale management trials. Decision-making responsibilities and ongoing development of the adaptive management process are the responsibility of an Adaptive Management Working Group comprising land managers, stakeholders, and scientific experts. The Adaptive Management Working Group is responsible for evaluating completed management actions and defining explicit objectives for future management actions.

A total of 10 threats were initially identified and evaluated during the development of the adaptive management program. Seven threats, including non-native plants, the loss of genetic diversity, fire suppression, trampling, fire exclusion, herbivory and seed predation, and the disruption of the natural soil-disturbance regime, are being carried forward as a focus of the

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adaptive management program, and detailed evaluations are provided in *Appendix D*. Drought, nitrogen deposition, and Argentine ants were originally considered to be addressed through adaptive management, but were eliminated for different reasons: Drought and nitrogen were eliminated from the adaptive management program because direct management is not considered feasible and since their potential effects are manifested in changes (i.e., increased cover of non-native grasses, changes in vegetation communities) that are already being addressed by adaptive management. Because Argentine ants can be effectively managed within and adjacent to the preserves through general aspects of preserve design with a limited need for active management and human mediation, it is not necessary to address Argentine ants through adaptive management.

10.5 Management Framework

This section describes the basic organizational structure of the proposed management framework based on the model provided by McEachern et al. (2006). The basic organizational elements include an Adaptive Management Working Group and a Technical Advisory Subgroup, an Annual Program Review, and a Spineflower Information Center that provides centralized storage and facilitates a structured flow of information related to all aspects of the adaptive management program.

Adaptive Management Working Group and Technical Advisory Subgroup

The Adaptive Management Working Group will consist of land managers, resource agency staff, and scientific experts. The Adaptive Management Working Group is the ultimate decision-making entity that will guide the management, monitoring, and planning activities of the adaptive management program. Management actions will be implemented using annual work plans developed by the Adaptive Management Working Group. Annual work plans will be developed based on the priority level assigned to individual threats and will incorporate the corresponding recommended management actions that are to be implemented in the upcoming year based on the results of monitoring.

The Technical Advisory Subgroup will consist of a subset of the Adaptive Management Working Group, specifically responsible for addressing technical scientific issues associated with management, monitoring designs, and data analysis.

Annual Program Review

A fundamental element of the adaptive management program is a repeating process of periodic review, short-term adjustment, and long-range planning. The goal of Annual Program Review is to evaluate the success of completed management actions to date, to develop new management

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actions and objectives as necessary, and to prepare annual work plans for the implementation of management actions in the upcoming year. Annual Program Review will be conducted by the Adaptive Management Working Group in September or October of each year, once spineflower is dehiscent, but before the onset of germination associated with seasonal fall and winter rains, which typically begin in October. The timing of Annual Program Review also must provide sufficient time to compile and analyze the monitoring data from the current year's activities, to incorporate that data into decision making, and to prepare the annual work plan for the upcoming year. As proposed by McEachern et al. (2006), Annual Program Review may include peer presentations and external review but will ultimately evaluate monitoring data to determine the success of management actions that have been implemented.

Annual Program Review will allow short-term adjustments to be made to the adaptive management program based on the results of implemented management actions. Short-term adjustments may result in changes to ongoing or planned management actions. Consideration of long-range planning will be done annually but will likely involve an overall evaluation of management activities over several years (e.g., over a 5-year horizon). Long-range planning pertains more broadly to the ongoing refinement of the biological goals and objectives of the Plan.

Centralized Information

Information sharing is a critical component of the adaptive management program. A Spineflower Information Center web site or File Transfer Protocol (FTP) server will be established to serve as a repository for annual work plans, monitoring data, and findings of Annual Program Reviews. Regional weather data, local weather information, and raw monitoring data will also be stored and accessible through the Spineflower Information Center. In addition, the Spineflower Information Center may also be configured to provide an Internet-based forum to facilitate discussion among Adaptive Management Working Group members outside of scheduled Annual Program Review meetings.

11.0 MONITORING ACTIVITIES

11.1 Qualifications

Monitoring shall be conducted under the direction of the preserve manager or the NLMO, as approved by the CDFG. The preserve manager, NLMO, and/or staff collecting data shall meet the qualifications described in *Section 9.0* and be familiar and experienced with the monitoring and data collection techniques outlined herein.

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11.2 Spineflower Monitoring Program

The Spineflower Monitoring Program is an integral part of the adaptive management program, and will measure the success of management in achieving the biological goals and objectives pertaining to spineflower populations (Goal 1) described in *Section 3.0*. The Spineflower Monitoring Program is described briefly here, but is presented in detail as an accompanying document to the Plan included as *Appendix E*. Specifically, the Spineflower Monitoring Program includes two distinct protocols for monitoring the distribution and abundance of spineflower populations within the preserves. To monitor spineflower distribution, areal extent mapping (i.e., mapping of the extent of spineflower distribution) will be conducted to delineate all spineflower patches within the preserves. To reduce the potential for inter-annual variability in density to influence areal extent, areal extent mapping will occur approximately every 10 years, and will be conducted only during years with weather conditions appropriate for establishment and survival (i.e., years with above-average rainfall). To monitor spineflower abundance, spineflower abundance sampling will occur annually and will involve plot sampling (i.e., within quadrats) to estimate the absolute cover of spineflower within the preserves.

The goal of the Spineflower Monitoring Program is to provide objective, repeatable methods for collecting, analyzing, and interpreting ecologically meaningful information that can be used to evaluate the status of spineflower populations, the effectiveness of the conservation strategy, and the design of future management and monitoring, using the most cost-effective methods possible. The Spineflower Monitoring Program includes quantitative thresholds to detect declines in spineflower distribution (areal extent) and abundance (absolute cover). Observed declines meeting the identified thresholds would trigger implementation of appropriate remedial actions, beginning with efforts to assess the causes(s) of the observed decline. Monitoring, management, and, if necessary, the implementation of remedial actions would occur as part of the adaptive management process described above in *Section 10.0*.

11.3 Monitoring of Preserve Area Vegetation

Vegetation communities within the preserve areas will be monitored to measure the success of management toward achieving the biological goals and objectives pertaining to community-level aspects of spineflower ecology as defined by Goal 2 in *Section 3.0*. Changes in vegetation communities within the preserve areas will be monitored using a combination of remote sensing, aerial interpretation, and field mapping at approximately 10-year intervals.

Monitoring of landscape-level changes in vegetation communities will be supplemented with the implementation of the CNPS “Vegetation Rapid Assessment Protocol” (CNPS 2004). This protocol has been adopted by CDFG, USFWS, and the National Park Service to assist them in

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effectively and efficiently updating the location, distribution, species composition, and disturbance information of vegetation types identified in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). Vegetation types are classified by general physical location, general habitat, alliance, and association. Mapping will be conducted to the association level, the most refined level within *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). The protocol, in summary, includes assessing stands of vegetation by field-analyzing it, photographing it from at least two vantage points, and filling out a field data form for each stand. As defined by *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995), a stand is a basic physical unit of vegetation in the landscape that has compositional and structural integrity (homogeneity).

11.4 Quantitative Monitoring of Habitat Restoration Areas

Quantitative monitoring of habitat restoration areas will include 50-meter-long point-intercept transects, at approximately the rate of one per acre. Transect data will be collected in the spring, as the vast majority of the restoration areas will be sage scrub or native grasslands (spring is typically the time of year that yields the greatest species diversity and cover for these vegetation communities). Data will be collected using the point-intercept method at each 0.5 meter along the transect line. At every 0.5 meter, a point will be projected vertically into the vegetation. Species intercepted at each point will be recorded, providing a tally of intercepts for each species in the herb and shrub layers. A column will be included to indicate if a non-native thatch layer is present and, if so, the depth in centimeters. In addition, grass species intercepted will be recorded according to their appropriate height range (i.e., 0 to 1.0 decimeters, 1.01 to 2.00 decimeters, 2.01 to 3.00 decimeters, 3.01 to 4.00 decimeters, 4.01 to 5.00 decimeters, 5.01 decimeters up to the maximum height).

Transect data will be analyzed to determine the percent vegetative cover of each species, species composition, species frequency, distribution, percent bare ground, percent and depth of non-native thatch, and average grass height along each transect. Quantitative transect data will be tabulated, graphed, analyzed, and compared to the previous year's data in each annual report.

11.5 Qualitative Monitoring of Preserve Areas

Qualitative monitoring will be performed quarterly and include an overall review of the spineflower populations and habitats within the preserve and preserve buffer. The monitoring will note physiognomic changes and potential problems, such as invasion or increase in cover by exotic species or weeds, plant pests, Argentine ants, gophers, squirrels, plant diseases, erosion, sedimentation, trash accumulation, unauthorized access, and vandalism. The monitoring will also make recommendations as necessary to help ensure that spineflower populations remain in a

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healthy state. Special attention shall be placed on examining preserve edges, as these locations are where new weed invasions and other problems are often first detected. Quarterly assessments will also include a review of the preserve's physical features, including the condition of protective fencing, preserve signage, access gates, locks, adjacent storm-drain outfalls, and BMPs.

Following the completion and occupancy of a development area, quarterly monitoring shall be initiated for Argentine ants along the urban–open space interface at sentinel locations where invasions could occur (e.g., where moist microhabitats that attract Argentine ants may be created). Based on a study by Suarez et al. (2001), Argentine ant populations disperse at a rate of about 15 to 270 meters per year; therefore, quarterly monitoring for Argentine ants should be adequate to detect incipient invasions. A qualified biologist shall determine the monitoring locations. Ant pitfall traps would be placed in these sentinel locations and operated on a quarterly basis to detect invasion by Argentine ants. If Argentine ants are detected during monitoring, the qualified biologist shall distinguish between foraging ants versus nesting ants and implement appropriate direct control measures immediately to help prevent the invasion from worsening. These direct controls may include but are not limited to nest/mound insecticide treatment and focused broadcast application of insecticides over large infested areas, or available natural control methods being developed. A general reconnaissance of the infested area would also be conducted to identify and correct the possible source of the invasion, such as uncontrolled urban runoff, leaking pipes, and collected water.

Qualitative monitoring will include quarterly qualitative reports that are prepared by the preserve manager (based on direct observation) and submitted to Newhall Land and CDFG. The reports will summarize the monitoring site visit, identify potential problems, and prescribe appropriate remedial actions when necessary, to protect spineflower populations. Quarterly reports will be included as appendices of the annual reports.

11.5.1 Fencing and Access

Monitoring will be conducted periodically along the preserve boundaries to evaluate whether fencing, signage, and current levels of enforcement (i.e., patrols) are successful in preventing unauthorized access into the preserves. Monitors will search specifically for typical signs of unauthorized access including damaged fencing, vandalism, creation of foot trails, and litter. Monitoring the preserves for unauthorized access that could lead to trampling impacts will initially be conducted on a quarterly basis, but the frequency of monitoring may be increased depending on the proximity and type of adjacent land uses.

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11.5.2 Monitoring for Argentine Ants

Monitoring will be necessary to determine the effectiveness of management strategies and techniques in controlling invasions by Argentine ants within the preserves. The following monitoring activities are proposed:

1. Quarterly monitoring along the urban–preserve edge to detect incipient Argentine ant invasions, remedying any inadvertent sources of moisture from outside the preserves that could create suitable ant habitat
2. Wet-season monitoring within core areas of the preserves to detect and remedy inadvertent introductions into naturally wet areas created within the preserves during and after winter rains
3. Quarterly monitoring within preserves to determine the presence or absence of native ant species. If native ant species are determined to be absent, further research into the cause of their disappearance will be conducted, and management measures will be developed to mitigate this effect.

11.6 Local and Regional Weather Conditions

Rain gauges and possibly other basic measurement devices for measuring temperature and soil moisture will be installed on the preserves to ensure that local environmental conditions are being accurately monitored. Because Santa Ana winds may play a role in interacting with drought conditions to reduce survival at critical times, data on wind conditions will also be tracked.

11.7 Monitoring Results

Monitoring results will be reported each year through the preparation of annual reports. Annual reports will be prepared and submitted to Newhall Land, the County, CDFG, and the Adaptive Management Working Group by December 31 each year for 10 continuous years and/or until management activities have successfully achieved the biological goals and objectives of the Plan. One comprehensive report will be submitted for all spineflower preserve areas.

Annual reports will include a summary of qualitative data, including the condition of protective fencing, signage, erosion, trash accumulation, unauthorized access, and vandalism, and will indicate the presence of ants, gophers, squirrels, or other potentially problematic species. Annual reports will include color photographs from pre-determined permanent and temporary photo-points to be established in conjunction with the proposed spineflower monitoring protocols. In addition, the reports will include at least 10 photos of each preserve from different vantage

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points. Photos will be analyzed and compared to the previous year's photos to help further identify qualitative changes in preserve vegetation.

Monitoring of spineflower distribution is proposed to occur approximately every 10 years, and only during years of above-average rainfall. Therefore, quantitative data from monitoring spineflower distribution (i.e., areal extent mapping) will be reported approximately every 10 years following the completion of spineflower distribution monitoring activities. Vegetation monitoring within the preserve areas is also proposed to occur once every 10 years and will be reported once every 10 years following the completion of vegetation monitoring activities. Monitoring of spineflower abundance is proposed to occur annually. Quantitative data from spineflower abundance sampling (i.e., plot sampling to estimate absolute cover) will be included in the annual reports.

Annual reports, the results of 10-year spineflower distribution and vegetation monitoring activities, the results of annual spineflower abundance sampling, and the annual results of adaptive management activities implemented during the year will be stored and made accessible through a centralized information system as described in *Section 10.5*.

12.0 SPINEFLOWER INTRODUCTION PROGRAM

If CDFG determines that avoidance and minimization efforts and establishment of the preserves are not adequate to substantially lessen the significance of direct and indirect impacts to the spineflower, a reintroduction program may be implemented.

12.1 Conservation of the Seed Bank

Spineflower seed shall be collected from spineflower areas in the development area(s) permitted for "take," prior to clearing and grubbing. Seed collection shall follow the approved seed collection protocol described in the October 8, 2003, CDFG letter to Newhall Land authorizing collection of spineflower seed (CDFG 2003b). Two-thirds of the collected seed will be sent to RSABG for storage (one-third for short-term and one-third for long-term storage), and one-third will be sent to the USDA National Seed Storage Lab in Fort Collins, Colorado, for long-term storage.

12.2 Seed Collection

In addition, approximately 5% of seed will be collected in each preserve area each year, only in years of within 20% or greater of normal rainfall, for 10 years, beginning in the year the preserves are established. This seed will be maintained in short-term storage at RSABG and may be used for seeding, as discussed in *Section 12.3*, below.

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12.3 Seeding

Seeding of spineflower in the preserves may be performed to create additional spineflower occurrences. Direct seeding may be performed as a remedial measure in association with, or following, other remedial actions identified during monitoring. Direct seeding in a preserve area would only utilize seeds from that preserve area; it would not involve seeds collected from development areas or other preserves. In the event that the goals and objectives described in *Section 3.0* are not met, direct seeding of existing populations may occur at the discretion of CDFG.

A direct seeding plan shall be developed for spineflower mitigation/creation areas that includes the following data:

1. Scaled topographic maps showing the accurate locations and acreages of the proposed seeding areas
2. A detailed description of proposed (site specific) methodology
3. Name of biologist that prepared the plan
4. Map and description of the habitat(s) adjacent to the seeding area
5. List of plant species and densities present within the seeding area
6. The project schedule
7. Plans and specifications for site preparation, seed application, and maintenance methods.

The direct seeding plan, which will include proposed monitoring and maintenance schedules and activities, shall be submitted to CDFG for input and approval prior to implementation.

In general, direct seeding will include identifying locations within the preserve areas with appropriate soils, geology, aspect, slope, and vegetation conditions that have no historical occurrences of spineflower. Only seed collected from the particular preserve area shall be introduced within that preserve in order to preserve the genetic integrity of the spineflower populations. Once the appropriate area(s) is identified and approved by CDFG, the site shall be adequately prepared by staking the boundaries, removing weeds and debris, and applying seeds. Seeding shall be performed at the onset of the rainy season (October through early December).

Seeding will be applied using two methods. The first method will use a calibrated hand or “belly” spreader and mix the seed with clean masonry sand or inert bran fiber for better distribution. Immediately following application, the seed shall be lightly raked into the soil to a

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depth of 5 millimeters (maximum) using a steel rake. This method will be used for approximately 60% of the spineflower mitigation/creation areas. The second method will use a seed imprinting device that has ripping teeth in front of the imprint wheel and a calibrated seed bin. This method shall be used for approximately 40% of the direct seeded area. This method mimics a natural disturbance situation and has proven to be highly effective for seeding native plants in non-irrigated situations. Imprints shall be parallel with the contours, “v” in shape, and between 3 and 4 inches deep. Imprinting teeth shall be offset to prevent channeling of water. Imprinting shall not occur on slopes steeper than 3:1. Imprinted areas shall be covered with blown straw certified as weed-free at the rate of 2,000 pounds per acre.

The rate of seeding will be dependent on the seed purity, percent germination, individual site conditions, and the quantity of seed available. Therefore, the seeding rate (to be expressed in pounds per acre) will be calculated by the project biologist and submitted to CDFG for review. Fifty percent of the seed shall be pretreated by clipping the seed coats, as previous studies (Sapphos 2001) have determined that germination rates were dramatically increased by clipping seed coats.

In areas where herbivores, including birds, are known or expected to be problematic, the seeded areas should include temporary exclusion fencing and/or bird deterrents, such as silver tape attached to posts, artificial owls, or other pre-approved devices. All spineflower direct seeding work shall be monitored by the preserve manager and reported to CDFG.

13.0 FUNDING

Funding requirements will be identified in the section 2081(b) Incidental Take Permit at the time of permit issuance. Funding will be implemented in accordance with the conditions required by the section 2081(b) Incidental Take Permit. Newhall Land, or a designee, would post bonds (or other CDFG-approved financial assurance mechanisms) for the management, monitoring, and reporting measures described in *Sections 9.0, 10.0, 11.0, and 12.0. Table 20* depicts the costs of the management measures for existing agricultural activities during construction and after construction, as well as costs associated with monitoring and reporting requirements. Three bonds (or other CDFG-approved financial assurance mechanisms) would be posted: one for \$477,480.00 for costs during construction and one-time start-up costs, one for \$1,801,000.00 for initial restoration activities, and one for \$3,550,700.00 for costs to be expended over a 50-year period. Thus, the total bond amount required for implementation of this Plan would be for \$5,829,180.00.

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Table 20
Operation Costs for Maintenance, Monitoring, and Management Measures

Activity	Frequency	Person-Hours or Cost Unit	Cost per Year
<i>Management Measures for Existing Agricultural Activities</i>			
Installation of signs (82 signs)	Once	Fixed cost	\$4,100
Erosion-control measures	Once	Fixed cost	\$20,000
<i>Subtotal for One-Time Costs</i>			<i>\$24,100</i>
<i>Management Measures during Construction</i>			
Installation of orange snow fencing (32,685 linear feet)	Once	Fixed cost	\$98,000
Erosion control (silt fence; 10,395 linear feet)	Annually	Fixed cost	\$19,250
Training construction personnel about the spineflower	Annually	3 (@ \$110)	\$330
Construction monitoring	Annually	400 (@110)	\$44,000
<i>Subtotal for 3 Years of Construction</i>			<i>\$161,580</i>
<i>General Management Measures and Monitoring for the Preserves</i>			
One-Time Costs			
Installation of signs (42 signs)	Once	Fixed cost	\$2,100
Installation of split rail fencing (17,090 linear feet)	Once	Fixed cost	\$170,900
Habitat Characterization Study	Once	Fixed cost	\$118,800
<i>Subtotal for One-Time Costs</i>			<i>\$291,800</i>
<i>General Management Measures and Monitoring for the Preserves</i>			
Initial Restoration Costs			
Landscape palette review and nursery stock inspection	Once	Fixed cost	\$6,000
Landscape planting within preserves (66.8 acres @ \$25,000/acre)	Once	Fixed cost	\$1,670,000
Landscape planting within preserves (5 years of monitoring)	Quarterly for 5 years	Fixed cost	\$125,000 (5 years)
<i>Subtotal for Initial Restoration Costs</i>			<i>\$1,801,000</i>
Years 1 through 10			
Argentine ants perimeter monitoring and control	Quarterly for 10 years	Fixed cost = \$2,400/quarter	\$96,000 (10 years)
Non-native plant management activities	Annually for 10 years	Fixed cost = \$37,500/year	\$375,000 (10 years)
Non-native plant monitoring	Annually for 10 years	Fixed cost = \$5,000/year	\$50,000 (10 years)
Annual spineflower monitoring – pilot study	Annually for 2 years	Fixed cost = \$45,000/year	\$90,000 (2 years)
Annual spineflower monitoring – ongoing	Annually for 8 years	Fixed cost = \$30,000/year	\$240,000 (8 years)
Spineflower areal extent mapping	Once every 10 years	Fixed cost = \$13,000/10 years	\$13,000 (10 years)
Monitoring of preserve area vegetation	Once every 10 years	Fixed cost = \$6,900/10 years	\$ 6,900 (10 years)
Spineflower seed collection	Annually for 10 years	Fixed cost = \$3,000/year	\$30,000 (10 years)
Spineflower seed storage	Annually for 10 years	Fixed cost = \$3,000/year	\$30,000 (10 years)
Reporting (annual)	Annually for 10 years	100 (@ \$110) = \$11,000/year	\$110,000 (10 years)

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Table 20 (Continued)

Activity	Frequency	Person-Hours or Cost Unit	Cost per Year
Reporting (quarterly)	Quarterly for 10 years	20 (@ \$110) = \$2,200/quarter (\$8,800/year)	\$88,000 (10 years)
<i>Subtotal for Annual Costs for Years 1 through 10</i>			<i>\$1,128,900</i>
Years 11 through 50			
Annual spineflower monitoring – ongoing	Annually for 40 years	Fixed cost = \$30,000/year	\$1,200,000 (40 years)
Spineflower areal extent mapping	Once every 10 years	Fixed cost = \$13,000/10 years	\$52,000 (40 years)
Monitoring of preserve area vegetation	Once every 10 years	Fixed cost = \$6,900/10 years	\$27,600 (40 years)
Qualitative monitoring (177 acres at 100 acres per 10-hour day)	Quarterly for 50 years	20 (@ \$110) = \$2,200/quarter (\$8,800/year)	\$352,000 (40 years)
Reporting (quarterly and annual)	Annually for 50 years	100 (@ \$110) = \$11,000/year	\$440,000 (40 years)
<i>Subtotal for Annual Costs for Years 11 through 50</i>			<i>\$2,071,600</i>
<i>Maintenance Measures</i>			
Maintenance activities (repairing fencing, signage; trash removal)	Quarterly	40 (@ \$40) = \$6,400/year	\$320,000 (50 years)
<i>Subtotal for Annual Costs for Years 1 through 50</i>			<i>\$320,200</i>
<i>Adaptive Management Measures and Research Studies</i>			
Non-native plant management plot experiments	Annually (Years 1–2)	Fixed Cost = \$10,000/year	\$20,000 (2 years)
Preserve Area Non-Native Plant Management Plan	Once (Year 2)	\$10,000	\$10,000
<i>Subtotal for Annual Costs</i>			<i>\$30,000</i>
Total Costs			
Management Measures for Existing Agricultural Activities			\$24,100
Management Measures during Construction			\$161,580
Total One-Time Costs			\$291,800
Total Initial Restoration Costs			\$1,801,000
Total Annual Management Costs for Years 1 through 10 (\$112,890 per year for 10 years)			\$1,128,900
Total Annual Management Costs for Years 11 through 50 (\$51,790 per year for 40 years)			\$2,071,600
Total Annual Maintenance Costs (\$6,400 annually for 50 years)			\$320,200
Total Adaptive Management Measures and Research Studies			\$30,000
Total Costs for 50-Year Period			\$5,829,180

14.0 RESPONSIBLE PARTIES

Newhall Land, or a designee, would be responsible for implementing this Plan. Newhall Land, or a designee, would post bonds for the management, monitoring, and reporting measures described

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in *Sections 9.0, 10.0, and 11.0*. The assigned party may include the CNLM or another assigned party responsible for overseeing the open area and River corridor portions of the Specific Plan area. Bonds shall be released by CDFG upon reaching identified milestones and/or upon receipt of verification of grants or special assessments obtained to implement this Plan.

15.0 REPORTING

This section identifies the reporting requirements associated with the five preserve areas of this Plan. It is anticipated that the five preserve areas will be established within 1 year of issuance of the section 2081(b) Incidental Take Permit (California Fish and Game Code, Section 2081) by CDFG under CESA, but that the assigned party (such as the CNLM) will accept oversight in a phased manner linked to the phased build-out of the project study area. Newhall Land, or a designee, shall install adequate signage and provide oversight to ensure that the preserves are not inadvertently damaged.

Initial reporting will be performed quarterly as described in *Section 11.5*, and annually as described in *Section 11.7* for 10 continuous years from the year of section 2081 Permit issuance. Annual reports will be prepared and submitted to Newhall Land, the County, CDFG, and the Adaptive Management Working Group by December 31 each year for 10 continuous years and/or until management activities have successfully achieved the biological goals and objectives of the Plan. In the event that annual status reports indicate that the biological goals and objectives outlined herein are not met 10 years following delineation of the spineflower preserves, the Project applicant, or its designee, shall continue to submit annual status reports to the County and CDFG for a period of no less than an additional 5 years, as required by Newhall Ranch Specific Plan EIR Mitigation Measures SP-4.6-66 and SP-4.6-77 (County of Los Angeles 2003). One comprehensive report will be submitted for all the established spineflower preserve areas. *Section 11.7* lists the contents of the reports.

16.0 SCHEDULE

Table 21 shows an estimated schedule for implementing this Plan, including establishment of the preserve areas, management activities for existing and proposed land uses, maintenance, monitoring, and reporting. The actual schedule will be based on the date/year that all project approvals described in the Newhall Ranch RMDP-SCP EIS/EIR are adopted by CDFG and Corps. Conservation easements shall be established at the preserves within 12 months of issuance of the Incidental Take Permit and prior to any impact to spineflower populations.

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Table 21
Schedule for Monitoring and Management Responses

Activity	Frequency
<i>Management Measures for Existing Agricultural Activities (Fall 2011 until Agricultural Activities are Discontinued)</i>	
Installation of signs (82 signs)	At the issuance of the spineflower Incidental Take Permit
Erosion control (silt fence; 10,395 linear feet)	At the issuance of the spineflower Incidental Take Permit
<i>Management Measures during Construction (Fall 2013 through Fall 2033)</i>	
Installation of orange snow fencing (32,685 linear feet)	Prior to starting construction
Erosion control (silt fence; 10,395 linear feet)	Prior to starting construction
Training construction personnel about the spineflower	Prior to starting construction
Construction monitoring	Prior to starting construction
<i>General Management Measures for the Preserves (Spring 2012 through Spring 2062)</i>	
Restoration planting within preserves	Approximately September 2012 through 2019
Installation of signs (42 signs)	Approximately September 2012 through 2033
Airport Mesa and Grapevine Mesa Preserve Areas	At initiation of development in the Mission Village planning area, or impact to VCC population, whichever occurs first
San Martinez Grande Preserve Area	At initiation of development in the Homestead Village development area north of SR-126, or development in the Entrada planning area, whichever occurs first
Potrero Preserve Area	At initiation of development in the Potrero Village planning area
Entrada Preserve Area	At initiation of development in the Entrada planning area
Installation of split-rail fencing (17,090 linear feet)	Approximately September 2012 through 2033
Airport Mesa and Grapevine Mesa Preserve Areas	At initiation of development in the Mission Village planning area, or impact to VCC population, whichever occurs first
San Martinez Grande Preserve Area	At initiation of development in the Homestead Village development area north of SR-126, or development in the Entrada planning area, whichever occurs first
Potrero Preserve Area	At initiation of development in the Potrero Village planning area
Entrada Preserve Area	At initiation of development in the Entrada planning area
Spineflower seed collection and storage	
Airport Mesa and Grapevine Mesa Preserve Areas	At initiation of development in the Mission Village planning area, or impact to VCC population, whichever occurs first, and then annually for 10 years
San Martinez Grande Preserve Area	At initiation of development in the Homestead Village development area north of SR-126, or development in the Entrada planning area, whichever occurs first, and then annually for 10 years
Potrero Preserve Area	At initiation of development in the Potrero Village planning area, and then annually for 10 years
Entrada Preserve Area	At initiation of development in the Entrada planning area, and then annually for 10 years
Quantitative monitoring (177 acres)	Annually, beginning approximately Spring 2013
Qualitative monitoring (177 acres)	Quarterly, beginning approximately Spring 2013
Reporting (quarterly and annual)	Annually, beginning approximately Spring 2013
Maintenance activities (repairing fencing, signage, etc.; weeding; trash removal)	Quarterly, beginning approximately Spring 2013
<i>Maintenance Measures (Spring 2013 through Spring 2063)</i>	
Pest control	Annually, beginning approximately Spring 2013
Weed control	Quarterly, beginning approximately Spring 2013

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Table 21 (Continued)

Activity	Frequency
Maintenance activities (repairing fencing, signage, etc.; trash removal)	Quarterly, beginning approximately Spring 2013
<i>Adaptive Management Measures (Spring 2013 through 2063)</i>	
Pest control	Annually, beginning approximately Winter 2013
Monitoring and removing trash	Quarterly, beginning approximately Spring 2013
Reporting	Annually, beginning approximately Winter 2013

NOTE: The timing of monitoring and management is subject to change dependent on the timing of development.

17.0 CONSERVATION AND TAKE ESTIMATES

This section quantifies and describes impacts to spineflower that are not avoided due to the development plans proposed for the project study area and documents the ways in which impacts have been avoided, minimized, and mitigated. As required by Fish and Game Code section 2081(b)(2), this section provides information that CDFG will consider when determining whether impacts of the authorized take are minimized and fully mitigated and, therefore, result in “no jeopardy” to the spineflower.

Since the spineflower was first discovered on the Newhall Land property in 2000, Newhall Land has conducted annual surveys to establish the distribution, areal extent, and numbers of spineflower. Based on the survey results, Newhall Land has revised the site development plans of the Specific Plan area and the Entrada planning area to avoid and minimize impacts to spineflower. As a result of the development redesign, direct impacts to spineflower have been reduced from almost 100% of the known populations outside the two existing conservation easements to approximately 31% of the 20.24 acres of known spineflower occurrences.

Avoidance of the spineflower and design of the preserves were based on a number of factors, including the distribution and abundance of the spineflower within the project study area, ecological indicators, and existing and proposed land uses. As described in *Section 7.0*, the preserves incorporate a cross-section of the ecological indicators associated with the overall spineflower occurrences, including vegetation, soils, geology, elevation, slope, and aspect. *Tables 7 through 13* in *Section 7.0* indicate that the various attributes of the six ecological indicators are represented in these preserves. In addition, the preserves contain areas of potentially suitable but unoccupied habitat that may accommodate fluctuations in the population numbers of the spineflower.

Four core occurrences (74% of 2002 through 2007 cumulative spineflower occurrence area within these areas) within the Specific Plan area would be preserved: San Martinez Grande Canyon, Potrero Canyon, Airport Mesa, and Grapevine Mesa. There are a number of occurrences

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that are not proposed for avoidance in this Plan because of their location and the difficulty associated with providing connectivity to those locations. These include occurrences adjacent to Airport Mesa, Grapevine Mesa, and Potrero Canyon.

At Entrada, approximately 49% of the 2002 through 2007 cumulative spineflower occurrence area would be conserved, although 25% of the cumulative spineflower area at Entrada occurs in or near an existing utility easement. Impacts were minimized by conserving the core area in the northeastern portion of the Entrada site.

At VCC, neither avoidance nor minimization is practicable in order to maintain the integrity of the approved development plan. The VCC project was approved for development in 1990, half of which has been built. Spineflower observed in the VCC planning area accounted for approximately 4% of all 2002 through 2007 cumulative spineflower occurrence area.

Table 22 depicts the proposed conservation and take of the 2002 through 2007 cumulative spineflower occurrence area in the project study area addressed in this Plan.

**Table 22
Conservation and Take by Project Site Using Total Footprint**

Project Site	SFVS Acres to be Conserved	SFVS Acres to be Taken	Total
Specific Plan area	12.86 (74%)	4.42 ¹ (26%)	17.28
VCC	0.00 (0%)	0.85(100%)	0.85
Entrada	1.03 (49%)	1.09 (51%)	2.10
Total	13.88 (69%)	6.36 (31%)	20.24

¹ A small portion (0.30 acre) of this area lies within what is designated as open space within the Grapevine Mesa and Potrero areas. While this area does not fall within the impact footprint, it will not be managed or monitored. For purposes of this analysis, this area is considered to be taken.

Spineflower occurrences located outside of these preserve areas would be subject to permanent impacts, and implementation of the Spineflower Conservation Plan would result in the take of approximately 6.36 acres (31%) of the 2002 through 2007 cumulative spineflower occurrence area. This direct impact would be fully mitigated, first by establishing a system of preserves to protect the core occurrences of spineflower in the project study area, and, second, by implementing management and monitoring within an adaptive management framework to maintain or enhance the protected spineflower occurrences within the five preserve areas. These activities, as described in *Sections 9.0, 10.0, and 11.0*, are essential to achieving a primary goal of this Plan, which is to ensure the long-term persistence of spineflower in the project study area.

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Each preserve and buffer area would be placed into a permanent conservation easement to ensure long-term protection. The permanent conservation easements would contain appropriate restrictions to help ensure the property remains in a condition suitable for spineflower and its associated ecosystem components, in perpetuity. The CDFG would approve the conservation easement holder and the conservation easement language to ensure it is consistent with the CESA standards.

Long-term management and monitoring is also proposed as mitigation for direct impacts to spineflower. Management of the preserves would include restoration and enhancement of degraded and/or damaged spineflower habitats, as described in *Section 9.2.10* above; areas that have greater than 30% absolute cover by weeds (not including annual grasses) would be restored to have at least 70% absolute cover by native species. This will contribute to the achievement of Goal 2, to maintain and enhance the structure and native species composition of the native communities within the spineflower preserves, as described in *Section 3.0*. Additional management measures include restrictions to prevent unauthorized access to the preserves; limitations to activities within adjacent fuel modification zones; response strategies to wildfire events as presented in the Emergency Fire Response Plan; and regular and ongoing consultation to be maintained with the County and CDFG in connection with ongoing agricultural operations.

These management activities would serve to maintain or increase spineflower populations within the preserves, as described in Goal 1 of *Section 3.0*. As described in *Sections 11.0* through *11.7*, various forms of monitoring shall be conducted under the direction of the preserve manager or the NLMO, as approved by the CDFG. Newhall Land shall fund the spineflower preserve manager to perform environmental monitoring, oversee the proposed spineflower preserve areas, and ensure the monitoring and management activities outlined in the proposed Spineflower Conservation Plan and previously incorporated mitigation measures are carried out. The spineflower preserve manager, NLMO, and/or staff collecting data shall meet the qualifications described in *Section 9.0* and be familiar and experienced with the monitoring and data collection techniques outlined herein. The establishment of the system of spineflower preserves, along with the long-term monitoring and management measures mentioned above, would allow spineflower to persist on site in perpetuity, and would fully mitigate the take of 6.36 acres of the 2002 through 2007 cumulative spineflower occurrence area.

In addition to the direct take of 2002–2007 cumulative spineflower occupied area, secondary impacts to spineflower would occur due to implementation of the Spineflower Conservation Plan. Secondary impacts to the spineflower preserve areas and the spineflower occurrences within the preserves could occur as a result of construction activities and the subsequent development. Threats to spineflower include the introduction of non-native, invasive plant and animal species; vegetation clearing; trampling; changes in hydrology; the introduction of

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chemical pollutants; and increased fire frequency. These potential impacts would be fully mitigated, first by establishing a system of preserves to protect the core occurrences of spineflower in the project study area, and, second, by implementing management and monitoring within an adaptive management framework to maintain or enhance the protected spineflower occurrences within the five preserve areas. These activities, as described in *Sections 9.0, 10.0, and 11.0*, are essential to achieving a primary goal of this Plan, which is to ensure the long-term persistence of spineflower in the project study area.

Each preserve and buffer area would be placed into a permanent conservation easement to ensure long-term protection. The permanent conservation easements would contain appropriate restrictions to help ensure the property remains in a condition suitable for spineflower and its associated ecosystem components, in perpetuity. The CDFG would approve the conservation easement holder and the conservation easement language to ensure it is consistent with the CESA standards.

Long-term management and monitoring is also proposed as mitigation for secondary impacts to spineflower. A spineflower preserve manager would perform environmental monitoring, oversee the proposed spineflower preserve areas, and ensure the monitoring and management activities outlined in the proposed Spineflower Conservation Plan and previously incorporated mitigation measures are carried out. Construction-related secondary impacts, such as vegetation clearing, trampling, and the introduction of chemical pollutants, would be addressed with the following management and monitoring measures: to reduce potential impacts due to unauthorized access, temporary fencing and signage would be required around the preserves prior to and during construction; various preserve and construction plan features including fencing requirements and installation practices, education sessions for construction workers, erosion control plans, dust control requirements, and an overall Project SWPPP are required to reduce potential impacts that may occur from the introduction of chemical pollutants, dust, and sedimentation; and weekly construction monitoring for all construction activities within 200 feet of preserve areas would be required.

Once construction is complete, secondary impacts from the resulting development could occur due to the introduction of non-native, invasive plant and animal species; trampling; increased fire frequency; the introduction of chemical pollutants; and changes in hydrology. Management and monitoring measures designed to address these potential secondary impacts include the following: management of the preserves to include the establishment of site-specific buffers aimed at neutralizing and controlling adverse edge effects from adjacent changes in land use, which would serve in reducing the impact of all of the above-mentioned threats; implementation of the Emergency Fire Response Plan to reduce impacts due to increased fire frequency; in order to minimize trampling, all portions of the preserves would be closed and permanent fencing and

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signage required along the subdivision tract bordering the preserves following the final stage of construction; plant palettes used on landscaped areas and fuel modification zones within 100 feet of the preserves, and all container plants to be installed within 200 feet of the preserves, would be reviewed by the preserve manager or qualified biologist for the presence of disease, weeds, and pests to minimize impacts due to the introduction of non-native, invasive plants; the invasion of Argentine ants would be minimized by maintaining an inhospitable habitat condition in the buffer between the development edge and the preserve and through quarterly monitoring along the urban–open space interface; and changes in hydrology would be addressed by minimizing changes in surface water flows to preserves, restricting the installation of storm drain outfalls from proposed development areas within preserve areas and requiring stormwater entering the preserves to pass through BMP measures outlined in the SWPPP.

These management and monitoring measures would serve to accomplish all three biological goals described in *Section 3.0*—maintain or increase spineflower populations within the preserves, maintain or enhance the structure and native species composition of the native communities within the spineflower preserves, and facilitate the natural ecological processes required to sustain the native populations and communities in the preserves—by minimizing and avoiding the potential secondary impacts that could occur due to construction activities and the subsequent development.

The establishment of the system of spineflower preserves, along with the long-term monitoring and management measures described above, would fully mitigate all direct and secondary impacts to the spineflower preserve areas and the spineflower within the preserves.

Permitting Process

Newhall Land has applied for a section 2081(b) Incidental Take Permit for spineflower within the project study area covered by this Plan. The CDFG and Corps are the lead agencies for the draft Newhall Ranch RMDP-SCP EIS/EIR for the Resource Management and Development Plan project component and associated section 404/Master section 1600 permits/agreements. The draft EIS/EIR will provide CEQA review for purposes of the section 2081 Permit for take of SFVS in the project study area. This Plan is intended to provide analysis of project and cumulative impacts to the spineflower, and it is anticipated that this Plan will be included as an appendix to the Draft EIS/EIR. In addition, this Plan will supplement Newhall Land's section 2081(b) Incidental Take Permit application for the spineflower as well as the Candidate Conservation Agreement between Newhall Land and the USFWS.

A Candidate Conservation Agreement for spineflower was submitted to the USFWS Ventura Field Office on February 2, 2005. This Plan will be attached to the Final Candidate Conservation

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Agreement as an appendix in order to demonstrate that threats to the spineflower will be reduced, such that spineflower need not be listed as endangered or threatened under FESA.

18.0 REFERENCES

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**Spineflower Conservation Plan
December 2007**

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Appendix A
Proposed Habitat Characterization Study



PROPOSAL

CHARACTERIZE THE HABITAT OF THE SAN FERNANDO VALLEY SPINEFLOWER

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October 12, 2007

BACKGROUND

As part of their development projects, Newhall Land is developing a Spineflower Conservation Plan (SCP), which will describe the preservation, adaptive management, and monitoring measures designed to fully mitigate the impacts of development on the San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*), a California Endangered Species. Scientists and planners who have been meeting to develop the SCP have determined that efforts to design and implement conservation measures for the San Fernando Valley spineflower (hereafter “spineflower”) would benefit from an increased understanding of the abiotic and biotic characteristics of habitat occupied by the spineflower, and the factors that influence the plant’s patchy occurrence, high variation in abundance, and highly variable size and thus reproduction.

This initial proposal provides an overview of a habitat characterization study designed to provide this information and then outlines the main study tasks. For each task, this proposal identifies project timelines, estimated costs, and any assumptions used to estimate the costs. A precise cost estimate will be developed based on the final study protocol to be developed in Task 1 (below). Details regarding how the habitat characterization will inform the SCP are provided in memos previously provided to the spineflower team (McGraw 2007a and McGraw 2007b).

GOALS AND OBJECTIVES

This project will conduct a habitat characterization for the San Fernando Valley spineflower. The goal of a habitat characterization for the spineflower would be to inform development and implementation of the SCP by increasing understanding of the factors that influence the distribution, abundance, and individual and population performance spineflower within the project area. This goal would be pursued through the following study objectives.

1. Determine the characteristics of spineflower habitat within the project area, by comparing quantitative data on the abiotic and biotic characteristics of areas with and without spineflower.
2. Identify microhabitat characteristics that influence the distribution, abundance, and performance of spineflowers, by comparing the abiotic and biotic characteristics of areas in which spineflowers are rooted to those without spineflower *within* occupied habitat.

OVERVIEW

The habitat characterization would use statistical analysis of systematically collected quantitative data depicting abiotic and biotic aspects of spineflower habitat and measures of spineflower abundance and performance to generate hypotheses for factors influencing spineflower distribution, abundance, and performance. Univariate statistical analyses would also be used to test existing hypotheses for the factors influencing spineflower occurrences which have been developed based on prior studies (e.g. spineflower preferentially occurs in areas of reduced thatch or lower grass cover). A suite of multivariate analytical techniques would be used to generate additional hypotheses, which can be tested through small-scale manipulative experiments and long term adaptive management of the spineflower preserves. Data for the study proposed here would be collected within a single year, though the plots would be permanently monumented and georeferenced, allowing extension of the study through time to increase understanding of the factors that influence the interannual variability in spineflower occurrences.

TASKS

The habitat characterization will be designed and implemented through seven main tasks.

1. Develop the Habitat Characterization Study Protocol

Prior to initiation of the study, a detailed protocol will be developed based on careful consideration of known aspects of the spineflower's ecology and distribution and abundance within the study site, and the goals and objectives of the study as a tool to inform the SCP. The protocol will identify the specific questions the study will be designed to answer and the hypotheses that will be tested; the study region; the spatial scale(s) at which habitat will be evaluated; the aspects of habitat that will be examined; the types of statistical tools used to analyze the data; and how the data will be interpreted.

The protocol will be provided for review to the spineflower team prior to finalization. For purposes of estimating the costs of the habitat characterization, this proposal assumes that habitat characterization will be similar to a similar successful characterization for an endangered terrestrial orchid (McGraw et al. 2006), as described below. The study protocol will serve as a basis for the methods section of the habitat characterization report.

2. Conduct field sampling of spineflower habitat within the Newhall Land holdings

Field sampling will be used to quantify characteristics of spineflower habitat within the SCP planning area, which includes the Newhall Ranch Specific Plan Area, Valencia Commerce Center planning area, and Entrada planning area (Dudek Assoc. 2007). In each of the areas, habitat characteristics will be examined within (approx.) 100, 10m x 10m quadrats randomly located in areas with and without spineflower, as determined through prior distribution mapping (Dudek Assoc. 2007). Within the (approx.) 50, 100m² quadrats with spineflower present, microhabitat characteristics will be measured within (approx.) 5 replicate 1m² circular quadrats located in areas within and without spineflower. Table 1 lists the anticipated data to be collected within plots of each size.

3. Analyze soils collected within habitat characterization sites

Soils will be collected within the estimated 100 sample sites (i.e. 100m² quadrats) and sent to a soil analysis laboratory to examine characteristics known or hypothesized to influence spineflower occurrences, including chemistry, texture, and moisture holding capacity. Table 2 lists the anticipated soils data that will be collected, and the methods used by the lab for soils analysis.

Table 1: Data to be collected within habitat characterization sites using plots of two sizes. Sites lacking spineflower will not have 1m² plots.

Type of Data	Data to be Collected	
	100m ² Quadrat	1m ² Plot
Plant Community Composition	absolute cover of species by cover classes	absolute cover of species by cover classes
abiotic conditions	litter cover and depth; thatch cover and depth; tree canopy cover, slope, aspect, and soil characteristics (Table 2)	litter cover and depth; thatch cover and depth
spineflower abundance	absolute cover of species by cover classes	density
spineflower performance	mean plant size and/or involucre production	mean plant size and/or involucre production

4. Enter and analyze the habitat characteristic data

All data collected from field examination and derived from the soil analyses will be entered into spreadsheets from which they will be imported into various statistical and graphing programs. Univariate and multivariate statistical analyses will be used to examine characteristics of spineflower habitat and microhabitat, and to test specific hypotheses identified during development of the study protocol (Task 1). Data will be used to create a series of tables and figures (i.e. graphs) that can be used to illustrate the patterns observed.

5. Present preliminary study results to the spineflower team

Results of the data analyses will be presented via power point to the SCP planning team, in order to receive feedback prior to preparation of the report. This important step will provide biologists familiar with the species an opportunity to examine the data and identify any additional analyses or interpretations that should be considered in characterizing the habitat.

6. Prepare the draft spineflower habitat characterization report

A report will be prepared to document the spineflower habitat characterization. The report will identify study goals and objectives, including the questions addressed and specific hypotheses tested; describe the methods used to collect and analyze the data, so that readers will be able to evaluate the results; present all of the observations as well as statistical results, including the negative findings, using narratives, tables, and figures; interpret the results in light of the specific questions addressed; and discuss the implications of the results for the design and implementation of the SCP.

7. Create the final spineflower habitat characterization report

Based on comments received from the spineflower team, the draft report will be revised to create the final spineflower habitat characterization report.

Table 2: Soils characteristics and methods of analysis proposed for the spineflower habitat characterization.

Characteristic	Variable	Method
soil texture	proportion gravel (>2mm), sand, silt, and clay	Sieves to determine the gravel, sand fractions; settling column to determine silt, clay fractions
soil moisture	amount of water in soil sample	loss on drying
organic matter	proportion of soil comprised of organic matter	loss on ignition
pH	concentration of Hydronium ions	electrode on saturation paste
NO3-N	concentration of nitrate as nitrogen	KCl extract, detection by cadmium reduction
NH3-N	concentration of ammonia as nitrogen	KCl extract, detection by phenate method
P	concentration of available Phosphorus	Olsen Bicarbonate
exchangeable cations (Ca, Mg, Na, K)	concentration on exchange sites within the soil	Ammonium Acetate extraction, detection by ICP-AES ¹
Hydrogen	concentration of Hydrogen on soil exchange sites	Derived from regression equation based on original soil pH and the SMP buffer pH
cation exchange capacity	concentration of cations bound to the exchange sites in the soil	sum of exchangeable cations measured (Ca, Mg, Na, K, NH ₄ , H)
electrical conductivity	Proportional to the total salts found in the solution	Saturation paste extract
soluble cations	Concentration of water soluble cations in the saturation paste extract	Saturation paste extract
SO ₄ -S	concentration of sulfate	ion chromatography on saturation paste extract
Cl	concentration of chloride	ion chromatography on saturation paste extract
Sodium Adsorption Ratio	ratio of sodium to calcium and magnesium	$Na/[(Ca+Mg)/2]^{1/2}$
Metals (Cu, Zn, Fe, Mn, and B)	concentration of available metals	DTPA ² plus Sorbitol extraction, detection by ICP-AES

¹ Inductively Coupled Plasma Atomic Emission Spectroscopy

² diethylenetriaminepentaacetic acid

PERSONNEL

The habitat characterization will be conducted by a team of plant ecologists and botanists with experience conducting quantitative assessments of plant populations and communities. The following briefly describes their qualifications and roles in the project. More detailed information including *curricula vitae* can be provided upon request.

Jodi McGraw, Ph.D., Lead Plant Ecologist and Project Manager

Jodi McGraw is a population and community ecologist with more than ten years experience designing and implementing research to inform the conservation of rare plants. Dr. McGraw has previously conducted a successful habitat characterization for an endangered orchid, and designed and implemented a research program examining the ecology of another endangered species of spineflower. As the Lead Plant Ecologist and Project Manager, Dr. McGraw will

design the study protocol, collect field data, conduct the data analyses, and prepare the presentation and report, with the assistance of Drs. Buck and Willoughby, as described below.

Roy Buck, Ph.D., Lead Botanist

Roy Buck is a consulting botanist with over 25 years experience within the flora of the western United States. Dr. Buck has conducted plant surveys throughout California and assisted implementation of a characterization of a rare plant's habitat. As Lead Botanist on the project, Dr. Buck will assist with collection of the field data, including the floristic analysis of spineflower habitat.

John Willoughby, M.S., Quantitative Botanist

As the head botanist for the Bureau of Land Management in California, John Willoughby has 35 years of experience conducting research to inform rare plant conservation. Mr. Willoughby is recognized for his expertise in designing and implementing successful quantitative studies of rare plant populations. Mr. Willoughby will assist development of the habitat characterization protocol and aid analysis and interpretation of the data.

INFORMATION AND ASSISTANCE

The habitat characterization is designed to build on prior studies examining the spineflower within the Newhall planning area. Success of the study will be greatly facilitated by access to available information about the spineflower and the planning area, including:

- Geospatial data describing the spineflower distribution and abundance within the planning area
- Population sampling data for the spineflower within the planning area
- Additional geographic information system (GIS) data for the project area, including (but not limited to): project area boundaries (incl. proposed preserves), vegetation, soils, roads, existing facilities, elevation contours, high resolution aerial imagery, hillshade, and digital elevation models.
- Plant species lists developed for the planning area.

Our team would also appreciate logistical assistance and support from personnel familiar with the planning area and region, including an initial site reconnaissance tour to orient our team to the various regions that comprise the overall planning area prior to the field work.

DELIVERABLES

The following documents will be prepared during this project:

1. Draft Spineflower Habitat Characterization Study Protocol Spineflower (Task 1)
2. Spineflower Habitat Characterization Study Protocol Spineflower (Task 1)
3. Spineflower Habitat Characterization Presentation (Task 5)
4. Draft Spineflower Habitat Characterization Report (Task 6)
5. Spineflower Habitat Characterization Report (Task 7)

In addition, all raw data including both tabular and geospatial (i.e. geographic information system) data will be provided upon completion of the project.

TIMELINE

Table 3 provides an estimated timeline for completion of the project tasks described above. Shaded areas indicate the months in which the tasks will be performed. Numbers indicate the month in which deliverables will be provided.

Table 3: Anticipated timeline for completion of the seven main tasks to develop a habitat characterization for the San Fernando Valley spineflower between December 2007 and December 2008. Details provided in text.

Number	Task Description	Month												
		Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	Prepare Study Protocol		1	2										
2	Conduct Field Sampling													
3	Conduct Soil Analysis													
4	Enter and Analyze Data													
5	Prepare Presentation													
6	Prepare Draft Report													
7	Create Final Report													

COST ESTIMATE

Table 4 estimates the labor, travel, and other direct costs to implement the habitat characterization. The costs are based on aspects of the current anticipated study design described above, and the assumption that our team of two observers can locate, monument, and collect data within an average of 6.5 sites per day, therefore requiring three weeks of field work, following a single day reconnaissance to examine phenology (flowering status) and become more familiar with the sites before the onset of field work.

The estimated costs are primarily influenced by the level of the sampling effort, the amount and type of data to be collected within the sample sites, and the extensiveness of the data analyses and interpretations. These and other aspects of the study will be refined through preparation of the final study protocol, based upon which a more precise cost estimate could be prepared.

REFERENCES

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McGraw, J. M. 2007a. Habitat Characterization for the San Fernando Valley Spineflower. Memo provided to the Spineflower Team. August 5, 2007. 7 pages.

McGraw, J. M. 2007b. Habitat Characterization for the San Fernando Valley Spineflower: Assessment of Data Gaps That Could begin to be Filled. Memo provided to the Spineflower Team. September 13, 2007. 5 pages plus appendices.

For confidentiality reasons, the cost estimate information has been removed so that this document can be circulated as part of the public review process.

Appendix B
*List of Invasive Ornamental Plants
(Prohibited in Landscape Areas adjacent to
Preserves)*

APPENDIX B
List of Invasive Ornamental Plants
(Prohibited in Landscape Areas adjacent to Preserves)

Botanical Name	Common Name
<i>Acacia latifolia</i>	Sydney golden wattle
<i>Achillea millefolium</i> var. <i>millefolium</i>	common yarrow
<i>Ailanthus altissima</i>	tree of heaven
<i>Aptenia cordifolia</i>	red apple
<i>Arctotheca calendula</i>	cape weed
<i>Arctotis</i> spp. (all species and hybrids)	African daisy
<i>Arundo</i> (all species and hybrids)	giant reed or arundo grass
<i>Atriplex semibaccata</i>	Australian saltbush
<i>Carex</i> spp. (all species)	sedge
<i>Carpobrotus chilensis</i>	ice plant
<i>Carpobrotus edulis</i>	sea fig
<i>Centranthus ruber</i>	red valerian
<i>Chrysanthemum coronarium</i>	annual chrysanthemum
<i>Cistus ladanifer</i> (incl. hybrids/varieties)	gum rockrose
<i>Cortaderia jubata</i> [syn. <i>C. Atacamensis</i>]	jubata grass, pampas grass
<i>Cortaderia dioica</i> [syn. <i>C. sellowana</i>]	pampas grass
<i>Cynodon dactylon</i>	Bermuda grass
<i>Cyperus</i> spp. (all species)	nutsedge, umbrella plant
<i>Cytisus</i> spp. (all species)	broom
<i>Dimorphotheca</i> spp. (all species)	African daisy, Cape marigold
<i>Drosanthemum floribundum</i>	rosea ice plant
<i>Drosanthemum hispidum</i>	purple ice plant
<i>Eichhornia crassipes</i>	water hyacinth
<i>Elaeagnus angustifolia</i>	Russian olive
<i>Eucalyptus globulus</i>	blue gum tree
<i>Festuca rubra</i>	creeping red fescue
<i>Foeniculum vulgare</i>	sweet fennel
<i>Fraxinus uhdei</i> (and cultivars)	evergreen ash, shamel ash
<i>Gaura</i> spp. (all species)	gaura
<i>Genista</i> spp. (all species)	broom
<i>Hedera canariensis</i>	Algerian ivy
<i>Hedera helix</i>	English ivy
<i>Hypericum</i> spp. (all species)	St. John's wort
<i>Limonium perezii</i>	sea lavender (Invades wetlands)
<i>Linaria bipartita</i>	toadflax
<i>Lolium multiflorum</i>	Italian ryegrass

APPENDIX B (CONT.)

Botanical Name	Common Name
<i>Lolium perenne</i>	perennial ryegrass
<i>Lonicera japonica</i> (including 'Halliana')	Japanese honeysuckle
<i>Lupinus arboreus</i>	yellow bush lupine
<i>Lupinus texanus</i>	Texas blue bonnets
<i>Mesembryanthemum nodiflorum</i>	little ice plant
<i>Myoporum laetum</i>	myoporum
<i>Oenothera berlandieri</i>	Mexican evening primrose
<i>Olea europea</i>	European olive tree
<i>Opuntia ficus-indica</i>	Indian fig
<i>Pennisetum setaceum</i>	fountain grass
<i>Phoenix canariensis</i>	Canary Island date palm
<i>Phoenix dactylifera</i>	date palm
<i>Plumbago auriculata</i>	cape plumbago
<i>Polygonum</i> spp. (all species)	knotweed
<i>Populus nigra</i> 'italica'	Lombardy poplar
<i>Prosopis</i> spp. (all species)	mesquite
<i>Ricinus communis</i>	castorbean
<i>Robinia pseudoacacia</i>	black locust
<i>Rubus procerus</i>	Himalayan blackberry
<i>Sapium sebiferum</i>	Chinese tallow tree
<i>Saponaria officinalis</i>	bouncing bet, soapwort
<i>Schinus molle</i>	Peruvian pepper tree, California pepper
<i>Schinus terebinthifolius</i>	Brazilian pepper tree
<i>Spartium junceum</i>	Spanish broom
<i>Tamarix</i> spp. (all species)	tamarisk, saltcedar
<i>Trifolium fragiferum</i>	strawberry clover
<i>Tropaeolum majus</i>	garden nasturtium
<i>Ulex europaeus</i>	prickly broom
<i>Vinca major</i>	periwinkle
<i>Yucca gloriosa</i>	Spanish dagger

Source: Hickman 1993.

Appendix C

Relationship of Argentine Ant to Conserved San Fernando Valley Spineflower Populations

D R A F T
Relationship of Argentine Ant
to Conserved San Fernando Valley Spineflower Populations

SECTION 1 INTRODUCTION AND BACKGROUND

The purpose of this paper is to address the potential impact and management of the invasive, non-native Argentine ant (*Linepithema humile*) on the Newhall Ranch San Fernando Valley spineflower preserve areas and the ways in which these impacts can be avoided, minimized, and mitigated. A Spineflower Conservation Plan (SCP) (Dudek 2007) has been prepared that describes the conservation and management framework to permanently protect and manage a system of preserves designed to maximize the long-term persistence of the state-listed endangered San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*; spineflower) within the project study area described below. The SCP addresses issues that will be important for controlling the Argentine ant in the spineflower preserves such as buffer zones, edge conditions, project design features, and management of hydrology within preserve areas. In response to questions raised by the California Department of Fish and Game (CDFG), who will be issuing a California Endangered Species Act Section 2081(b) incidental take permit for the spineflower, this paper is intended to expand on the issues of controlling Argentine ants in the preserves that were not explicitly addressed in the SCP.

SECTION 2 ARGENTINE ANT BIOLOGY AND GENERAL CHARACTERISTICS

Argentine ants are native to subtropical and mild-temperature portions of Argentina (Holway et al. 2002a). They are small-bodied, about 0.0625 inch long, and are dark-brown to black in color. They are very social and in California they are thought to be “unicolonial,” living in large “supercolonies” that function as one interdependent group and lacking distinct behavioral boundaries among separate nests (Holway et al. 2002a). These supercolonies may consist of hundreds to thousands of members. These ants have more than one queen per colony (i.e., are polygynous), typically with about eight queens for every 1,000 workers (Lanthrop and Valdellon 1999). New colonies form from old ones when a queen leaves with a band of workers to start a new colony in a process termed “budding.” Holway et al. (2002a) note that invasive ants in general tend to be unicolonial and suggest that this pattern allows the colonies to become quite large and dominate invaded habitats.

Argentine ants are omnivores, meaning that they are dietary opportunists and generalists that eat both plant and animal matter, including seeds. This appears to be characteristic of invasive ant species in general (Holway et al. 2002a). Argentine ants, also known as “sugar ants,” have a strong preference for sweet substances.

Argentine ants usually occupy the top 6 feet of soil. They prefer moist soil underneath buildings and sidewalks. As discussed in more detail below, Menke and Holway (2006) experimentally

D R A F T
Relationship of Argentine Ant
to Conserved San Fernando Valley Spineflower Populations

demonstrated with drip irrigation that, with elevated soil moisture and plant cover, Argentine ants both increase in abundance and invade native ant communities, and that the abundance of Argentine ants decreases with cessation of irrigation. Food sources and temperature dictate where they create their nests.

Argentine ants were originally introduced to North America via coffee and sugar shipments to New Orleans from South America around 1890. They have spread to several continents and smaller land bodies around the world, including sub-Saharan Africa, Atlantic Ocean islands, Asia, Australia, the Mediterranean, North America, and Pacific Ocean islands (Holway et al. 2002a). In North America, they have spread eastward from the Carolinas south to Florida and westward through Texas to California (Lanthrop and Valdellon 1999). They are thought to have first spread into Southern California near Ontario in San Bernardino County and then spread rapidly throughout citrus groves (Suarez et al. 1998). They are widespread in mild-temperature, Mediterranean ecosystems, but do not invade tropical and cold-temperature areas (Holway et al. 2002a), possibly because they have relatively narrow thermal tolerances. Holway et al. (2002b) exposed Argentine ants and six native ant species to high temperatures and found that Argentine ants have the lowest tolerance for high temperatures, with 100% of field-collected workers dying after 60 minutes of exposure to temperatures greater than or equal to 46°C (114.8°F). Similarly, Argentine ants were less tolerant of low soil moisture conditions in a laboratory setting. Generally, Argentine ants foraged more actively and had less mortality under warm and humid conditions than they did under hot and dry conditions (Holway et al. 2002b).

Dispersal by Argentine ants occurs by budding as opposed to winged dispersal of females. This budding limits the rate at which Argentine ants can disperse. Based on a compilation of several studies, Suarez et al. (2001) reported that Argentine ants in Northern California disperse at a rate of about 15–270 meters per year and suggest that budding depends on “human-mediated dispersal to colonize new and distant locations.” Invasion of new areas thus occurs at the point of introduction or at points adjacent to source populations. For example, if the adjacent habitat has suitable habitat conditions (i.e., high moisture levels), infested landscape plants translocated to a new development could be a source of introduction that spreads to suitable habitat contiguous with the point of introduction. The likelihood that Argentine ants disperse also relates to nesting behavior, as colonies may relocate nests in response to changes in the physical environment or changes in food sources (Holway et al. 2002a). Argentine ants are also highly adaptive to dispersal in urban environments, able to disperse by “rafting” along water courses, including urban runoff (Holway et al. 2002a).

Recent studies have demonstrated that the invasive population of Argentine ants in California functions as a single large supercolony, based on population genetics and colony structure

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(Tsutsui et al. 2003). Population samples in California compared to native populations in Argentina showed reduced genetic variability in the non-native California population compared to the native population, along with reduced intraspecific (within species) aggression among different colonies. This supercolony structure, and related lack of aggression between different nests, may have important ramifications for long-term management of this species because it is thought to be one of the factors that make the Argentine ant such a successful colonizer.

SECTION 3 IMPACTS ON NATIVE SPECIES AND HABITATS

Invasive ants, including Argentine ants, may significantly disrupt the natural ecosystems within their introduced range. Argentine ants may become abundant within their introduced range and may drive out or kill native ants of a newly invaded territory (Holway et al. 2002a; Suarez et al. 1998). This displacement of native ants is the most obvious and widely reported effect of non-native ants and may cause as high as 90% or more reduction of native ant abundance (Holway et al. 2002a). The displaced ants often are ecologically similar to the invasive ants (e.g., occupy similar ecological niches, use same food resources), but displaced ants may also be ecologically different (e.g., use different food sources), such as harvester ant species that are displaced by Argentine ants in California (Holway et al. 2002a). Cold- and heat-tolerant native ants may better coexist with Argentine ants in California because the Argentine ant cannot as effectively invade their habitats due to limited thermal tolerances and requirement of moist, mild conditions.

Argentine ants may impact native fauna may be mediated through killing or displacing prey of higher trophic species. In Southern California, for example, this impact has greatly reduced the numbers of the coast horned lizard (*Phrynosoma coronatum*), which predominantly feeds on native harvester ants (Suarez and Case 2002).

The mechanisms of displacement of native ants by non-native ants are not well understood, but appear to be some combined effect of what Holway et al. (2002a) call “interference” and “exploitative competition.” Interference by invasive ants refers to worker-level behaviors, such as physical aggression and use of chemical defensive compounds, and colony-level behaviors, such as recruitment of nestmates, interspecific (between species) territoriality, and nest raiding (Holway et al. 2002a). The sheer size of the invading supercolonies relative to native ant populations is an important factor contributing to interference. Interference behavior of Argentine ants in particular includes chemical defensive compounds, physical aggression by workers, workers preying on the winged queens of native species, remaining at baits longer than native species, recruiting to baits in higher numbers than native species, recruiting to more baits than native species, discovering and recruiting to baits more quickly than native species,

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displacing native ants from baits, adjusting foraging behavior to local worker density, and remaining active both day and night and throughout the year (Holway et al. 2002a).

Exploitative competition, though indirect, can have severe impacts on native species. Supercolonies have superior work forces with more “scouts” looking for food and more “recruits” from the nest who help to exploit discovered food sources. This force of numbers allows Argentine ants to discover food and exploit food sources more quickly than native ants (Holway et al. 2002a). Holway et al. (2002a) suggest that exploitative competition may be relatively more important for colonizing new areas, such as “at the leading edge of an invasion front.”

The impact of Argentine ants on native ants can have a cascading effect throughout the ecosystem. In addition to filling the ecological role of displaced native ants, Argentine ants can also directly impact other taxa (Holway et al. 2002a). The known ecological effects of Argentine ants in California on non-ant species through competition and predation identified by Holway et al. (2002a) include:

- Predation on invertebrates, including eggs, larvae, and certain adult forms
- Cause of California gnatcatcher nest failure
- Displacement of harvester ant prey of coast horned lizard
- Lower growth rate of coast horned lizard feeding on Argentine ants
- Lack of geographic overlap between Argentine ants and coast horned lizard (presumably due to impact on harvester ants)
- Negative relationship between Argentine ant density and gray shrew (*Notiosorex crawfordi*) captures
- Negative relationship, absence, or reduced abundance of Collembola (springtails), flies, spiders, beetles, longhorn beetle, yellowjackets (due to attacks on yellowjacket colonies by Argentine ants), mealybug, and walnut aphid.

Of particular interest in this analysis of the Argentine ant is its potential impact on the San Fernando Valley spineflower. Ant-plant “mutualisms” or relationships include tending, seed dispersal, and interactions with flowers (Holway et al. 2002a). If native ants that carry out these functions are replaced by non-native ants that may or may not fulfill any or all of these functions, the reproductive cycle of the plant may be disrupted

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There is some evidence that native ants are pollinators of spineflower. Jones et al. (2004) conducted pollinator studies on spineflower populations on Newhall Ranch and Ahmanson Ranch. They found that one of the dominant floral visitors on Newhall Ranch was a little red ant (*Forelius Mccooki*) and the dominant floral visitors at the Ahmanson Ranch were two species of ants - the pyramid ant (*Dorymyrmex insanus*) and the southern fire ant (*Solenopsis xylonii*). About 76% of red ants collected from spineflower flowers on Newhall Ranch carried one or more spineflower pollen grains. Jones et al. also experimentally demonstrated that the pyramid ant is an effective pollinator of spineflower in a controlled laboratory setting. It appears that ants on Newhall and Ahmanson Ranch may be effective pollinators of spineflower, and, thus, any displacement of these native ant pollinators by Argentine ants could disrupt the reproductive cycle of the spineflower.

Argentine ants that are attracted to floral nectars also may be exploiting the nectar resource more effectively than native non-ant pollinators or directly displacing the native non-ant pollinators. Either way, the presence of Argentine ants may be detrimental to the plant. There is some evidence that Argentine ants are associated with declines in seed set, but the data are equivocal (Holway et al. 2002a).

Ants may be involved in seed dispersal from the parent plant. Some evidence indicates that a native harvester ant (*Messor andrei*) plays a role in dispersal of San Fernando Valley spineflower. LaPierre and Wright (2000) observed harvester ants carrying spineflower flower parts containing seeds to nest sites and spineflower parts were evident in harvester ant midden piles. Harvester ants are capable of foraging for seeds as far as 330 feet from the nest and thus seeds may be dropped along the way. Although there is no direct evidence that Argentine ants impact potential spineflower seed dispersal by *M. andrei*, their documented displacement of native harvester ants indicates a strong potential for disruption of seed dispersal to occur. Moreover, in South Africa, Argentine ants displace native ants that are seed dispersers, but they themselves are poor seed dispersers in that they fail to disperse or bury seeds. They consume the seed's elaiosome (fleshy skin) and leave the seed above ground where it is susceptible to rodent predation and fire (Holway et al. 2002a).

Unchecked and under suitable conditions, Argentine ants may penetrate several hundred meters into native habitats in California. Suarez et al. (1998) investigated the penetration of Argentine ants into fragmented patches of coastal sage scrub in the San Diego region of Southern California. All of the sample locations were within about 10 to 11 miles of the coast and thus experience a fairly strong coastal influence throughout the year, including overcast conditions in the late spring and early summer months. Suarez et al. (1998) report that Argentine ants have penetrated several hundred meters into native habitats. For example, they state that, "at the

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University of California's Elliot Reserve, Argentine ants have displaced native ants over 400 m into the reserve, and at Torrey Pines State Park Argentine ants have penetrated over 1 km into the park (J. King, *unpublished data*), both in areas with predominantly native vegetation" (Suarez et al. 1998, p. 2053). However, Suarez et al. also state that the amount of penetration is correlated with human-mediated disturbances such as the presence of exotic vegetation, changes in soil conditions, and increases in moisture. A complicating factor is that the amount of penetration is site-specific, likely resulting from some interaction among these factors. For example, a canyon receiving runoff from adjacent development (either through natural or artificial drainage), resulting in newly created high moisture conditions, may be vulnerable to invasion and create a point of penetration into surrounding habitat.

Suarez et al. (1998) also provide some systematic data for Argentine ant penetration along urban edges. All traps within 300 feet of urban edges in San Diego canyons showed high levels of Argentine ants, whereas traps greater than 300 feet from urban edges showed lower levels of Argentine ants.

Understanding the mechanisms that create suitable habitat conditions for Argentine ants is critical for controlling invasions. Menke and Holway (2006) conducted field experiments to examine the direct effect of increased moisture through drip irrigation and the associated indirect effect of increased plant cover in irrigated areas on the abundance of Argentine ants and their displacement of native ant species. Irrigated plots had soil moisture ranging from 50% to 80% saturation (depending on time since last watering) while the non-irrigated control transects had soil moistures of less than 5% saturation.¹ By artificially elevating moisture and manipulating plant cover (by suppressing plant cover in irrigated plots), they demonstrated that increased moisture resulted in a greater abundance of Argentine ants and increased their ability to invade native plant communities. Although increased moisture alone caused increases in Argentine ants, the associated increase in plants increased abundance of Argentine ants by 38% over plots where plant growth was suppressed, suggesting that fine-scale variation of the physical environment is an important factor in the susceptibility of an area to Argentine ant invasion. Menke and Holway (2006) suggested that the increased abundance on plots with plants may be related to presence of aphids. They concluded that the increased abundance in irrigated plots was probably due to the "combined result of colony reproduction by budding, nest relocation and enhanced colony productivity" (Menke and Holway 2006). Menke and Holway also concluded that the increased abundance, even when plant growth was suppressed, was directly due to increased moisture because there was no indication that ants were attracted to food resources on the irrigated plots.

¹ Soil measurements were obtained using an Aquaterr EC-200[®] soil probe, which estimates the percentage of saturation of the top 10 cm (3.9 in) of soil.

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SECTION 4 PRESERVE DESIGN

Based on the foregoing review, and particularly on information regarding Argentine ant penetration into native habitats in fragmented canyon areas in Southern California, this section analyzes the risk of Argentine ant invasion of the Newhall Ranch San Fernando Valley spineflower preserve areas.

One factor affecting whether increased moisture could attract Argentine ants to the spineflower preserve is the aspect of the conserved spineflower populations. According to the SCP, in the 2003 and 2005 surveys, spineflower populations tended to be concentrated in the west, southwest, southeast, east, northwest, and flat aspects. The south, northeast, and north aspects consistently had the lowest percentages of spineflower populations (Dudek 2007). The spineflower preserves generally conserve those aspects that have the greatest natural concentrations of spineflower. These aspects are also those that would have the most xeric natural conditions resulting from greater solar and wind exposure and, thus, would be less likely to support moist conditions conducive to invasion by Argentine ants. In addition, the spineflower preserves are about 25 to 30 miles from the coast and experience hotter and drier summers than the coastal areas of San Diego (i.e., within 10 to 11 miles of the coast) where Suarez et al. (1998) observed ants in all sampled areas. It is possible that the spineflower preserves in the more inland area of Santa Clarita (where the Newhall Ranch spineflower preserve areas are located) would be less susceptible to Argentine ant invasion—all else being equal—than native habitats in coastal San Diego County, although this hypothesis would need to be tested.

The SCP analyzed the amount of buffer between the urban edge and spineflower populations within each of the preserve areas. The buffers between spineflower populations and urban development are required by the Newhall Ranch Specific Plan (NRSP) EIR to be at least 80 feet, and in most cases the buffer is much greater than 80 feet. In order to control Argentine ant invasions, this minimum 80-foot buffer will need to remain a “dry zone” where typical (i.e., non-rainy season) soil moistures are maintained below 10% saturation. Even though a few Argentine ants (scouts) may occur in this dry zone looking for suitable foraging and nesting resources, the chance of colonization will be greatly reduced if this zone can be maintained as a dry, xeric area.

These preserve buffer zones will be adjacent to fuel modification zones (FMZs) that will provide additional separation from the edge of urban development. Although FMZs are for public safety and the protection of property and not for management of the spineflower preserves, some general principles can help provide additional protection against Argentine ant invasions between the edge of urban development and spineflower populations. The foremost principle is to use native or non-invasive, non-native, drought-resistant plants to the extent possible in the

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FMZ to minimize the amount of irrigation required to maintain the vegetation; irrigated zones should be eliminated to the extent possible, and particularly in the area adjoining the spineflower preserves. Soil disturbances in the FMZ should be avoided and minimized to reduce the chance of erosion, disturbance of cryptobiotic soils, and impacts to native species because Argentine ants also appear to be attracted to disturbed areas (Suarez et al. 1998).

The following section discusses project design features and mitigation and management measures for preserve areas that will further reduce the risk of Argentine ant invasions into the spineflower preserves.

SECTION 5 PROJECT DESIGN FEATURES AND MITIGATION AND MANAGEMENT MEASURES FOR PRESERVE AREAS

Controls on Argentine ants will likely require a combination of methods. The primary method is to maintain an inhospitable habitat condition between the development area and the spineflower preserve. This species is sensitive to moisture gradients and is more likely to invade mesic areas and avoid xeric areas. Menke and Holway (2006) noted that the abundance of Argentine ants changes dramatically across soil moisture gradients. They suggest that interception and diversion of urban runoff from naturally xeric areas could restrict invasions by Argentine ants and that “even small reductions in urban run-off may act to limit *L. humile* in areas that are otherwise too dry” (Menke and Holway 2006, p. 374). Thus a “dry zone” between urban and natural habitats where there is naturally little moisture may act a barrier for the ants and inhibit them from invading the natural areas.

Therefore, the focus of the Argentine-ant-control approach will be to implement measures that minimize the likelihood of Argentine ants establishing colonies at the interface between spineflower preserve and development areas and expanding into the preserve. Several project design features and mitigation and management measures described in the SCP will help prevent invasions of the Argentine ant into the spineflower preserves. Additional control measures beyond those specifically discussed in the SCP are discussed in this section.

Project Design Features

First, to minimize initial establishment of Argentine ants adjacent to preserves, container plants to be installed within 200 feet of the preserves shall be inspected for pests, including the Argentine ant, and any plants found to be infested shall be rejected. The CBI (2000) study suggests that this measure will be moderately effective for buffer widths of 80 to 100 feet and highly effective at buffers greater than 200 feet.

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Second, project-specific design measures will be implemented in order to minimize changes in surface water flows to the spineflower preserve areas. These measures are intended to maintain the existing hydrology of the preserves and to prevent unnatural increases in moisture within the preserves. As described above, increased soil moisture is the primary cause of Argentine ant invasions into natural habitats. Roadways will be constructed with slopes that convey water flows within the roadway easements and away from spineflower preserve areas. French drains will be installed along the edge of any roadways and fill slopes that drain toward the preserve areas. The CBI (2000) study suggests that French drains should be highly effective for buffers as small as 15 feet in width. Underground utilities will not be located within or through the preserve areas. Drainage pipes installed within the preserve areas (but away from spineflower populations) to convey surface or subsurface water away from the populations will be aligned to avoid the preserve areas to the maximum extent practicable. Fencing or other structural barriers that will be installed to reduce intrusion of people or domestic animals into the preserve areas shall incorporate footing designs that minimize moisture collection.

Storm drain outfalls from proposed development areas will only be installed within preserve areas where necessary to retain hydrologic conditions within the preserves, to sustain existing riparian and wetland habitats, and/or to allow for the restoration of currently disturbed areas to native riparian/alluvial habitat. It is important that no new wetlands or riparian areas are inadvertently created in proximity to spineflower populations.

When located in a preserve area, storm drains must meet the following criteria:

1. Storm drains must not impact spineflower either directly or indirectly, based upon specific evaluations and a determination by CDFG.
2. Storm drains within preserve areas may only daylight at the bottom of slopes.
3. Under no circumstances shall storm drains daylight onto steeply sloped areas or other areas that would cause erosion.

Any surface water entering a preserve area from development areas is required to pass through best management practice (BMP) measures, in accordance with the requirements of the County of Los Angeles (County) and the California Regional Water Quality Control Board (RWQCB), which will be described in the Stormwater Pollution Prevention Plan (SWPPP). Storm drain outlets must contain adequate energy dissipaters to prevent downstream erosion and stream channel downcutting, in accordance with County and RWQCB requirements.

In addition, storm drain outlets must be designed based on pre- and post-construction hydrologic studies (in accordance with NRSP EIR Mitigation Measure 4.6-69 [County of Los Angeles

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2003]). Storm drains and BMP measures shall be designed by a qualified licensed civil engineer, with design reviews by the consulting biologists, the County, and CDFG. Long-term maintenance of storm drain BMPs will be the responsibility of a County landscape maintenance district or other entity responsible for BMP maintenance.

General Monitoring and Management

Although the project design features described above will help control Argentine ant invasion into the spineflower preserves, there is still a potential for invasions to occur where typical soil moisture increases above about 10% saturation. Fortunately, invasions by Argentine ants, if they occur, are reversible under appropriate conditions. Menke and Holway (2006) demonstrated that Argentine ant abundance systematically declined in experimentally irrigated areas over a few months once the irrigation was terminated. If soil moisture can be restored to 10% saturation or less, Argentine ant abundances will decrease. If, for example, Argentine ants were found to have invaded an area of the preserve, remediation of the causal factor in increasing soil moisture will reduce the abundance of the ants in that area.

Qualitative and quantitative monitoring for Argentine ants should be performed quarterly and include an overall review of the spineflower populations and habitats within the preserve and preserve buffer. Based on the Suarez et al. (2001) study, which indicates that populations disperse at a rate of about 15 to 270 meters per year, quarterly monitoring for Argentine ants should be adequate to detect incipient invasions. The monitoring will note physiognomic changes and potential problems associated with Argentine ants such as evidence of increased moisture along the edges of and within preserve areas. Systematic sampling for Argentine ants should be conducted using pitfall traps established at various points along the urban–preserve interface (see *Appendix A* for a suggested field method).

The monitoring will inform management recommendations as necessary to maximize the likelihood that spineflower populations remain free of Argentine ant invasion and in a healthy state. Special attention should be placed on examining preserve edges, as these locations are where new ant invasions and other problems such as collecting moisture are often first detected. Quarterly assessments will also include a review of the preserve’s physical features, including the condition of protective fencing, adjacent storm-drain outfalls, and BMPs to ensure they are functioning properly and not creating a suitable environment for Argentine ants.

Managing Infestations

Complete Argentine ant eradication in an urbanized environment is not feasible because the species is well-established in Southern California and is a very prolific colonizer. A more

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practical objective is to control their populations and prevent their spread into new areas. The most effective approach is to control soil moisture at potential invasion points—in this case, along the urban–preserve edge.

If ants appear, there are generally two distinct approaches to direct controls: (1) source or nest/mound treatment, and (2) broadcast applications.

Source or nest/mound treatment requires locating the colony’s nest or mound and applying an insecticidal treatment in or around the nest. Delivery of the poison can be through a liquid drench treatment, dust or granule cover, or fumigation. Ants must come into contact with the insecticidal agent and killing the colony’s queen is imperative to success. Nest/mound treatment can be effective, but it can also be costly because it is labor intensive.

Broadcast applications involve the distribution of insecticidal bait over large infested areas. Baits work because ants share food and nutrients among one another. If food contains a slow-acting toxicant that is not detected, it gets passed from ant to ant and eventually to the queen. Baits can also be applied in a source treatment at the nest/mound. Specific site conditions will dictate which treatment method will be appropriate to use. With any of these treatments, special consideration must be given to special-status wildlife and plants, non-target native ants, and/or other beneficial insects that may be affected by the treatments.

Through quarterly monitoring along the preserve edge, it should be possible to identify trouble spots fairly early before large colonies become established. If only a few ants (scouts) are trapped and soil moisture conditions in the area appear to be low enough to preclude colonization, a localized search within 300 to 500 feet of where the ants were observed may be adequate to identify and fix a source of increased moisture (e.g., a leaking pipe or uncaptured runoff) that could create a future problem. If the monitoring reveals a high abundance of ants in the area, suggesting the presence of a nearby nest, the direct controls discussed above may be warranted.

SECTION 6 SUMMARY AND CONCLUSION

This paper reviews the biology of the invasive Argentine ant and the risk of the Newhall Ranch San Fernando Valley spineflower preserves to Argentine ant invasions. This species is well-established in Southern California and can be expected to invade areas adjacent to urban development that provide suitable habitat conditions, such as where soil moisture levels are allowed to remain relatively high (>10% soil saturation). The keys to controlling Argentine ants in the spineflower preserves include:

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- Providing “dry zones” between urban development and spineflower populations where typical soil moistures are maintained at levels below about 10% soil saturation, which will deter the establishment of nesting colonies of ants
- Ensuring that landscape container plants installed within 200 feet of spineflower preserves are ant-free
- Maintaining natural hydrological conditions in the spineflower preserves through the project design features for roadways, French drains, and storm drains that convey water away from the preserves
- Using drought-resistant plants in FMZs and minimizing irrigation to the extent feasible
- Quarterly monitoring along the urban–preserve edge to detect incipient ant invasions and remedying any inadvertent sources of moisture that could create suitable ant habitat
- Managing infestations through direct controls such as source or nest/mound treatment and/or broadcast applications.

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APPENDIX A

Field Method for Sampling for Argentine Ants

APPENDIX A

Field Method for Sampling for Argentine Ants

Pitfall trapping for Argentine ants is fairly straightforward but should be conducted by a biologist/entomologist who can identify the local invertebrate fauna to species level (to the extent possible) and at least to genus level. The following excerpt from Suarez et al. (1998) describes the basic field sampling methods:

The pitfall traps consisted of 60 mm wide (internal diameter at the mouth), 250-mL (8-oz) glass jars. The jars were placed in a pattern resembling the five on a die with the corner jars being 20 m apart. The traps were filled halfway with a 50:50 water : Sierra brand antifreeze mix. Sierra brand antifreeze (Safe Brands, Omaha, Nebraska, USA) was used because it is non-toxic and works as an excellent preservative of insects. The jars were dug into the ground so the lip of the jar was flush with the surface. The jars were collected after 5 [days] and all ants counted and identified....Pitfall traps are an effective method for sampling ant communities (Anderson 1995, 1997) and provide an estimate of ant activity for each species by counting the number of workers falling into the jars for each [5-day] sample period.

Appendix D
Spineflower Conservation Plan
Adaptive Management Program Module
November 2007

SPINEFLOWER CONSERVATION PLAN

Adaptive Management Program Module

November 2007

This adaptive management program (AMP) module was developed as a component of the Spineflower Conservation Plan (SCP) (Dudek 2007a). The AMP module includes portions that have been incorporated into Section 10.0 of the SCP, as well as detailed descriptions of seven threats evaluated as part of the adaptive management planning process. The AMP module is being prepared in isolation to facilitate the development and review process. This page outlines the basic structure of the module.

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SPINEFLOWER CONSERVATION PLAN

Adaptive Management Program Module

November 2007

INTRODUCTION

Development of the Adaptive Management Framework

Development of an adaptive management framework to support the conservation goal of this Plan began after preliminary attempts to develop management based upon performance standards and remedial-action triggers proved to be premature. The combination of natural variability inherent with spineflower populations and the lack of available information regarding the taxon's biology and ecology required the adoption of a more flexible, programmatic approach.

As described in Section 4.0 of the SCP, the spineflower is an annual, spring-blooming plant exhibiting dramatic fluctuations in aboveground populations apparently tied to annual climatic variability and other poorly understood stochastic (random) environmental variables. Population levels vary from very small numbers of plants in severe drought years to millions of plants when growing conditions are more favorable. From a management and monitoring perspective, therefore, the natural variability in the observed population levels can interfere with detecting the effects of non-natural factors. In particular, population declines due to anthropogenic factors can be very difficult to differentiate from the natural variability of the system. Furthermore, annual plant seed banks are difficult to study because a potentially large and significant portion of the population resides below ground in a seed bank that is otherwise difficult to directly quantify. The need to balance this natural uncertainty with the demands for developing scientifically based and timely conservation and management methods calls for a flexible adaptive management approach.

The adaptive management framework proposed in the Plan thus is designed to balance natural sources of uncertainty with the demands and finite timescale associated with the conservation planning process. The adaptive management planning team was expanded in 2007 with the addition of outside scientific experts Jodi McGraw, PhD, and John Willoughby to the existing team of resource agency staff, land managers, landowners, and consultants representing CDFG, the Center for Natural Lands Management (CNLM), and Newhall Land. Since that time, development of the adaptive management framework has proceeded steadily, through iterations of strategy and design, using available information.

The Concept of Adaptive Management

McEachern et al. (2006) provide a description of the concept of adaptive management. Their description is provided in the context of multiple-species conservation planning, but it applies equally well to this situation, given the similar issues of uncertainty and incomplete information that are often inherent in the conservation planning process (McEachern et al. 2006, p. 18).

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[Adaptive management] is an iterative process of strategy, design, implementation, monitoring, evaluation and adjusting management to maximize conservation success. It evaluates decisions or actions through carefully designed monitoring and proposed subsequent modification to management, threat abatement and monitoring. The modifications are in turn tested with an appropriate, perhaps redesigned, monitoring protocol. At each turn of the cycle, active learning through monitoring and evaluation reduces management uncertainty. Adaptive management is logical, can deal with uncertainty and data gaps, and is similar to the scientific process of hypothesis testing.

Components of the Adaptive Management Framework

Using the McEachern et al. (2006) description as a foundation, the proposed adaptive management framework includes the following key elements:

- Biological goals and objectives
- Description of the programmatic approach
- Identification and evaluation of threats
- Reporting and plan adjustments
- Monitoring Protocols (Section 11.0 and Appendix E of the SCP)

These key elements form the basis of the proposed adaptive management program and thus provide the framework that will be augmented and modified as the adaptive management program progresses.

Programmatic Approach

The proposed adaptive management framework is being developed as a stressor-based plan that focuses on managing anthropogenic threats. Monitoring will be tied directly to management actions (i.e., “effectiveness” monitoring), such that management can be evaluated as having the desired effect of maintaining or enhancing spineflower populations. Management actions are categorized as near-, intermediate-, and long-term (i.e., 0 to 1 year, 1 to 5 years, and 5 to 20 years; time frames are set based on the timing of Annual Program Review) and are linked to the characterization of threats as low, medium, or high priorities for management. For example, near-term actions would address high-priority threats, such as existing and anticipated invasion by non-native species. Annual review, near-term adjustment, long-range planning, and the

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development of annual work plans are incorporated as features of the adaptive management framework.

Adjustments to the annual work plans will rely on feedback from monitoring activities and on the newly available information (e.g., scientific research) to guide changes in management activities or overall strategy. Adjustments to management will also be made based upon the response of spineflower to experimentally designed small scale management trials. Decision-making responsibilities and ongoing development of the adaptive management process are the responsibility of an Adaptive Management Working Group comprising land managers, stakeholders, and scientific experts. The Adaptive Management Working Group is responsible for evaluating completed management actions and defining explicit objectives for future management actions.

A total of 10 threats were initially identified and evaluated during the development of the adaptive management program. Seven threats, including non-native plants, the loss of genetic diversity, fire suppression, trampling, fire exclusion, herbivory and seed predation, and the disruption of the natural soil-disturbance regime, are being carried forward as a focus of the adaptive management program, and detailed evaluations are provided below. Drought, nitrogen deposition, and Argentine ants were originally considered to be addressed through adaptive management, but were eliminated for different reasons: Drought and nitrogen were eliminated from the adaptive management program because direct management is not considered feasible and since their potential effects are manifested in changes (i.e., increased cover of non-native grasses, changes in vegetation communities) that are already being addressed by adaptive management. Because Argentine ants can be effectively managed within and adjacent to the preserves through general aspects of preserve design with a limited need for active management

Biological Goals and Objectives

The following biological goals and objectives are the cornerstone of the adaptive management program for the spineflower within the preserves established as part of the Newhall Ranch Specific Plan (Specific Plan).

Three main goals for the preserves presented here describe the desired conditions of (1) the spineflower populations, (2) the communities in which the spineflower occurs, and (3) the ecosystem processes known or hypothesized to maintain the spineflower populations and associated communities. For each goal, a set of objectives provides the steps for attaining the goals, and a short explanation or rationale is provided for each objective.

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Population

Goal 1: Maintain or increase San Fernando Valley Spineflower populations within the preserves.

Objective 1.1

Maintain or increase the distribution of the spineflower within each preserve. Persistence of an endangered plant is enhanced when it occupies a larger geographic area. The more extensive the distribution (i.e., areal extent), the lower the probability that localized events such as wildfire, pest outbreaks, or disease will remove the entire population. Therefore, it is anticipated that maintaining or increasing the distribution of spineflower within each preserve will reduce the probability that foreseen and unforeseen changes in habitat conditions will result in population declines that could threaten persistence throughout the preserve system.

Objective 1.2

Maintain or increase the abundance of the spineflower within each preserve. In general, more abundant populations (i.e., those comprising more individuals) will have a greater probability of persisting and maintaining genetic diversity necessary to adapt to a changing environment than smaller (less abundant) populations. Existing anthropogenic alterations to the habitat within the preserves, including the invasion and spread of exotic plants, may have reduced spineflower abundance. Management of preserves will be designed to remove unnatural barriers to spineflower populations and maintain conditions conducive to persistence of a viable seed bank, in order to increase abundance and enhance long term population persistence. It is important to note that this objective will be reached within the context of an ecological system so that maintaining or increasing spineflower abundance retains ecological functions as near to “natural” as possible rather than compromising other aspects of the ecosystem.

Objective 1.3

Reduce or prevent the increase of identified stressors or anthropogenic factors that negatively impact spineflower individual and population performance. Management of the preserves will be designed to address anthropogenic factors that are known or hypothesized to reduce spineflower individual and population performance, including exotic plants, Argentine ants (*Linepithema humile*), trampling or erosion due to trespass, and introduction of unseasonal run-off from off-site locations.

Objective 1.4

Increase understanding of the ecological factors influencing the distribution, abundance, and population persistence of the spineflower in order to inform management and

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monitoring within the preserves. Many gaps remain in the understanding of the ecology of the spineflower, making it difficult to devise management strategies to prevent its extirpation, and to design efficacious monitoring protocols. Studies, management, and monitoring will be designed and implemented to increase information about the spineflower needed to inform habitat management and increase the effectiveness of monitoring, thus facilitating Objectives 1.1 through 1.3.

Objective 1.5

Plan and conduct small scale experimental management trials to test the effects of proposed on-the-ground management treatments and evaluate effectiveness and spineflower's response. Tools and treatment methods needed to manage spineflower and its habitat, including measures to address excessive competition and implement weed control in occupied habitat, will be tested by implementing small scale experimental trials. The results will be monitored and evaluated, and those measures which produce a favorable spineflower response or otherwise do not result in adverse ecosystem effects, would then be implemented across larger areas over time.

Communities

Goal 2: Maintain or enhance the structure and native species composition of the native communities within the spineflower preserves.

Objective 2.1

Maintain a mosaic of naturally occurring native communities within the preserves. Under this objective, management would be implemented if a 25% change or greater is observed in the absolute cover of existing native plant communities within each preserve, as measured through a combination of remote sensing and aerial mapping at 10-year intervals. Land slated to be included within the spineflower preserves currently supports a mosaic of native plant communities likely reflecting different abiotic conditions (e.g., soils, topography, and microclimate) and disturbance history (time since fire, cultivation, grazing regime, and other land uses). The proposed preserves also include considerable acreage of disturbed land and non-native annual grassland, which can be restored to native vegetation types and perhaps even suitable spineflower habitat. The existing native plant communities differ in native plant species composition, including the presence and relative abundance of spineflower. As a result of their different plant species composition and physiognomy (structure), these communities likely differ in the habitat conditions (e.g., food availability, abiotic conditions) and thus animal species composition. Through a variety of direct and indirect mechanisms, these

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plants and animals could be essential to the long-term persistence of the spineflower populations (e.g., by maintaining populations of pollinators and/or seed dispersers).

Anthropogenic contributions to global climate change are generally accepted by the scientific community, and these changes over time may influence the type and composition of native vegetation communities as well as other aspects of the natural environment in Southern California. Although it is an objective of this plan to prevent anthropogenic changes to the naturally occurring communities within the preserves, management of the preserves is not intended to reverse or slow changes that are the result from global climate change.

Objective 2.1(a)

Restore damaged habitats potentially capable of supporting spineflower, within the preserves. Specific areas shall be restored where they appear capable of being potentially occupied by spineflower. A spineflower Habitat Characterization Study will be conducted in the spring season following issuance of the Incidental Take Permit. The results of the study will be used to inform the restoration of potentially suitable spineflower habitat, and maps will be produced showing the areas where such restoration will occur. Area-specific plans will be prepared for each location where restoration will occur and reviewed by the proposed adaptive management working group, and approved by CDFG.

Objective 2.1(b)

Revegetate areas within preserves that have been damaged and do not support native habitats but are unlikely to support spineflower in the future. Damaged habitats with deeper valley soils, for example, may not be suitable for spineflower, but may be capable of supporting other appropriate native habitats and pollinator habitat. These locations will also be identified and plans prepared, similar to Objective 2.1(a) to revegetate them and repair soil damage.

Objective 2.2

Maintain or increase the absolute cover of native plant species by 15% within each preserve every 10 years. Native plant species are important components of natural communities. Maintaining or increasing their relative abundance will facilitate the persistence of native plant populations and the maintenance of native plant communities to which native animals, fungi, and other organisms are adapted.

Because early successional stages characterized by sparse native plant cover provide the ideal habitat for some species, perhaps including the spineflower, increasing *total* native plant cover would be an inappropriate target. Instead, the objective will be to maintain and enhance the

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natural community structure and species composition, and to increase relative native plant cover—the proportion of the total plant cover that is composed of native plant species.

Objective 2.3

Maintain or increase the diversity of native plant species within each preserve by at least 15%, as measured within each preserve every 10 years. Maintaining the diversity of native plant species is also important for the persistence of native communities. A function of species richness and evenness, diversity is often created and maintained by natural ecological processes, including disturbances (e.g., fire) that enhance the diversity of habitat conditions for animals as well as other organisms. Species diversity will be examined at both at the landscape scale (i.e., total diversity), which is a function of community heterogeneity, and at the local or ‘plot’ scale (i.e., alpha diversity).

Though the abundance and diversity of other organisms including animals and fungi are also important, it can be difficult and costly to monitor all of the different groups of organisms. Native plant species can be used cautiously as indicators of native community structure for purposes of monitoring overall habitat conditions, unless research indicates this assumption is not met in this system.

Objective 2.4

Increase understanding of the ecology of the native communities needed to inform management of the preserves by undertaking the studies specified as part of the adaptive management program. Greater knowledge about the ecology of the natural communities within the preserves will facilitate management to attain the objectives designed to attain the population, community, and ecosystem goals. Information that could facilitate conservation and management includes: 1) ecological factors that influence the spatial variability in abiotic and biotic conditions within the communities, 2) species composition of various taxonomic groups (including mammals, birds, herpetofauna, insects, fungi, etc.), 3) components of the natural disturbance regimes, 4) ecological responses to disturbance, and 5) successional relationships among communities.

Ecosystem

Goal 3: Facilitate the natural ecological processes required to sustain the native populations and communities in the preserves.

Objective 3.1

Maintain or enhance opportunities for migration of plant and animal populations, including spineflower, between preserve areas. Following development, the preserves will

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contain remnant patches of native habitat. All else being equal, small areas are less likely to support persisting populations of endangered species than large areas. If extirpations occur, recolonization will be unlikely due to patch isolation. Genetic diversity is often lower in small, isolated habitat patches, due to genetic bottlenecks, inbreeding, and genetic drift.

Providing opportunities for plant and animal populations to migrate between protected areas can increase the probability of species persistence by increasing the size of populations, allowing recolonization following localized extinctions, and increasing genetic exchange among otherwise isolated populations.

Objective 3.2

Maintain the hydrologic conditions within the preserves. Direct and indirect impacts associated with adjacent development, particularly that which occurs upslope of the preserves, can alter hydrology and thus affect soil moisture and erosion processes. Increased moisture underneath and on the soil surface is predicted to facilitate the invasion and spread of Argentine ants—non-native arthropods that outcompete native ants that could be important spineflower pollinators and/or seed dispersers. Increases in soil moisture can also facilitate populations of native and non-native plants that can outcompete spineflowers, which are poor competitors. Preserves should be managed to prevent alterations to soil moisture by avoiding concentrated runoff, inhibiting drainage, and other factors that could increase soil moisture

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THREATS

The threats discussed in this section are based on discussions with the scientific experts (McGraw and Willoughby), observations by biologists working in the field (Dudek and FLx), and input from CNLM, the land management entity that will be responsible for managing the proposed preserves. Threats are assigned low, medium, or high priority for management using several criteria: severity of impacts, probability of occurrence, certainty of consequences, and indirect and interactive effects.

Severity of Impacts

Each threat has either known or hypothesized impacts to spineflower. Impacts can be direct or indirect, and can affect spineflower at the population, community, or ecosystem level. This is a qualitative estimate of the magnitude of the impacts that could occur, regardless of whether the impacts are well-known and documented in the scientific literature, or whether they are only hypothesized to occur based on local observations or observations of similar situations elsewhere.

Probability of Occurrence

Probability of occurrence estimates the likelihood that the identified threat will occur or be present within or adjacent to the preserves. Non-native plants, for example, are currently present throughout the preserves, are already ubiquitous within developed areas of the Specific Plan adjacent to the preserves, and thus there is a 100% certainty that non-native plants occur within these areas and ought to be addressed by management.

Certainty of Consequences

Certainty of consequences addresses whether the impact of a potential threat to spineflower is adequately studied and documented in the literature and is virtually certain. Non-native annual grasses, for example, are known to have competitive effects detrimental to other native species, and the same is likely true for spineflower. In an experimental study of the Ben Lomond spineflower, low rainfall conditions were only found to have negative effects on demographic performance if non-native annual grasses were also present (McGraw 2004). Soil compaction and erosion (as indirect effects of trampling), on the other hand, could actually have both positive and negative effects on spineflower. Some level of soil compaction and erosion may increase the availability of suitable microhabitats by providing “safe sites” that are relatively free of potential competitors. Alternatively, soil compaction and erosion may invite colonization by invasive annual grasses and have an overall negative impact on spineflower.

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Indirect and Interactive Effects

This section describes other ways in which an identified threat could have additional impacts to spineflower by influencing or combining with one or more other identified threats.

Each threat is explored further with a description of the relevant background information, known or hypothesized effects, the relationship between the threat and the biological goals and objectives, questions and topics for future research, the proposed management strategies and techniques, and proposed monitoring activities.

Individual threats are discussed in detail below. *Table 1*, Threats Characterization Summary, and *Figure 1*, Stressor Model, provide an overview of the threats characterization, proposed management actions, and a conceptual illustration of on the relationships between identified stressors and the basic life stages of the spineflower.

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TABLE 1
Threats Characterization Summary

Threat	Information Known or Needed	Management and Monitoring
High Priority for Management		
Non-Native Plants	<ul style="list-style-type: none"> • Non-native plants are fairly ubiquitous within preserves. • Effect of non-native plants has not been well-studied for spineflower, but congeners are generally poor competitors and typically negatively impacted by non-native species. • Fire suppression, and cessation of cattle grazing can exacerbate the impacts of non-native plants. • Non-native plants reduce availability of belowground resources (water and soil nutrients), reduce light availability, and create thick litter on the soil surface that can inhibit seedling germination and establishment. • Non-native plants can indirectly affect spineflower by reducing populations of pollinators and/or seed dispersers, accelerating soil development and thus succession, and altering the natural fire regime. • Habitat characterization may identify correlation (positive or negative) between spineflower performance and non-native plants and experimental studies may examine the effects of various treatments intended to reduce the abundance and effects of non-native plants. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Develop preserve system non-native plants management plan to eradicate, control and prevent non-native plants. 2. Collect baseline data regarding non-native plant distribution and abundance. 3. Define management goals and objectives based on habitat characterization study and experimental studies examining available management techniques. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Monitor effectiveness of non-native plant management techniques. 2. Monitor non-native plant distribution and abundance in concert with annual abundance sampling to determine effects of management on spineflower distribution and abundance. 3. Monitor distribution and abundance of non-native plants within the preserves.

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Threat	Information Known or Needed	Management and Monitoring
Loss of Genetic Diversity	<ul style="list-style-type: none"> • Loss of genetic diversity is recognized as a significant threat to the conservation of endangered taxa. • Small population size and low genetic diversity can interact to increase risk of extinction. • Outcrossing, migration, and maintenance of seed banks are the primary mechanisms by which genetic diversity is maintained. • Primary causes of reduced genetic diversity include the loss of pollinators (i.e., ants, bees), increased rates of self-pollination, reduced or ineffective seed dispersal, and the reduction of seed bank, all of which could result from reduced connectivity between preserves. • Loss of genetic diversity can reduce demographic and population performance and the ability of a population to respond to changing environmental conditions. • A series of studies will investigate the genetic structure of spineflower occurrences, the presence of local adaptations within the occurrences, and whether a correlation exists between genetic diversity and potential pollinators. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Focus on maintaining and enhancing conditions for pollination, seed dispersal, and/or migration. 2. Possibly investigate the mechanisms of a loss of genetic diversity. 3. Artificial transplantation of seed between occurrences is not proposed at this time because current information is insufficient to understand the potential effects and associated risks. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Monitor changes in the invertebrate and small mammal populations 2. Monitor for decreased fitness associated with loss of genetic variation. Annual spineflower abundance sampling will track changes in cover that will provide an indication of annual seed production.
Medium Priority for Management		
Fire Suppression	<ul style="list-style-type: none"> • Fire suppression may include clearing, bulldozing and other activities conducted by fire agencies to control and suppress fires. • Areas of the preserves have burned on 7 separate occasions from 1858 to 2007 and fire suppression activities are expected to increase with development. • Fire suppression can directly impact spineflower and its habitat by damaging vegetation physically and chemically. • Indirect effects of fire suppression include increased erosion, the establishment of non-native plants, increased thatch and altered hydrology. • No experimental studies are recommended to manage fire suppression. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Fire response plan for first responders. 2. Establish contacts for communication and coordination with fire department and other appropriate agencies. 3. Periodic meetings to review fire response plan. 4. Incorporate fire response plans as an appendix to the SCP. 5. Repairing soil, seed bank and habitat values if preserve lands are affected by ground-disturbed suppression activities. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Opportunistic ad hoc studies to examine effects of various management treatments under post-fire conditions.

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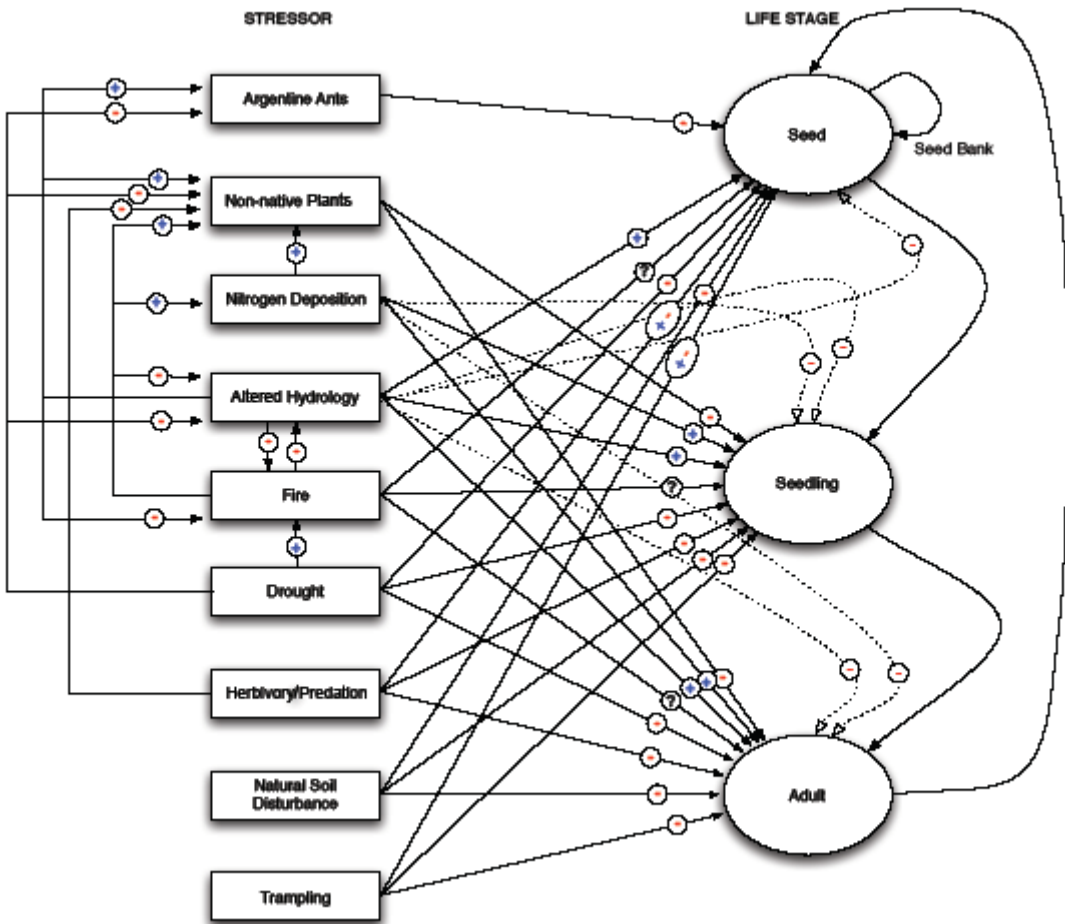
Threat	Information Known or Needed	Management and Monitoring
Trampling	<ul style="list-style-type: none"> • Access to preserves will be controlled, but unauthorized access could lead to soil compaction or trampling. • Trampling could also occur inadvertently as a result of management activities such as weed removal and biological monitoring activities within the preserves. • Trampling of spineflower can increase mortality and reduce productivity, but can also indirectly impact spineflower through increased cover of non-native plants, erosion, soil compaction, and loss of soil organic horizon. • Spineflower impacts associated with soil and vegetation disturbances from trampling are addressed through studies specific to these factors; focused research on the impacts of trampling in itself are not recommended at this time. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Control access to preserves. 2. Install clearly marked, fenced boundaries. 3. Outreach and education. 4. Install signing as early as possible. 5. Include patrolling and enforcement of boundaries if necessary. 6. Planning management and monitoring activities within occupied areas to minimize adverse effects of trampling on aboveground plants. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Quarterly monitoring to evaluate whether fencing and signage are successful in preventing unauthorized access which could lead to trampling impacts within the preserves.
Low Priority for Management		
Fire Exclusion	<ul style="list-style-type: none"> • Fire exclusion involves fuel modification practices between developed areas and preserves. • Fire exclusion may increase shrub cover and decrease openings in scrub habitats transitioning habitat towards conditions thought to be unfavorable for spineflower, and can also increase the risk of high-intensity fires. • Fire exclusion can allow unnatural accumulation of litter on soil surface; increased plant cover and litter may be unfavorable for growth and establishment of spineflower. • It is unclear whether fire exclusion increases or decreases non-native cover. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Results of habitat characterization study to inform whether potential effects of fire exclusion will require management. 2. Available management actions include physical (mechanical or manual) control or removal of shrubs within preserves. Prescribed burns may be utilized if determined to be a viable and useful management tool. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Increased shrub cover would be monitored as part of the overall monitoring of vegetation communities within the preserves.

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Threat	Information Known or Needed	Management and Monitoring
Herbivory and Seed Predation	<ul style="list-style-type: none"> • Herbivory and seed predation have not been directly studied, but physical signs of herbivory have been observed anecdotally in the field in the study area. • Spineflower may be susceptible to herbivory by small mammals and invertebrates, which may negatively affect germination, plant growth, seed production, seed viability, and seed dispersal. • Reduced abundance of predators (coyotes, raptors) could increase herbivory by small mammals. • Invasion by Argentine ants could result in the displacement of existing invertebrate seed predators that are effective seed dispersers. • The habitat characterization study should determine extent of herbivory within preserves. 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Maintain large core open-space areas and biological connectivity between preserves to maintain presence of top predators. 2. Control of small mammals through trapping and exclusionary fencing if herbivory or granivory shown to be deleterious. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Periodically conduct raptor and scat and track surveys to estimate the abundance of top predator species 2. Effectiveness monitoring to evaluate the success of reducing the effects of herbivory and granivory.
Disruption of Natural Soil-Disturbance Regime	<ul style="list-style-type: none"> • Sources of soil disturbance include mammal diggings, trails, and erosion. • Soil disturbance can disrupt the creation and maintenance of safe sites for spineflower and create openings for the establishment of ruderal plants. • The habitat characterization study could determine what the sources of soil disturbance and whether aspects of spineflower performance are correlated with such disturbances (either natural or artificial). 	<p>Management Strategies and Techniques</p> <ol style="list-style-type: none"> 1. Prevent anthropogenic disruptions of natural soil disturbance regime. 2. Collect more data regarding the effects of soil disturbance and determine whether the overall effect is positive or negative for spineflower. <p>Monitoring</p> <ol style="list-style-type: none"> 1. Status and trends of soil disturbances within occupied portions of the preserves will be tracked as part of annual spineflower abundance sampling.

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FIGURE 1
Stressor Model



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Non-Native Plants

Priority: High

Non-native plants were identified as a high priority for management within the preserves for the following reasons:

- Severity of Impacts: Non-native plants may have a very severe negative impact on spineflower population performance.
- Probability of Occurrence: Non-native plants are fairly ubiquitous within the preserves and invasions are likely to continue.
- Certainty of Consequences: Though not studied in this system, prior research has identified that other species in the *Chorizanthe* genus are poor competitors and that demographic rates (i.e., recruitment of new individuals and seed production) decline in the presence of non-native annual grasses and forbs.
- Indirect and Interactive Effects: Other anthropogenic impacts, including nitrogen deposition, fire suppression, and cessation of cattle grazing, can exacerbate the impacts of non-native plants, which can also alter the effects of disturbance on spineflower populations.

Background

A suite of non-native plants has become established within the California sagebrush scrub and California annual grassland communities in which spineflower occurs. Non-native annual grasses are widespread and patchily very abundant, including *Avena* spp., *Bromus diandrus*, *B. madritensis*, *Schismus barbatus*, and *Vulpia myuros*. Non-native forbs co-occurring with spineflower include *Brassica* spp., *Centaurea melitensis*, *Erodium* spp., and *Salsola tragus*. There is potential for a new invasion by yellow star thistle (*C. solstitialis*), which is expanding its range in the southern California area. Point-intercept transect sampling of spineflower polygons in the Entrada, Airport Mesa, Grapevine Mesa, Potrero Canyon and San Martinez Grande occurrences conducted in 2006 found that relative cover of non-native species in the sampled polygons ranged from 50% to 94% (Dudek and Associates 2006). In 2007, cover estimates based on quadrat sampling within sampled spineflower polygons found that relative cover of non-native species ranged from 28% to 100%, with relative cover of non-native grasses and forbs accounting ranging from 25% to 100%, and 0% to 33%, respectively (Dudek 2007).

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Known or Hypothesized Effects and Their Mechanisms

Based on research examining the effects of non-native annual grasses and forbs on a species in the same genus as the San Fernando Valley spineflower, *Chorizanthe pungens* var. *hartwegiana*, non-native annual plants are hypothesized to compete with spineflower, reducing both individual and population performance (Kluse and Doak 1999; McGraw 2004). The impacts of non-native annuals occur through a variety of mechanisms, including:

- Reducing availability of soil resources (moisture, soil nutrients)
- Reducing light availability
- Creating thick litter on the soil surface that can inhibit seedling germination and establishment (McGraw 2004).

Invasive plant species alter the dynamics of the entire community. Hamilton (1997) presents evidence that southern California grasslands now dominated by non-native grasslands were likely to have once been occupied by desert scrub. Therefore, a distinct vegetation type developed due to disturbance (primarily grazing) rather than a simple conversion from native to non-native grassland as originally presumed (Hamilton 1997). Conversion to grassland, however, is not unidirectional, but rather depends on the level of disturbance experienced by the community. In general, areas that have been subjected to recent burning, grazing or other disturbance are typically dominated by grassland while areas without disturbance are likely to become dominated by shrubs (Frudenberger et al. 1987). Conversion from one vegetation type to another facilitates transformations throughout the ecosystem. Coastal sage scrub in particular appears to be susceptible to change, even over short time scales, because of its extensive coexistence with invasive annual grasses. By altering nutrient and moisture regimes, exotics inhibit the establishment, growth and survival of native shrubs, thereby fundamentally altering community structure and ecosystem functions (Minnich and Dezzani 1998).

Non-native annual plants could also indirectly negatively impact spineflower populations by:

- Reducing populations of pollinators and/or seed dispersers (i.e., by excluding native species and habitats that support natural native animals)
- Accelerating soil development and thus succession, which can increase the competitive environment, thus precluding use of habitat by
- Altering the natural fire regime (e.g., by increasing fire frequency, intensity, and/or severity by increasing the habitat's flammability) (D'Antonio and Vitousek 1992).

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Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for non-native plants will help achieve the following specific biological objectives:

- Population: Objectives 1.1, 1.2, 1.3, and 1.5
- Community: Objectives 2.1, 2.2, 2.3, and 2.4.

Questions and Future Research

Prior observational studies have not examined patterns of spineflower distribution, abundance, or performance in relation to non-native plants, nor have experimental studies been conducted to examine the specific effects of non-native plants on the San Fernando Valley spineflower.

The following are specific questions that will be addressed through a habitat characterization study to be undertaken in the spring of 2008 if favorable rainfall conditions occur and through future experimental research that will be designed, in part, based on results of the habitat characterization study.

Habitat Characterization

Are the distribution, abundance, and/or performance of spineflower (positively or negatively) correlated with the occurrence of:

- One or more non-native plant species?
- Guilds (or functional groups) of non-native plant species (e.g., annual grasses, annual forbs)?
- Non-native plant species overall?

What are the distribution and abundance of non-native plant species within occupied spineflower habitat?

Are there any observable and consistent patterns in the occurrence of non-native plants and abiotic characteristics of the habitat (e.g., soil conditions) or disturbance (e.g., soil disturbances, time since fire) that might indicate the microhabitats in which non-native plants are most likely to occur in general and/or to compete with spineflower?

Experimental Studies

Experimental studies will be designed to examine the effects of various treatments intended to reduce the abundance and competitive effects of non-native plants. Experimental studies will

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evaluate available non-native plant management techniques that are appropriate for use within portions of the preserves occupied by spineflower. Such experiments will involve establishing replicated plots in which various treatments are tested, including for example:

- Soil disturbance
- Weed whipping or mowing
- Raking (i.e., to remove accumulated thatch, if identified as a potential impediment)
- Small scale burning under controlled conditions
- Direct hand weeding
- Carefully timed selective herbicide application.

Management Strategies and Techniques

Management of the preserves has been designed to eradicate, control, and prevent non-native plants within the preserves. Specific management strategies will be developed within the context of a preserve-system non-native plant management plan which identifies the following:

1. Baseline data documenting the current distribution and abundance of each non-native species, gained from the habitat characterization study. Following completion of this study, mapping will be undertaken to capture spatial differences in weed abundance and distribution so that subsequent treatments can be customized.
2. Goals and objectives for non-native plant management within the preserve system and each preserve, derived from the habitat characterization study and any experimental studies
3. Strategies, targets, and techniques for non-native plant management within the preserve system and each preserve, derived from the habitat characterization study and any experimental studies
4. A coordinated program for non-native plant management within the preserves, including:
 - a. A prioritized list of non-native plant control and eradication projects, developed through consideration of the distribution, abundance, impacts, and methods of control as well as the impacts of control methods on spineflower
 - b. Timelines and budgets for project implementation
 - c. A detailed program to prevent invasion by new non-native plants.

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Depending on the outcome of the habitat characterization study and any experimental studies, various strategies will likely need to be developed for different guilds of non-native plants, including non-native grasses, early-season forbs, and late-season forbs, or for individual non-native plant species. Management techniques and metrics will also differ depending on the existing conditions of specific areas within the preserves. Management in areas dominated by non-native plant species will be intended to convert these areas back to native vegetation types, while in areas with existing native vegetation management will be intended to retain native character and reduce or prevent invasion by non-native plants. These should be based on available outside research examining effective control techniques (e.g., the use of Fusilade to control annual grasses; see Allen 2006) and will be tested and refined through on-site experimental trials designed to evaluate their effectiveness and effects on spineflower in this system. Those techniques that are proven to be successful would be implemented across a larger scale to achieve broader goals and objectives. Management strategies and techniques would be refined through the adaptive management processes, in which effectiveness of management is evaluated through monitoring and changes are made, as needed, to enhance achievement of the management objectives.

Monitoring

Monitoring linked to management within the preserves has been designed to attain four goals with regard to non-native plants:

1. Evaluate the effectiveness of management in attaining the goals and objectives established for non-native and native plant species within the preserves, including relative and absolute cover.
2. Examine the effects of non-native plant management techniques on spineflower populations, including abundance and distribution.
3. Assess the status and trends of non-native plant populations within the preserves.
4. Increase understanding of the factors influencing the distribution and abundance of non-native plants and their impacts on spineflower within the preserves.

These goals could be attained through three main types of monitoring.

Project Monitoring

The first two goals will be attained through project-level monitoring, in which non-native plant control projects are monitored to examine their effectiveness at attaining the goals and objectives of the control effort (e.g., reducing non-native annual grasses to <10% absolute cover) and to

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determine their effects on spineflower populations. Project monitoring can include conducting management as an explicit experiment, in which the factors mentioned in the goals above are compared between treatment areas and untreated areas (i.e., control areas).

Biological Effectiveness Monitoring

As part of monitoring protocols to track the distribution and abundance of spineflower through time, observations of non-native plant distribution and abundance will also be recorded, allowing managers to evaluate the status and trends of spineflower distribution and abundance as well as to increase understanding of how non-native plant populations interact with changes in the environmental conditions (e.g., disturbance, annual rainfall) to influence spineflower populations.

Non-Native Plant Monitoring

The status and trends of non-native plants within the preserves will also be monitored through a separate protocol focused on determining their occurrences preserve-wide, such as aerial extent mapping. This protocol would be used to supplement project and biological effectiveness monitoring studies and would provide additional information about the status and trends of non-native plants throughout the preserves and, perhaps, throughout the adjacent buffer areas and fuel modification zones from which non-native plants could invade.

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Loss of Genetic Diversity

Priority: High

The loss of genetic diversity was identified as a high priority for management for the following reasons:

- Severity of Impacts: The loss of genetic diversity is widely recognized as a significant threat to the conservation of endangered taxa, and the loss of genetic diversity thus is considered to be a significant risk to the long-term persistence of spineflower.
- Probability of Occurrence: Loss of genetic diversity can occur in a number of ways in response to both natural conditions and anthropogenic factors. The likelihood that spineflower occurrences conserved within the preserves will be subject to anthropogenic factors (loss of pollinators and seed dispersers, reduced connectivity between preserves) with the potential to reduce genetic diversity is moderate.
- Certainty of Consequences: The nature and magnitude of impacts due to reduced genetic diversity can vary, depending on the scale at which diversity is measured and the observed genetic structure, but the overall effect is presumed to be an increased risk of extinction over time.
- Indirect and Interactive Effects: The interaction of small population size and low genetic diversity can increase the risk of extinction.

Background

The genetic structure (intra- and interrelatedness) of spineflower occurrences in the Newhall Ranch RMDP study area has not been studied, so the potential for a loss of genetic diversity is currently unknown. Generally, outcrossing (via pollination) and migration (via seed dispersal between occurrences) are the primary mechanisms by which genetic diversity is maintained; for annual plants like spineflower, the seed bank is the repository for this reservoir of diverse alleles. Seed banks of annuals disproportionately represent genotypes that were successful in good years when large quantities of seeds were produced. In addition, a single year's seed production may not contain as much diversity as the entire seed bank, which represents that of several years of aboveground plants (Baker 1989). Genetic diversity within preserves would primarily be influenced by natural selection interacting with insect-mediated pollen exchange and movement of seeds over time. Genetic diversity between preserves primarily would be influenced by seed dispersal between preserves, and, to the extent that potential pollinators are capable of traveling between preserves, by pollination between preserves. Although other invertebrate taxa have been documented as floral visitors (Jones et al. 2002, 2004) and represent potential pollinators, native

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ants are hypothesized to be among the primary pollinators of spineflower (Jones 2007). Other pollinators include flies, beetles, and bees as well as other invertebrates. The relative abundance of these groups of pollinators differed between the different sites within Newhall Ranch (Grapevine Mesa, Mesa South, and Magic Mountain) and varied seasonally (Jones et al. 2004). European honeybees have been observed visiting spineflowers at the Laskey Mesa site (Jones et al. 2002) and may be able to transfer pollen between preserves. It is believed that European honey bees currently may be experiencing colony collapse syndrome, and pollination relying upon them therefore may be tenuous.

Known or Hypothesized Effects and Their Mechanisms

Loss of genetic diversity may threaten the ability of a species to persist in the face of abiotic and biotic environmental change by altering the ability of a population to cope with short-term challenges, such as pathogens and herbivores. Spineflower is susceptible to reduced genetic diversity through several general mechanisms discussed below whose effects tend to be exacerbated in populations of limited size. The presence of a seed bank, however, helps to retain genetic variation within a population by buffering against dramatic changes in genetic composition (Ellstrand and Elam 1993).

Genetic drift decreases variation within populations and increases differentiation among populations. Smaller populations are more susceptible to the loss and reorganization of variation by genetic drift than larger populations.

Inbreeding increases homozygosity within populations. Smaller populations tend to lose heterozygosity faster than larger populations. Increased homozygosity as a result of so-called inbreeding depression is associated with reduced demographic and population performance, specifically decreases in viability and fecundity (Ellstrand and Elam 1993).

- A plant species' mating system may influence its susceptibility to loss of genetic diversity. Honnay and Jacquemyn (2007) found that the genetic diversity of self-compatible species were less affected by decreasing population size than self-incompatible species.
- Spineflower appears capable of self-pollination, but studies have not been conducted to determine seed viability. In a laboratory experiment, Jones et al. (2004) found that spineflower excluded from all insect visitors experienced 29.2% seed set compared to spineflower excluded from all insects except for ants that experienced 64.6% seed set.
- Jennersten (1988) found that lower pollinator visitation rates were associated with lower seed sets in *Dianthus deltoids* in fragmented sites compared to intact sites.

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- Horovitz and Harding (1972) found that self-pollination in an annual lupine, *Lupinus nanus*, varied across populations, and that self-pollination was negatively correlated with pollinator abundance.
- Self-incompatible plants in small populations can suffer from the inability to find a mate resulting in a lower seed set per individual and an increased variation in seed set among individuals (Byers and Meagher 1992).

Gene flow is the movement of genes among populations either through mating or migration of seeds (Ellstrand and Elam 1993). This generally contributes to more genetic variation making habitat fragmentation a primary conservation concern (Honnay and Jacquemyn 2007). Under certain circumstances in small populations, however, gene flow can reduce local variation, prevent local adaptive differentiation, and reduce fitness through outbreeding depression (Ellstrand and Elam 1993).

- Genetic erosion and a subsequent loss of fitness (e.g., demographic performance) caused by the loss of adaptive traits could occur if gene flow between previously connected occurrences is interrupted.
- Genetic contamination could occur by mixing previously isolated occurrences through human-mediated transplantation efforts and could lead to the unintended loss of local adaptations and an overall decline in fitness.
- Hybridization between sensitive rare species and more common species can put the rare species at risk of genetic assimilation or if the progeny is sterile or fitness is reduced, the plant may suffer from outbreeding depression (Ellstrand and Elam 1993). Turkish rugging (*Chorizanthe staticoides*), a common species from the same genus, co-occurs with spineflower but it is not known whether hybridization occurs or if it is possible.

The primary causes of reduced genetic diversity likely include the loss of pollinators, increased rates of self-pollination and reduced or ineffective seed dispersal, leading to loss of genetic diversity harbored in the seed bank and even reductions in the amount of viable seed produced. Increased isolation and loss of connectivity could lead to losses in unique alleles. Increased distance between preserved spineflower populations may result in reduced exchange of pollen or dispersal of seed to new areas.

Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for the loss of genetic diversity will help attain the following specific biological objectives:

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- Population: Objectives 1.1, 1.2, 1.3, and 1.4
- Community: Objective 2.4
- Ecosystem: Objective 3.1.

Questions and Future Research

The first step in developing an appropriate strategy for maintaining genetic diversity is to complete a genetic study to investigate the genetic structure of the spineflower occurrences in the Newhall Ranch RMDP study area. This initial study of genetic diversity will utilize neutral genetic markers to compare differences in genetic diversity within and between spineflower occurrences, and if feasible, will sample the genetic diversity of the seed bank as well. Sampling seed banks in the field, however, can be very challenging and may not be feasible without an efficient way to collect and sort seed collected in the field. A second component to this study will investigate the viability of seed produced from self-fertilized individuals compared to seed produced from pollinated individuals. This genetic study is considered a high priority and will be conducted in the near-term within a 1-year time frame or in the first year where there are sufficient aboveground populations to undertake the study.

A second, more involved genetic study would investigate the presence of local adaptations within the spineflower occurrences. This study would take place in the medium-term 1- to 5-year time frame.

Another question to address would be: Is genetic diversity related to the abundance or assemblage of native ants and other invertebrate species?

Management Strategies and Techniques

Management strategies will focus on maintaining and enhancing conditions for pollination, seed dispersal, and/or migration.

In addition to maintaining habitat conditions to facilitate the natural movement of pollen and seed within and among preserves, depending on the outcome of the genetic studies, artificial human-mediated transfer of seed between adjacent occurrences could be used as a management technique for maintaining genetic diversity. Although according to Ellstrand and Elam (1993), the introduction of migrants may slow or halt loss of genetic variation caused by drift, the human-mediated transfer of individuals (i.e., seed) is not proposed at this time. Substantial information would be necessary to understand the potential effects of transplanting seed between

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populations and substantial risk is associated, for example, with the potential for the inadvertent loss of locally adapted alleles important for survival.

Monitoring

Monitoring of changes in the invertebrate and small mammal populations will be implemented to detect potential disruptions in gene flow within and among preserves.

Directly monitoring changes in genetic variation can be difficult. A more practical approach may be to monitor for decreased fitness associated with the loss of genetic variation, indicated, for example, by reduced seed set (Ellstrand and Elam 1993). As described in Appendix E of the SCP, spineflower abundance sampling will utilize cover as a measure of abundance which will also provide a measure of seed production, since the number of involucre is related to plant size (Dudek 2007).

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Fire Suppression

Priority: Medium

Fire suppression was identified as a medium priority for management within the preserves for the following reasons:

- Severity of Impacts: Fire suppression activities can involve clearing, bulldozing, and other activities that have direct impacts on habitat and species. Alteration of the natural fire frequency return interval reflecting conditions that local vegetation and species are adapted to, is also a concern. Long-term impacts within the preserves may occur, resulting from changes in vegetation communities (e.g., increased cover of non-native species, increased litter produced by expanding shrub cover).
- Probability of Occurrence: Based on historical records between 1858 and 2006, portions of the preserve areas were burned on 6 separate occasions as a result of 38 fires that occurred within 0.5 mile of the Newhall Ranch RMDP study area. Historical fire frequency appears to be correlated with current levels of shrub cover within preserves. For example, San Martinez Grande has had the highest fire frequency return interval (20 to 30 years) and supports very low shrub cover, whereas Grapevine Mesa has had low fire frequency and supports a more diversified complex of shrub, tree, and herb layers (County of Los Angeles Fire Department 2007). Increasing urbanization is expected to increase the frequency of wildfires in the area and, therefore, the need for fire suppression activities.
- Certainty of Consequences: Previous studies have documented the negative effects of fire suppression on other native plants. Clearing, bulldozing, and other activities within the preserves would directly impact spineflower and its habitat, particularly if conducted within occupied habitat areas.
- Indirect and Interactive Effects: Potential indirect effects could include erosion, soil compaction, the establishment of non-native plants, introduction of new weeds, and altered hydrology if sheet flow is redirected.

Background

In the greater Santa Clarita area, 39 fires have been documented within 0.5 mile of the Newhall Ranch RMDP study area based on Los Angeles County records between 1858 and 2007 (Recent fire records since 1950 jointly maintained by CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies include fires 10 acres or greater in size. Fire records prior to this typically only recorded large fires, however, what was historically considered a large fire was not defined and may have varied over time. As a result, fire records prior to 1950 may

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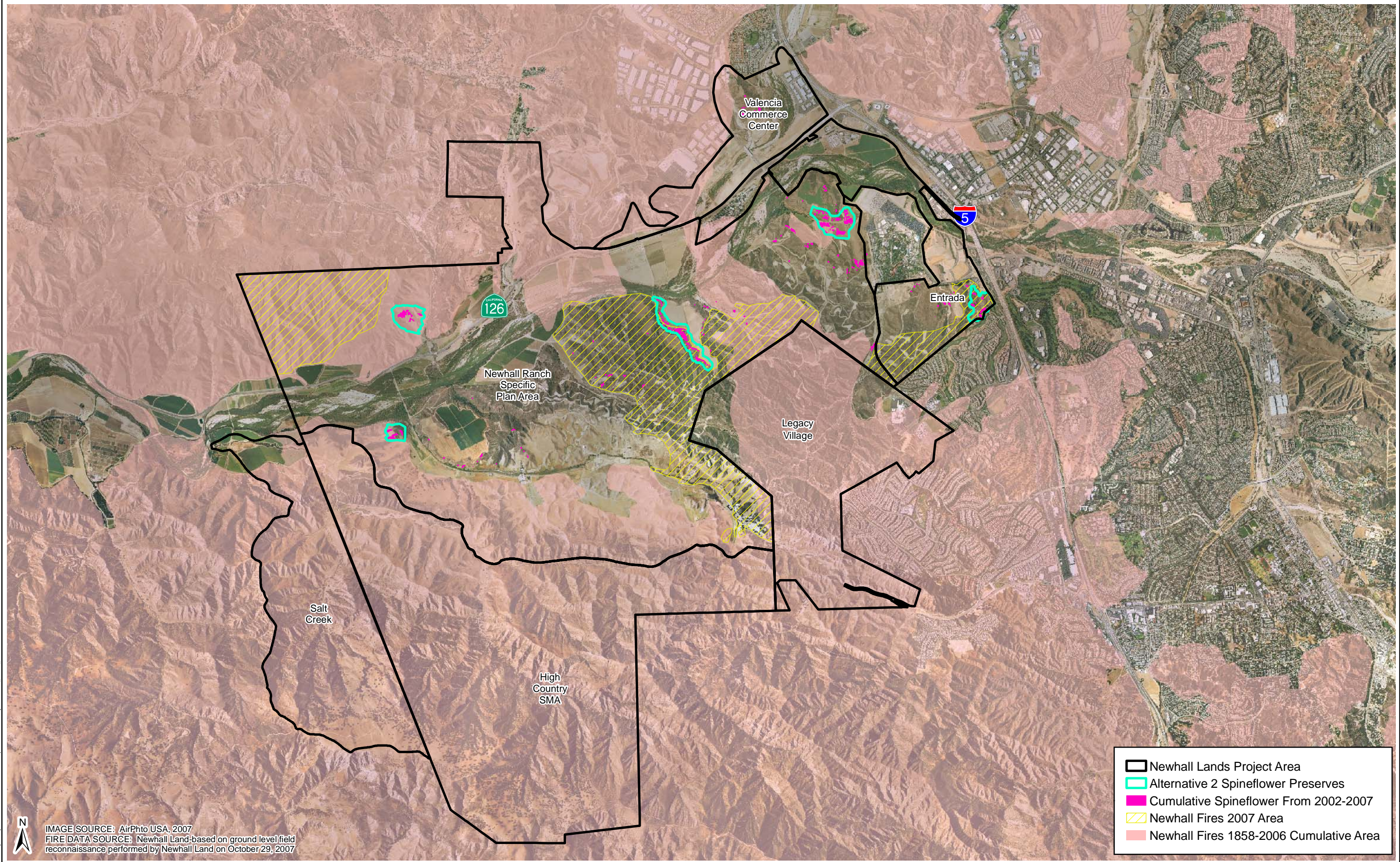
understate the occurrence of fire). Seven fires have occurred within the proposed boundaries of the actual preserves during this period, including the Magic fire in October 2007 that burned portions of Entrada and Grapevine Mesa. *Table 2* summarizes these fire occurrences. *Figure 2* shows the cumulative boundary of all fire perimeters occurring within the greater Santa Clarita area between 1858 and 2007. In response to wildfires, fire agencies conduct clearing, bulldozing, and other activities to control and suppress fires. It should be noted that the causes of these fires are unknown, (although typically, the vast majority of wildfires in southern California are human caused) except for Verdale in 2003, which was caused by aircraft.

TABLE 2
Newhall Fire History 1858-2006: Incidents Occurring within at least 0.5 mile of Newhall RMDP Study Area

Year	Fire Name	Total Acres Burned	Preserve Area Burned (Acres)
1913		644	
1927	HARRISON RANCH NO. 5	34	
1929	BOWMAN RANCH NO. 88	251	
1930	TOWER NO. 88	132	
1940	TOWNLEY CYN-PICO CYN	598	
1943	NEWHALL FIRE NO. 197	1,889	San Martinez Grande (32)
1945	SHERIFF NO. 109	70	
1953	EDISON	771	
1954	PICO FIRE	327	
1962	GOLDEN FIRE	5,409	
1963	RAMONA	54	
1969	VALENCIA FIRE	438	
1969		568	
1970	MAYO FIRE	2,420	San Martinez Grande (32)
1970	CLAMPITT FIRE	10,565	Potrero (6)
1970		17	
1975		12	
1975		19	
1975		39	
1979	HASLEY FIRE	97	
1979	CHIQUITA FIRE	1,315	
1979	VALENCIA FIRE	463	
1979	WAYSIDE FIRE	266	
1982	HASLEY FIRE	93	
1986	HASLEY FIRE	14	
1986		8	
1986		42	
1988	PIRU FIRE	3,508	
1988	PIRU	2,639	San Martinez Grande (34)
1989		50	
1989		4	
1989		4	
1989		43	Airport Mesa (8)

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Year	Fire Name	Total Acres Burned	Preserve Area Burned (Acres)
1989		12	
1995	SAN MARTINEZ FIRE	3	
2000	WEST	121	
2003	VERDALE	2,102	San Martinez Grande (34)
2003	SIMI FIRE	10,201	
2007	MAGIC FIRE	1,219	Entrada (24), Grapevine Mesa (26)



Z:\Projects\373801\Newhall Ranch\export\Fire History\Newhall_Fires_1858-2007.mxd - SB 12/14/07 NM

IMAGE SOURCE: AirPhoto USA, 2007
 FIRE DATA SOURCE: Newhall Land-based on ground level field reconnaissance performed by Newhall Land on October 29, 2007

DUDEK
 Santa Barbara GIS Division
 621 Chapala Street
 Santa Barbara, Ca 93101
 (805) 963-0651

0 0.5 1 Miles

Newhall Ranch
Newhall Fires 1858-2007 Cumulative Area

FIGURE
2

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Known or Hypothesized Effects and their Mechanisms

Fire suppression activities have been documented to negatively impact natural communities and constituent species. Damage caused by bulldozing and clearing have a direct impact on vegetation. Chemicals, such as fire retardants and suppressants, also directly impact soil and vegetation. Surfactant suppressant foams partially dissolve plant epicuticular wax, making the plants more susceptible to other threats. Fire retardants can decrease nitrogen mineralization; however, no other chemical or microbial changes in soil treated with fire retardants were detected in laboratory tests (Backer et al. 2004). In addition, gasoline or diesel contamination, which is a risk involved in fire suppression efforts, can induce negative plant responses, including acute toxicity, inhibited germination, and stunted and retarded growth (Backer et al. 2004).

Erosion is one of the indirect outcomes of fire suppression activities, such as the construction of fire lines and roads. Fire lines and the associated berms cause artificial channeling that accelerates erosion. The use of tractors, bulldozers, and wheeled skidders to construct fire lines also contributes to soil compaction (Backer et al. 2004). Both erosion and soil compaction alter the natural soil characteristics, which may negatively affect spineflower.

Fire suppression activities also can promote the introduction and spread of invasive species. Fire camps, fire lines, helibases, and incident command posts are likely sites for invasion by invasive plants because personnel, vehicles, and equipment can act as vectors for propagules (Backer et al. 2004; Keeley 2006). For example, higher densities of the non-native spotted knapweed (*Centaurea maculosa*) were found on bulldozer-constructed fire lines, and knapweed density decreased exponentially with distance from the fire line. Post-fire rehabilitation treatments, such as tilling and ripping the soil, post-fire logging, and the application of straw mulch contaminated with weeds, can also promote the spread of non-native plants (Backer et al. 2004). By increasing the risk of non-native plants, fire suppression activities can indirectly affect spineflower by exposing spineflower to competitive pressure by non-native plants. (See discussion on the threat of non-native plants for more information.)

Backfires and “burnout” areas may also indirectly affect vegetation. Backfires from containment lines may increase the extent and intensity of the fire. Burnout operations remove unburned “islands” of vegetation, producing a much more homogeneous burned area than would occur within typical fires. Refugia for plants and animals can even be removed by these burnout operations (Backer et al. 2004).

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Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for fire suppression will help attain the following specific biological objectives:

- Population: Objective 1.3
- Community: Objectives 2.1, 2.2, and 2.3
- Ecosystem: Objectives 3.1 and 3.2.

Questions and Future Research

Prior observational studies have not examined patterns of spineflower distribution, abundance, or performance with respect to fire suppression, nor have experimental studies been conducted to directly examine the effects of fire suppression on the spineflower.

In the case of fire suppression, thoughtful planning is likely to be a more profitable approach than focusing efforts on research. However, in the event that fire suppression activities do take place within or adjacent to the preserves, opportunistic ad hoc monitoring studies could be implemented to examine the effects of various management treatments under post-fire conditions. In addition, a fire response plan will be in place to avoid and minimize the direct impacts of fire suppression activities. Many of the potential indirect impacts (i.e., non-native plants, erosion) are threats identified elsewhere and will be managed accordingly.

Management Strategies and Techniques

Specific management strategies for fire suppression in the preserves shall be designed to cover the following:

1. Developing a fire response plan for first responders
2. Establishing contacts for communication and coordination with the fire department and other appropriate agencies
3. Conducting periodic meetings with appropriate agencies to review the fire response plan
4. Incorporating the fire response plan as an appendix to the SCP (Dudek 2007a).
5. Repairing soil, seed bank and habitat values if preserve lands are affected by ground-disturbing suppression activities.

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Monitoring

Opportunistic ad hoc studies to examine effects of fire suppression within or adjacent to preserves.

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Trampling

Priority: Medium

Trampling was identified as a medium priority for management within the preserves for the following reasons:

- Severity of Impacts: Trampling could have significant direct and indirect impacts to spineflower and habitat conditions within the preserves. Impacts could be severe but would likely be localized to the area directly disturbed by trampling.
- Probability of Occurrence: Access to preserve areas will be restricted via exclusionary fencing, signage and enforcement, so the incidence of trampling is expected to be low. However, trampling may also occur as a result of authorized or planned activities, including non-native plant control and spineflower monitoring.
- Certainty of Consequences: Direct trampling of spineflower occurrences would have a clear direct impact on spineflower performance through increased mortality and reduced flowering and seed production. Depending on the level of trampling, indirect effects could negatively impact spineflower due to potential increased cover of non-native plants, erosion, soil compaction, and loss of soil organic horizon¹.
- Indirect and Interactive Effects: Soil compaction and erosion (as indirect effects of trampling) could have both positive and negative effects on spineflower, but it is assumed that most impacts would be negative. Trampling could promote the invasion and spread of non-native plants, by both vectoring their seeds and by creating disturbance, which can promote their establishment.

Background

The primary cause of trampling within preserves is expected to be caused by human trespass. Preserves will be set aside as open space for conservation purposes only and will not be authorized for public uses, including both passive (e.g., hiking) and active recreation. Access to the preserves will be restricted using fencing and signage. However, trespassing into the preserves may occur and could include unauthorized foot traffic, though proposed fencing should be adequate to prevent entry by mountain bikes, horses and motorized off-highway motor vehicles (OHVs), such as motorcycles and quad runners. There is also the potential for trampling

¹ An organic layer of fresh and decaying plant residue at the surface of a mineral soil (NRCS 2007).

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to occur inadvertently as a result of management activities such as weed removal and habitat monitoring within the preserves.

Known or Hypothesized Effects and their Mechanisms

Trampling has been documented to have both positive and negative ecological effects. On the positive side, it can slow the growth of competitive dominants and allow the persistence of less vigorous species by creating openings in vegetation, and higher rates of species richness have been attributed to trampling (Hobbs and Huenneke 1992). However, these openings can also facilitate the establishment of non-native plants (CBI 2000). Also on the negative side, Cole (1987) correlated trampling with a decrease in species richness and Hobbs and Huenneke (1992) demonstrated that most, though not all, species were negatively impacted by trampling. A study (Mashinski et al. 1996) comparing the endangered sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*), before and after it was protected from human trampling, showed that seedlings became reproductive more quickly, the total numbers of undamaged plants surpassed the numbers of damaged plants, and the population began to stabilize rather than decline after protection. In addition, the consequences of trampling are dependent upon the severity of the damage. For example, plants with light damage produced seven times more fruit than plants with severe damage (Maschinski et al. 1996). As an herbaceous plant, spineflower branches and stems can be easily crushed or broken and damage to this species is expected to be more severe than to more robust plants (CBI 2000).

Soil compaction and the loss of soil organic horizons are indirect effects of trespassing or trampling, apart from the direct loss of vegetation cover. Although in one study (Cole 1987) the loss of organic horizons sufficient to expose the underlying mineral soil only occurred at higher levels of trampling, the extent to which such soil disturbances caused by trampling affect spineflower demographic performance remains unknown and should thus be assumed to be negative.

Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for trampling will help attain the following specific biological objectives:

- Population: Objectives 1.2 and 1.3
- Community: Objectives 2.1 and 2.2

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Questions and Future Research

The potential direct and indirect effects of trampling are expected to be minimized to an acceptable level by restricted access to the preserves through fencing, signage, and enforcement. Because the more obvious direct effects of trampling (e.g., OHVs) are almost certainly negative, focused research on their impacts is not recommended at this time. Apart from a focus on trampling impacts themselves, spineflower impacts related to soil and vegetation disturbances (i.e., non-native plants) are addressed through studies that are specific to these impacts.

Management Strategies and Techniques

Management of the preserves should be designed to control unauthorized access to the preserves. This includes:

1. Controlling public access to preserves
2. Installing clearly marked, fenced boundaries
3. Public outreach and education
4. Installing signage as early as possible
5. Increasing patrolling and enforcement of preserve boundaries if unauthorized access becomes evident.
6. Planning management and monitoring activities within occupied habitat to minimize adverse effects of trampling on aboveground plants.

The success of protection from human disturbance has been documented. In a study that controlled access to an area in the western Mojave Desert via fencing resulted in greater overall community biomass and diversity as well as other benefits (Brooks 1995).

Monitoring

Monitoring will be conducted periodically along the preserve boundaries to evaluate whether fencing, signage and current levels of enforcement (i.e., patrols) are successful in preventing unauthorized access. Monitors will search specifically for typical signs of unauthorized access including damaged fencing, vandalism, creation of foot trails, litter, etc. Monitoring the preserves for unauthorized access that could lead to trampling impacts will initially be conducted on a quarterly basis, but the frequency of monitoring may be increased depending on the proximity and type of adjacent land uses.

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Fire Exclusion

Priority: Low

Fire exclusion was identified as a management issue for the preserves but is considered a low priority for management, for the following reasons:

- Severity of Impacts: The exclusion of fire within the preserves could lead to a shift toward native shrub-dominated communities, reducing or eliminating the openings in which spineflower occurs. An increase in the extent of native shrub-dominated communities may reduce suitable openings for spineflower within the preserves, but it may also benefit spineflower by reducing competition from non-native plants and by maintaining favorable habitat conditions for pollinators. However, because openings within the preserves may also be attributable to environmental factors other than fire (White 1995), the negative effects of fire exclusion may be less severe than otherwise expected. This potential impact will need to be monitored over the long term to determine whether it is having a significant adverse effect on spineflower populations.
- Probability of Occurrence: Natural fire frequency (i.e., wildfires) in preserve areas will likely be reduced or eliminated by the exclusion of fires within and immediately surrounding developed areas, thus allowing for regeneration of native shrub communities in some areas. In addition, in concert with fire exclusion, management to control non-native grasses and forbs may encourage regeneration of native shrubs.
- Certainty of Consequences: Because fire exclusion can have both positive and negative effects on spineflower depending on various factors, the effect of fire exclusion on spineflower populations remains uncertain and difficult to predict.
- Indirect and Interactive Effects: Increased accumulation of thatch and expansion of native shrub cover due to fire exclusion may create conditions unsuitable for spineflower. Fire exclusion may increase or decrease non-native plant species populations, which compete with spineflower. Fire exclusion also increases the risk of higher-intensity fires, which may negatively affect spineflower populations. These potential impacts will need to be monitored over the long term to determine whether they are having a significant adverse effect on spineflower populations.

Background

Development will likely reduce or eliminate the opportunity for natural fires within preserve areas, by removing substantial areas of fuel and through fuel modification practices between developed areas and the preserves. Although the “natural” fire regime has undoubtedly been

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altered by landscape-level changes in vegetation and land use (e.g., agriculture) over the last 100 years, it is the recent historic fire regime (i.e., in the last 100 years) that has influenced the current distribution and abundance of spineflower. In the greater Santa Clarita area, 39 fires have been documented within 0.5 mile of the RMDP study area from records between 1858 and 2007, the first of which occurred in 1913. Seven fires have occurred within the preserves (Grapevine Mesa, Potrero Canyon, San Martinez Grande) themselves over this period (County of Los Angeles Fire Department 2007). *Table 2* summarizes the 39 fires that included the preserves or occurred within 0.5 mile of the Newhall Ranch RMDP study area and *Figure 2* shows the cumulative boundary of all fire perimeters occurring within the greater Santa Clarita area between 1858 and 2007 (see Fire Suppression).

Known or Hypothesized Effects and Their Mechanisms

In the absence of fire, shrub canopy cover could increase as a result of increased shrub survivorship and biomass, and herb-dominated communities could decrease. Fire exclusion may also facilitate establishment or spread of exotic plant species. Finally, fire exclusion can allow the unnatural accumulation of leaf litter on the soil surface (McGraw 2004). Increased plant cover and litter can create unfavorable conditions for the establishment and growth of spineflower.

Although the habitat and climate of the area in which San Fernando Valley spineflower is found differs from that of Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*), the effects of fire exclusion on these two taxa may be similar. Through experimental research to inform conservation of the Ben Lomond spineflower, McGraw (2004) showed that fire exclusion increases the cover of shrubs and trees. This woody vegetation restricts the distribution of the endangered annual herb through the shade, which reduces growth and fecundity, as well as through the leaf litter that accumulates on the soil surface and reduces establishment, growth, and fecundity. In an experiment examining the effects of reintroducing fire or using fire surrogates to enhance habitat, fire increased spineflower demographic performance directly by removing accumulated leaf litter on the soil surface (McGraw 2004). However, the open structure of coastal sage scrub communities in the preserves could also be due to arid desert-transition physiography (White 1995), in which case a shift toward shrub-dominated communities and the potential impact to spineflower may be less severe than expected.

Fire exclusion can potentially benefit or harm spineflower by altering the relative abundance of non-native species. Fire can potentially promote the invasion and spread of non-native plants by reducing thatch and providing them with an opportunity to establish (Zedler and Scheid 1988). However, McGraw (2004) found that fire actually indirectly facilitated spineflower by reducing

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the cover of non-native annual grasses and forbs, which negatively impact the spineflower through strong competition for soil resources. Raking to remove leaf litter had similar, beneficial effects on spineflower performance by removing leaf litter and reducing the abundance of non-native annuals (McGraw 2004).

Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for fire exclusion will help attain the following specific biological objectives:

- Population: Objective 1.1, 1.2 and 1.5
- Community: Objective 2.1, 2.2 and 2.3

Questions and Future Research

Research should examine whether prescribed burns can be used as a management tool to maintain or increase spineflower populations. Due to political, public safety and air quality issues, research would need to be conducted at a small spatial scale, through the aid of burn boxes (*sensu* McGraw 2004). Due to concerns over the long term viability of using prescribed fire as a management tool in the spineflower preserves, it will be important to also investigate fire surrogates—alternatives that mimic the beneficial effects of fire spineflower habitat conditions.

Management Strategies and Techniques

Results of the habitat characterization study to be conducted in the spring of 2008 should inform whether potential effects of fire exclusion (i.e., increased abundance of native shrubs, non-native species, and thatch) will require management. Management strategies for non-native species are discussed above. Management techniques and strategies for native shrubs include physical (mechanical or manual) control or removal within preserves. If determined to be a viable and useful management tool, prescribed burns may be utilized to maintain or increase spineflower populations.

Monitoring

Landscape-level changes in vegetation communities within the preserves will be monitored using remote sensing and aerial interpretation at 10-year intervals. In order to detect changes in relative shrub cover, landscape-level monitoring of vegetation communities may need to be supplemented with on-the-ground vegetation monitoring techniques, including the use of

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permanent photo-documentation stations. As a potential effect of fire excluding fire within the preserves, increases in shrub cover would be measured as part of the overall monitoring of vegetation communities within the preserves.

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Herbivory and Seed Predation

Priority: Low

Herbivory and seed predation are identified as management issues for the preserves but are considered low management priorities, for the following reasons:

- Severity of Impacts: Impacts due to herbivory and/or seed predation of spineflower are uncertain, but are unlikely to be severe. A number of factors can influence the occurrence and effects of herbivory and seed predation, including seasonal abundance of herbivores and granivores (seed predators), timing of plant production, vegetation type, and food availability (Hamback et al. 2004). Changes in seed predation and herbivory levels may affect spineflower competitors, which could indirectly affect spineflower in positive or negative ways. For example, if native harvester ants decline, there is potential for reductions in sparsely vegetated openings that may be favorable safe sites for spineflower to occupy. Red harvester ants tend to occupy such openings and maintain more open conditions by thinning annual grass vegetation and removing seed from the soil surface.
- Probability of Occurrence: Loss of top predator habitat where connectivity to preserved habitats is impaired, and proximity to development are likely to decrease predator (coyote, bobcat, raptor) abundance from pre-development levels. This could increase existing rates of herbivory and seed predation within the preserves due to a release effect on herbivores and granivores.
- Certainty of Consequences: Herbivory would most likely depress spineflower performance. However, the effects of granivores are less certain and may depend upon which species are removing seed and whether or not they are providing effective dispersal of spineflower seed in the process. Currently, it is not known whether or not loss of spineflower seed to seed predators is a significant concern.
- The potential impact to spineflower is tied to the effects of reduced predator abundance cascading down trophic levels, which can be complex and difficult to study due to multiple levels of interactions. Reduced top predator abundance could lead to a release in prey species and a resultant increase in herbivory and granivory. Alternatively, reduced top predator abundance and the proximity to development may cause mesopredator release (Crooks and Soulé 1999), in which case the abundance of prey species may decrease and reduce the potential for herbivory and granivory. In addition, even if prey abundance increases, the extent to which increased herbivory and granivory will affect spineflower as a potential food source remains unknown. In the absence of additional information, the potential effects of herbivory and granivory are very uncertain.

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- Indirect and Interactive Effects: In addition to the complex predator–prey relationships discussed above, invasion by Argentine ants could cause the displacement of existing invertebrate seed predators that are effective seed dispersers. The interactive effects of granivory and invasion by Argentine ants, therefore, could have significant negative impacts to spineflower performance.

Background

Herbivory and granivory of spineflower has not been directly studied, but physical signs of herbivory, for example, have been observed anecdotally in the field in the Newhall Ranch RMDP study area (FLx 2007). With regard to granivory, spineflower seeds are retained within the spine-tipped involucre even after the plant disarticulates in the late summer, and release of seed from involucre may not occur for several more months (Sapphos 2001). The delayed release of seeds from spiny involucre and the timing of disarticulation may inhibit seed predation, although the presence of spiny involucre likely inhibits seed predation by small mammals more so than invertebrates. In mammal trapping studies conducted at Ahmanson Ranch in September 1999, no seeds or seed heads were found in the cheek pouches of kangaroo rats or pocket mice among four species trapped within spineflower habitat (Sapphos 2001). Also at Ahmanson Ranch, LaPierre and Wright (2000) noted harvester ants carrying flower parts containing seeds to nest sites.

Known or Hypothesized Effects and Their Mechanisms

Increased herbivory and granivory are hypothesized to depress demographic performance of spineflower within the preserves. Germination, plant growth, seed production, seed viability, and seed dispersal could be affected. The effects of increased herbivory and granivory may also vary by species.

Increases or qualitative changes in herbivory and granivory may occur as an indirect result of changes in predator and prey (i.e., herbivores such as small mammals) abundance. Changes in the level of granivory and herbivory are anticipated if small mammal prey species (e.g., rabbits, gophers, pocket mice) increase in abundance due to decreased predation associated with development. However, as noted above, this effect may be negated by an increase in mesopredators, resulting in a reduction of the granivores and herbivores.

Hambach et al. (2004) examined the effects of predator exclusion on herbivory and found that outcomes were dependent upon seasonal changes in prey abundance and food availability, vegetation type (i.e., herb or shrub), and the timing of plant emergence and growth. Annual herbs (grasses and forbs) as opposed to perennial shrubs were able to avoid the effects of increased

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herbivory under predator exclusion as herbivores had low densities in the spring and were unable to track the increase in plant productivity.

Potential interactive effects of granivory and invasion by Argentine ants, which may displace native invertebrate granivores, could be significant. In coastal San Diego county, Argentine ants were ineffective in safely dispersing seeds of the myrmecochorous tree poppy (*Dendromecon rigida*) relative to displaced native harvester ant (*Pogonomyrmex subnitidus*) as seeds left by Argentine ants were not sufficiently buried to avoid subsequent predation at the soil surface.

Herbivory could promote spineflower populations indirectly by reducing competition from non-native annual grasses and forbs. For example, harvester ants collect and consume a lot of seed, including spineflower seed. If Argentine ants effectively exclude harvester ants from preserves then any effect their granivory may now have on controlling or limiting competing plant species would be lost.

Relationship to Biological Goals and Objectives

Management to reduce or eliminate the potential direct and indirect effects described for herbivory and granivory will help attain the following specific biological objectives:

- Population: Objectives 1.1, 1.2, 1.3, and 1.4
- Community: Objective 2.4
- Ecosystem: Objective 3.1

Questions and Future Research

The Habitat Characterization Study to be conducted in the spring season following issuance of the Incidental Take Permit will document the extent of herbivory as indicated by evidence of browsing on spineflower plants. If warranted by the extent of herbivory, future research projects should determine the extent to which herbivores and granivores within the preserves utilize spineflower plants and seed as a food source. If herbivory and granivory of spineflower are found to occur, additional studies might include enclosure experiments to determine the effects of herbivory and granivory on spineflower demographic performance on a small scale so that appropriate management measures could be identified. Further studies could be conducted to investigate whether the effects of granivory within the preserves are dependent upon species, in which case management efforts could be refined and made more effective by targeting a particular species. With the uncertainty regarding potential effects, herbivory and granivory are considered a low priority for management at this time.

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The following are specific questions that will be addressed through the habitat characterization study to be conducted in the spring of 2008 and through additional, experimental research that will be designed, in part, based on results of the habitat characterization study.

- Is spineflower subject to browsing? If so, what are the predators of spineflower and what is the incidence of herbivory?
- What are the effects of browsing on spineflower demographic performance? Should management interference occur?

Management Strategies and Techniques

Maintenance of large core open-space areas (i.e., High Country Special Management Area (SMA), Salt Creek area, and River Corridor SMA) and biological connectivity between preserves is intended to maintain the presence of top predators, such as raptors, coyotes, and bobcats and would prevent the occurrence of predator release within the preserves.

If necessary to control increased herbivory or granivory, small-mammal trapping and exclusionary fencing could be used as management techniques. In addition, raptor perches could be installed to discourage small mammals from predating spineflower if they are determined to negatively affect spineflower.

Monitoring

Monitoring the effectiveness of the core open-space areas and wildlife corridors between preserves could be achieved by periodically conducting raptor and scat and track surveys (for large mammals) to estimate the abundance of top prey species for comparison against pre-development levels.

The incidence of herbivory will initially be determined as part of the Habitat Characterization Study in the spring season following issuance of the Incidental Take Permit. Additional monitoring of herbivory or seed predation is not proposed at this time, but could be implemented in the future if warranted.

Effectiveness monitoring would be implemented to evaluate the success of reducing the effects of herbivory and granivory.

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Disruption of Natural Soil-Disturbance Regime

Priority: Low

Disruption of the natural soil-disturbance regime was identified as a management issue for the preserves but with a low priority, for the following reasons:

- Severity of Impacts: The disruption of the natural soil disturbance could have an overall negative effect on spineflower distribution and abundance. However, management of non-native plants, which mediate the impacts, may limit the severity of the impacts.
- Probability of Occurrence: Natural soil disturbances could decline due to reductions in populations of burrowing mammals due to predation by domestic cats or general decline in suitability and connectivity of habitat within the preserves as a result of adjacent development. Fire exclusion could reduce erosion due to gravity, wind, or water, by increasing plant cover that stabilizes the soil.
- Certainty of Consequences: The impacts of alterations to the natural disturbance regime depend on the role of soil disturbances in influencing the distribution, abundance, and demographic performance of spineflowers within the preserves, and the aspect of the disturbance regime that is altered (i.e., type of disturbance, frequency, severity, etc.) A range of consequences are possible.
- Indirect and Interactive Effects: Because soil disturbances affect spineflower both directly and indirectly, via effects on non-native plants, alterations to the natural disturbance regime will similarly have both direct and indirect consequences for spineflower populations, as described below.

Background

San Fernando Valley spineflower preferentially occurs in open habitat away from shrub and tree canopy, and where the cover of non-native annual herbs is sparse (Lukos 2000). While recurring fire likely plays a role in limiting woody plant encroachment, small-scale soil disturbances may help create and maintain areas of reduced non-native annual grass and forb cover (Lukos 2000). Natural and anthropogenic soil disturbances within the spineflower preserves include trails, erosion, and diggings created by burrowing small mammals, including California ground squirrels (*Spermophilus beecheyi*), pocket gophers (*Thomomys bottae*) murid rodents (*Peromyscus* spp., *Reithrodontomys megalotis*), pocket mice (*Perognathus* spp. and *Chaetodipus* spp.), and kangaroo rats (*Dipodomys* spp.). Cattle are likely responsible, to some degree, for existing levels of soil disturbance.

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Known or Hypothesized Effects and Their Mechanisms

Based on experimental research examining the effects of erosion, trails, and gopher mounds on the Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*; McGraw 2004), soil disturbances may directly facilitate spineflower populations by removing established plant cover, thatch, and leaf litter, which inhibit germination and seedling survival. Soil disturbances can also promote spineflower populations indirectly, by reducing competition from other species, thus increasing plant growth and fecundity. Soil disturbances might also directly facilitate spineflower performance by increasing soil nutrients (J. McGraw, unpublished data).

Through many of the same mechanisms, soil disturbances can enhance establishment of disturbance-adapted non-native plants, which in turn can compete with native plants, causing soil disturbance to have indirect negative effects (Hobbs and Huenneke 2002). Soil disturbances can also directly negatively impact spineflowers by killing seed or plants.

However, in already invaded communities, such as the California annual grassland and degraded California Sagebrush scrub that occur within the spineflower preserves, the net effects of soil disturbances are likely to be positive, in that they create safe sites for spineflower germination, survivorship, and growth, amidst otherwise dense cover of non-native annual grasses and forbs. This net beneficial effect was observed in experiments for the Ben Lomond spineflower, which like the San Fernando Valley Spineflower, occurs in open vegetation that is largely dominated by non-native annual grasses and forbs (McGraw 2004).

Because the San Fernando Valley spineflower may require recurring soil disturbance to create and maintain open microsites required for germination, survivorship, and growth, alterations to the natural disturbance regime have the potential to reduce its distribution and abundance (McGraw 2004). Declines in small mammal populations due to predation by domestic cats or other declines in the suitability and connectivity of habitat due to the adjacent development could reduce the occurrence of diggings. Erosion due to gravity, wind, or water, might also decline in the absence of recurring fires which historically remove plant cover and destabilize the soil.

Relationship to Biological Goals and Objectives

Management to address disruptions of the natural soil-disturbance regime will help attain the following specific biological objectives:

- Population: Objectives 1.1, 1.2, 1.3 and 1.4

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- Community: Objectives 2.2 and 2.4
- Ecosystem: Objectives 3.1

Questions and Future Research

Research is needed to further understand the role of soil disturbances in influencing the distribution, abundance, and demographic performance of spineflowers within the preserves. The net effects of soil disturbances on spineflower populations will be determined by complex interactions between aspects of the soil disturbance, including the type, seasonality, frequency, and severity, and the conditions of the habitat in which it occurs, including soil conditions, spineflower distribution and abundance, and the occurrence of nonnative competitors, among other factors.

The following are specific questions that could be addressed through the Habitat Characterization study to be conducted in the spring of 2008.

- Are the distribution, abundance, and/or performance of spineflower (positively or negatively) correlated with incidences of natural and/or artificial soil disturbance?
- Is spineflower distribution or abundance affected by the type of soil disturbance (i.e., natural or artificial)?

Management Strategies and Techniques

The preserves will be managed to prevent anthropogenic disruptions to the natural soil-disturbance regime. More information regarding the net effects of soil disturbance will be needed to determine whether the overall effect is positive or negative for spineflower.

Monitoring

As described in Appendix E of the SCP, annual spineflower abundance sampling will include recording the percent cover of soil disturbances observed. In this way, some measure of the status and trends of soil disturbances in occupied areas of the preserves will be gained on an annual basis.

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MANAGEMENT FRAMEWORK

This section describes the basic organizational structure of the management framework proposed in the AMP and is based on the model provided by McEachern et al. (2006). The basic organizational elements include an Adaptive Management Working Group and a Technical Advisory Subgroup, an Annual Program Review, and a Spineflower Information Center that provides centralized storage and facilitates a structured flow of information related to all aspects of the AMP.

Adaptive Management Working Group and Technical Advisory Subgroup

The Adaptive Management Working Group will consist of land managers, resource agency staff, and scientific experts. The Adaptive Management Working Group is the ultimate decision-making entity that will guide the management, monitoring, and planning activities of the AMP. Management actions will be implemented using annual work plans developed by the Adaptive Management Working Group. Annual work plans will be developed based on the priority level assigned to individual threats and will incorporate the corresponding recommended management actions that are to be implemented in the upcoming year based on the results of monitoring. Approximate schedules and funding for management activities and research studies currently proposed are listed in Sections 13.0 and 16.0 of the SCP. Recommended management activities for which work plans have yet to be developed but are anticipated in the 1 to 2 years following issuance of take authorization are also identified. Work plans will be developed by the Adaptive Management Working Group at the appropriate time.

The Technical Advisory Subgroup will consist of a subset of the Adaptive Management Working Group, specifically responsible for addressing technical scientific issues associated with management, monitoring designs, and data analysis.

Annual Program Review

A fundamental element of the AMP is a repeating process of periodic review, short-term adjustment, and long-range planning. The goal of Annual Program Review is to evaluate the success of completed management actions to date, to develop new management actions and objectives as necessary, and to prepare annual work plans for the implementation of management actions in the upcoming year. Annual Program Review will be conducted by the Adaptive Management Working Group in September or October of each year, once spineflower is dehiscent, but before the onset of germination associated with seasonal fall and winter rains, which typically begin in October. The timing of Annual Program Review also must provide

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sufficient time to compile and analyze the monitoring data from the current year's activities, to incorporate that data into decision making, and to prepare the annual work plan for the upcoming year. As proposed by McEachern et al. (2006), Annual Program Review may include peer presentations and external review but will ultimately evaluate monitoring data to determine the success of management actions that have been implemented.

Annual Program Review will allow short-term adjustments to be made to the AMP based on the results of implemented management actions. Short-term adjustments may result in changes to ongoing or planned management actions. Consideration of long-range planning will be done annually but will likely involve an overall evaluation of management activities over several years (e.g., over a 5-year horizon). Long-range planning pertains more broadly to the ongoing refinement of AMP objectives.

Centralized Information

Information sharing is a critical component of the AMP. A Spineflower Information Center web site or FTP server will be established to serve as a repository for annual work plans, monitoring data, and findings of Annual Program Reviews. Regional weather data, local weather information, and raw monitoring data will also be stored and accessible through the Spineflower Information Center. In addition, the Spineflower Information Center may also be configured to provide an internet-based forum to facilitate discussion among Adaptive Management Working Group members outside of scheduled Annual Program Review meetings.

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Appendix E
Draft Monitoring Protocols

**MONITORING PROGRAM FOR THE
SPINEFLOWER CONSERVATION PLAN PRESERVES
JODI M. MCGRAW
DECEMBER 19, 2007**

1. Introduction

An integral part of the overall adaptive management program of the Spineflower Conservation Plan, monitoring will be used to evaluate the Plan's success toward its biological goals and objectives, and indicate where and when modifications to management are needed in order to enhance success of the conservation strategy (Figure 1; Elzinga et al. 2001). This appendix describes the elements of the monitoring program that will evaluate the biological effectiveness of the Spineflower Conservation Plan at attaining the objectives of its first goal:

Goal 1: Maintain or increase San Fernando Valley Spineflower populations within the preserves.

Objective 1.1: Maintain or increase the distribution of the spineflower within each preserve.

Objective 1.2: Maintain or increase the abundance of the spineflower within each preserve.

Objective 1.3: Reduce or prevent the increase of anthropogenic factors that negatively impact spineflower individual and population performance.

Objective 1.4: Increase understanding of the ecological factors influencing the distribution, abundance, and population persistence of the spineflower in order to inform management and monitoring within the preserves.

The program describes the monitoring protocols that will be used to measure success of management toward attaining these biological goals and objectives and outlines how monitoring results will be evaluated to inform changes in management. Background information about the elements of the monitoring protocols, including the monitoring objectives, field methods, and statistical analyses that are described here can be found in Elzinga et al. 2001 and Hayak and Buzas 1997, among other texts addressing monitoring design and implementation.

Goal

The goal of the monitoring program will be to provide objective, repeatable methods for collecting, analyzing, and interpreting ecologically meaningful information about San Fernando Valley spineflower that can be used to evaluate the status of the populations, the effectiveness of the conservation strategy, and the design of future management and monitoring, using the most cost-effective methods possible.

2. Monitoring Protocols

The monitoring program for San Fernando Valley spineflower incorporates two monitoring protocols:

1. Areal mapping to determine and monitor spineflower distribution (Objective 1.1).
2. Abundance sampling to estimate and monitor spineflower cover (Objective 1.2).

These complementary protocols will track success toward the first three biological objectives for the spineflower populations, as well as increase understanding of the rare plant's ecology needed to inform management (Objective 1.4). Additional monitoring protocols could be developed to evaluate success toward the other goals and objectives of the Spineflower Conservation Plan (Dudek and Assoc. 2007a).

2.1 Areal Extent Mapping

Background

In areal extent mapping, the perimeter spineflower plant patches within the preserves is delimited and mapped, allowing monitoring of the distribution of the population through time. When incorporated into a GIS, patch polygons can also be used to evaluate changes in the area occupied. In addition, analyses can be conducted to evaluate the association of the plant patches with abiotic and biotic characteristics of the environment (soils, vegetation types, topography) to evaluate the habitat characteristics, and in response to different management treatments and regimes.

Monitoring Objectives

The objectives of areal mapping are:

1. To identify and track the location and areal coverage of spineflower patches within the preserves.
2. To allow spatially explicit examination of the spineflower distribution that will facilitate the design of management and other monitoring studies (incl. abundance sampling), and provide insight into the factors affecting the population distribution and persistence.

Monitoring Design

Field Survey

Location: Areal mapping will occur throughout each of the preserves established as part of the Spineflower Conservation Plan (SCP).

Patch Delimitation: The perimeter of each spineflower patch will be delimited using pin flags by identifying the outermost plants, with plants more than 4 m apart included in separate patches. Isolated patches (i.e., one or more plants) that occupy 1 m² or less will be mapped as points and the area estimated to the nearest 0.25 m².

Following patch delimitation on the ground, mapping will be conducted using a GPS equipped with ArcPad software and recent, high resolution aerial imagery. Following field assessment, the polygons can be downloaded directly into GIS software which can be used to 'connect the dots' represented by the outermost plants to create the minimum convex polygon for each patch.

Anthropogenic Factors: Within each delimited polygon, the occurrence of anthropogenic factors known or hypothesized to degrade spineflower habitat will be examined. These factors and the methods to assess them will be identified based on the spineflower habitat characterization, including: 1) invasive exotic plants, 2) non-native annual plants (grasses and forbs), and 3) soil disturbance (such as that caused by recreation). Occurrence of factors will include presence/absence and where possible, a visual estimate of the area impacted using cover classes: <1, 1-5, 6-25, 26-50, 51-75, 76-95, and 96-100%.

It is important to note that separate monitoring will likely be needed to examine the status and trends of factors that degrade spineflower habitat throughout the preserves as well as perhaps adjacent to the preserves, not just within occupied habitat. The purpose of this data is to aid interpretation of any detected changes in spineflower distribution.

Implementation

Seasonality: Field surveys will occur when the spineflower is in fruit in approximately late June and mid-July. During this period, the reddened leaves and inflorescence stalks can be more readily detected (compared to the small, white flowers), and the plants are less susceptible to trampling. Beginning in June, weekly reconnaissance surveys will be used to track spineflower phenology and determine the onset of areal mapping, which will occur during the period of maximum flower production.

Frequency: Areal mapping will occur approximately every 10 years. To reduce the potential for inter-annual variability in density to influence areal extent, areal mapping will be conducted only during years with weather conditions appropriate for establishment and survival (i.e., years of good aboveground expression). Areal extent mapping will only be conducted in years with the above average annual rainfall (mean rainfall plus one standard deviation of the mean based on historic data for the region).

Personnel: Areal extent mapping will be completed by individuals trained to identify the rare plant and distinguish it from co-occurring congeners. Individuals will also be trained to delineate patch perimeters following the mapping rules described above and to record the spatial location of the patches using the GPS.

Analyses

Descriptive: Through GIS, the patch (polygons) layer will be used to calculate total patch area, the number of patches, and mean patch size. These statistics will be computed by preserve and for the preserve system overall. Maps illustrating spineflower occurrences with respect to other habitat characteristics and prior management activities will be used to interpret observed changes.

Single Interval Comparisons: Change in spineflower areal coverage between two sample periods (i.e., a single interval) can be calculated as:

$$\Delta = \frac{\text{Area}(t) - \text{Area}(b)}{\text{Area}(b)}$$

where t is the current time period, and b is the baseline.

The changes will be calculated for each preserve and for the preserve system overall.

Extra-curricular: In support of Objective 4, the spatial and tabular data could be used in additional analyses designed to increase knowledge of spineflower ecology. For example, overlay analyses can be used to evaluate the occurrence of patches within different vegetation types, conditions (e.g. historically disturbed vs. intact), or in response to management (e.g. exotic plant control). If changes, particularly declines, are detected, additional analysis can be used to detect patterns relating change in occupied habitat to changes in the occurrence of anthropogenic factors that degrade habitat.

Pilot Study

Exploratory studies will be used to evaluate the effectiveness of the mapping rules in delineating patch polygons. Specifically, the nearest neighbor rule for patch inclusion (4 m) will be evaluated. Previous monitoring has used this nearest neighbor rule value (Dudek Assoc. 2007). Additional exploratory studies will be used in several sites exhibiting a range of spineflower densities, distributions, and other conditions such as vegetation structure and species composition that could influence the accuracy and repeatability of the protocol.

Establishing the Baseline

The baseline for spineflower distribution will be established through implementation of areal mapping during the spring of a growing season with above average rainfall (mean + 1 S.D.) soon after establishment of each preserve. Provided that the sampling protocol meets the monitoring objectives, the total patch area identified during the initial mapping will be used as the baseline for spineflower distribution.

Thresholds and Evaluation

Due to the low frequency at which areal mapping will be conducted, thresholds used to trigger remedial efforts for spineflower are based on single intervals (i.e. 2020 compared to 2010). The following thresholds will be used to trigger remedial action:

- A 10% decline in total areal extent of spineflower compared to the baseline for each preserve or for the preserve system overall.
- A 10% increase in the frequency of occurrence and/or percent cover of anthropogenic factors that negatively impact spineflower distribution, including invasive exotic plants, non-native annual plants, and unnatural disturbances.

Remedial Action

If monitoring reveals that spineflower distribution has declined below the established threshold and thus biological objective 1.1 is not being met, then remedial action will be initiated to enhance success. Remedial measures will be developed through consideration of all available information about the preserves, including the status and trends of spineflower abundance developed through quantitative abundance sampling (Section 3).

2.2 Abundance Sampling

Background

Spineflower abundance will be tracked by repeatedly sampling spineflower absolute percent cover within patches of occupied habitat identified in the areal extent mapping within each preserve (Section 2.1). The efficacy of abundance sampling for tracking annual plants and species that exhibit dormancy, such as those with seed banks, has been questioned (Elzinga et al. 2001). This is because large interannual variability in abundance due to plant responses to a host of factors can make it difficult to discern overall trends. San Fernando Valley spineflower has been observed to exhibit such high variability (Dudek Assoc. 2007).

Though the problem presented by high variability in abundance is acute for monitoring programs occurring over short time scales, this concern is less of an issue for monitoring programs that extend over long time periods. Long term monitoring programs provide the opportunity to quantify the interannual variability in abundance. With each sample point, there is greater ability to distinguish prolonged population declines perhaps due to declining habitat conditions or other intrinsic factors from short term drops due to natural factors (e.g. drought). Statistical analyses employing General Linear Models will help partition the variability in spineflower abundance that is related largely to extrinsic factors such as interannual variability in weather, from actual trends occurring due to changes in the suitability of habitat conditions or other factors causing population declines (i.e., intrinsic factors), such as reduced pollinator availability. When coupled with distribution monitoring, as in this program, abundance sampling can be an effective means of detecting long term declines in abundance, including those resulting from degradation of habitat, which can threaten population persistence.

As in all sampling, numerous characteristics of the monitoring design can influence the precision of the abundance estimate, including the size and shape of the sample unit, the method of allocating samples (randomly, stratified randomly, etc.), whether the samples are temporary (re-allocated each interval) or permanent (resampled each interval), and most importantly, the number of samples taken (Hayek and Buzas 1997, Krebs 1999, Southwood and Henderson 2000, Elzinga et al. 2001).

A recent development in long term ecological monitoring is the use of panel designs, which increase the area monitored and avoid artifacts (inadvertent impacts) associated with repeatedly monitoring the same samples through time (e.g. soil compaction). In panel designs, sample plots (sites) are grouped within panels, within which all sites are sampled at the same interval. The sites within a panel can be permanent (sampled throughout the life of the monitoring study),

temporary (sampled only once), or sampled for a limited duration, such as 10 years. In split panel monitoring designs, the revisit schedule, or frequency of resampling, is different for one or more of the panels. One split panel design balances the objective of trend detection with that of accurate status estimation. In this design, one panel is comprised of permanent plots that are always revisited. The other panel (or series temporary panels) is comprised of sites that are randomly located each sample period (McDonald 2003).

Panel designs offer many advantages to long term monitoring, however one disadvantage is that slightly more complicated statistical approaches are required for data analysis. Mixed linear models (statistical analyses) are needed to partition the variance associated with the different factors and thus discern changes and trends in population parameters.

For spineflowers, abundance can be measured as density, the number of individuals per given area, or absolute cover, the proportion of a given area occupied or covered by the plant. Cover is recommended as a measure of spineflower abundance for the following reasons:

1. Cover reflects both density and plant size: Spineflowers very likely experience reduced growth due to intraspecific competition, in that individual plants in higher density patches are smaller and produce fewer seeds than individuals in lower density patches, such that overall the production of seed in a given year is more a function of plant cover than plant density.
2. Density requires counts which are very time consuming, particularly if sampled in an area large enough to evaluate simultaneously the occurrence of anthropogenic factors that degrade habitat.

Current information about the distribution and abundance of spineflower within Newhall Ranch was used to inform the abundance sampling protocols. However, it will be essential to evaluate the effectiveness of the sampling design using a 'pilot study' (McGraw 2004).

Monitoring Objectives

The objectives of abundance sampling are to accurately track spineflower cover within the preserves in order to:

1. Detect biologically meaningful declines in cover amidst the background fluctuations in abundance, and
2. Link any observed declines in abundance to changes in habitat conditions in order to inform remedial management (Section 3).

Sampling Objectives

The objectives of the monitoring protocol are to have 90% power to detect 20% declines in spineflower cover over at least 5 sampling intervals, with a 10% chance of indicating a statistically significant change has occurred when one has not.

Monitoring Design

Field Methods

Sampling Design: The absolute percent cover of spineflower will be visually estimated in 1 m x 5 m quadrats randomly located within the areal extent mapping polygons that are large enough to fit the quadrat.

The samples will be allocated using a stratified, random design, in which an equal number of quadrats are located within each of the spineflower preserves, which are the strata, and the quadrats within each preserve are located randomly within the areal extent mapping polygons that are at least 1 m x 5 m.

Monitoring will be conducted using a split panel design designed to balance the power to detect trends derived from permanent plots, with the power to estimate the status of the populations that comes from randomly locating plots (Table 1). The first panel (set of plots) will consist of 20 plots per preserve (strata) randomly located within the areal extent mapping polygons that were used to establish the baseline for the plant's distribution (Section 2.1). This panel will be sampled annually beginning after the areal extent mapping is completed and continuing in perpetuity.

In addition, rotating panels consisting of 10 plots (1 m x 5 m quadrats) per preserve will be randomly located within spineflower patch polygons each time the areal extent mapping is conducted. The plots within each panel will be sampled until the areal extent mapping is conducted again (i.e., approximately 10 years), after which time a new panel of 10 plots will be established within each preserve, and the prior panel will be retired (Table 1).

In each 1 m x 5 m sample plot, measurements will be taken within 5, contiguous, 1 m² quadrats located along the length of the plot (Figure 2).

Measurements: A 30m transect tape will be pulled taut around the outside of the corner stakes to delimit the perimeter of the quadrat, with the tape oriented perpendicular to the soil surface to create a boundary of minimal width. To create the 1 m² areas to be sampled, meter sticks will be temporarily located perpendicularly to the tape at the 1, 2, 3, and 4 m intervals. Within the 1 m² plot created by the tape and meter sticks, absolute percent cover of spineflower will be estimated using 5% increments from 10% to 90%, and 1%, 3%, 5%, 8% as values below 10%, and 91%, 93%, 95%, and 98% as values above 90%. Accurate estimation will be facilitated through the use of square cardboard cutouts that represent 1%, 2%, 5%, and 10% of the 1 m² quadrat, which observers will use to calibrate their visual estimation.

In addition to the cover of spineflower, the occurrences of factors known or hypothesized to negatively impact spineflower performance will be recorded. The variables to be measured will be identified based on results of the habitat characterization. At present, potential variables to be visually estimated using separate cover classes include:

- the percent cover of non-native plants by species
- the percent cover of woody plants (subshrubs, shrubs, and trees) by species
- the percent cover of anthropogenic soil disturbance and/or erosion
- depth of litter (including thatch)
- cover of litter (including thatch)

Cover classes, in percentages, will be the same as that listed for spineflower cover above.

Implementation

To provide accurate information about spineflower abundance that can be compared through time, sampling will be implemented following these considerations.

Seasonality: To facilitate comparable cover estimates, field surveys will occur during the peak portion of the flowering period, which differs each year but is typically between mid-April and early May. Beginning in April, bi-weekly reconnaissance surveys will be used to track the spineflower phenology and determine the onset of abundance sampling.

Personnel: Spineflower cover sampling will be completed by a team of individuals trained to identify the rare plant and distinguish it from morphologically similar species. Field staff will be able to provide repeatable visual estimates of spineflower cover and habitat factors using the designated cover classes. They must also be able to identify all co-occurring plant species.

Plot Monumenting: To increase the repeatability of measurements between sampling intervals, the four corners of the quadrat will be permanently monumented using 20 cm long pieces of aluminum conduit (approx. ½" diameter). The markers will be placed 25 cm into the ground. In areas where vandalism is not a concern, the tops of the markers can be painted to facilitate detection. The coordinates of the north corner stake will be recorded using a survey grade GPS, which will facilitate relocation of the plot should the corner stakes be removed.

Analyses

Mean spineflower cover and the mean cover and frequency of anthropogenic factors will be calculated for each plot based on the values obtained from the five, 1 m² subplots (i.e., the 1 m x 5 m plot is the statistical sampling unit). Changes in these statistics, relative to the baseline, will be examined within each preserve and for the preserve system as a whole, as described below.

Single interval declines in spineflower cover and/or increases in the cover or frequency (expressed as a percent of the subplots) of anthropogenic factors can be evaluated using paired t-tests—statistical tests used to evaluate whether statistically significant changes have occurred between permanent plots. Though this might be a reliable indicator of changes in

the disturbance and/or the cover of woody species, changes in spineflower abundance and the cover of non-native annual plants detected over single sampling intervals should be cautiously interpreted, due to natural variability in abundance due to climate and sampling error.

After data are available from five iterations of sampling, and for every year thereafter, the mean trend in spineflower abundance and the cover and frequency (as a percent) of anthropogenic factors across all permanent plots within each preserve and preserve system-wide will be examined using route regression—a statistical test designed to detect and measure significant trends observed within a set of permanent plots (Elzinga et al. 2001).

Pilot Study to Evaluate Monitoring

To refine the abundance monitoring protocol and evaluate its ability to attain the monitoring objectives, a pilot study will be conducted. The monitoring protocol must be implemented for two years in order to evaluate the variation in the difference between plots between years (i.e. the standard deviation of the mean difference in cover), which will be crucial in determining the sample size necessary to attain the power to detect significant changes. Data from the pilot study will be used to determine whether permanent plots provide a more effective tool for tracking changes in abundance, or whether temporary plots would provide greater power and/or reduced costs (Elzinga et al. 2001, McGraw 2004).

Establishment of the Baseline

The baseline for spineflower cover will be established through implementation of the abundance sampling protocol during three years after areal extent mapping. The baseline will be calculated for each preserve and for the entire preserve system as the average of the three year mean cover for each plot, provided that at least two years have precipitation at or above the mean for the region. After 10 years of abundance monitoring, ANOVA will be used to evaluate whether the three year average was abnormally high or low as a result of climate or other stochastic factors during the first three years of abundance sampling. If so, the baseline will be corrected.

Evaluating Thresholds Based on Long Term Monitoring

The following thresholds are proposed to trigger remedial efforts based on the results of the spineflower cover sampling:

- 20% decline in cover relative to the baseline over a five year period
- 20% increase in the percent cover or frequency of anthropogenic factors that negatively impact spineflower over a five year period.

Trends toward persistent declines in spineflower, or increases in anthropogenic factors affecting spineflower that do not exceed the threshold will trigger evaluation of remedial action, including additional analyses (Section 3).

Additional Analyses

Data generated by this monitoring protocol can be used to enhance understanding of the ecology of the system and species through the additional analyses, which might include:

- examine potential relationships between the cover of spineflower and the occurrence (extent) of the measured anthropogenic factors
- evaluate spineflower cover in different habitat conditions (e.g., vegetation types)
- examine patterns of spineflower cover with respect to climate (abundance and distribution of precipitation) and management (exotic plant control projects).

3. Remedial Actions

If monitoring studies reveal that spineflower population parameters have declined below the established thresholds and thus one or more of the biological objectives are not being met, then remedial action will be initiated to enhance success. Because the factors affecting spineflower distribution and abundance remain poorly understood, and because it is difficult to anticipate potential future changes to the populations and communities, remedial measures will be developed based on an assessment of available information, and will likely include a suite of management techniques designed to address anthropogenic stressors to the spineflower populations, as described in the Spineflower Conservation Plan (Dudek and Assoc. 2007).

In general, a series of steps will be taken to identify appropriate remedial actions, beginning with efforts to assess the cause(s) of the observed decline (Figure 3). Known or hypothesized causes for decline in spineflower distribution or abundance will be classified as either natural or anthropogenic, considering the full range of proximate and ultimate, direct and indirect impacts of human activities on the system. If the cause is known and is deemed anthropogenic in origin, for example in the case of the invasion or spread of one or more non-native plants, then management will be implemented to address the cause, within an adaptive management framework. Studies and experimental management to develop effective remedial actions to known anthropogenic stressors must be implemented before declines are detected.

If the cause of the decline is unknown, additional analyses of existing information and/or new studies will be used to determine potential causes. If the putative causes for decline are anthropogenic, steps will be taken to remove the stressor from the system or alleviate its impacts using experimental management—management conducted at small spatial scales using elements of experimental design in order to evaluate effectiveness. If the decline is not anthropogenic in nature, the determination will be made as to whether it is important to intervene within the system to protect remaining populations.

The following are examples of remedial efforts that could be initiated if monitoring reveals declines in spineflower distribution (areal extent) and/or abundance (cover).

Declines in Distribution

Distribution monitoring is designed to detect declines in the spineflower areal extent that could result from landscape-level reductions in the availability of suitable habitat. Such declines might occur as a result of succession, which reduces gaps in the shrub canopies in California sagebrush scrub, the invasion and spread of aggressive exotic plants, which compete with spineflower, and degradation of habitat due to trespassing within spineflower preserves, among other factors. However, declines in aboveground expression of spineflower (i.e. abundance) due to interannual variability in climate could result in reduced patch area as measured during areal extent monitoring of distribution.

The following series of additional analyses and associated remedial actions are recommended in the event that total spineflower patch area declines beyond the 10% threshold. They are designed to first assess the potential that declines are due to natural fluctuations. If there is no evidence for this, the subsequent steps are designed to assess potential anthropogenic causes and prescribe remedial management actions.

1. Determine the proportion of preserves in which a decline in areal extent (distribution) was observed.

Climate-induced variation in spineflower performance is more likely to cause declines in distribution throughout the preserves and preserve system, than in a subset of a preserve or the preserves within the system. In contrast, degradation of habitat due to anthropogenic stressors is anticipated to cause patchy declines in distribution within or among preserves. Therefore, if declines in spineflower distribution are observed only in a subset of the previously occupied areas (preserves or portions of preserves), efforts will be initiated to identify potential causes of contracted distribution those areas. This would include examination of the anthropogenic factor occurrence data collected within each polygon (Section 2.1), as well as evaluation of additional information available for the area where declines were observed. Because the spineflower preserves will be established following permitting, but development will be staggered through time, changes in spineflower distribution can be compared among preserves adjacent to existing development and those adjacent to intact habitat, to help interpret observed declines in distribution.

2. Evaluate whether declines were also observed in spineflower abundance and, if so, in what proportion of the monitored patches and preserves.

Widespread declines in spineflower abundance are more likely to result from short term reductions in spineflower performance due to climate than they are to loss or degradation of habitat due to anthropogenic factors such as exotic plants and/or trespassing, which are unlikely to simultaneously impact many areas.

3. If declines in abundance were not observed, and declines in distribution were only observed in some of the preserves (or portions thereof), the available data on anthropogenic factors will be examined to determine whether new or persistent

threats might be causing declines in distribution in the preserves where they occurred.

Data will be examined to determine whether the declines in distribution are spatially correlated with new or persisting anthropogenic stressors. If so, management will be conducted to remove the stressors and restore the habitat, as needed.

Declines in Abundance

Abundance sampling is designed to detect reductions in the suitability of habitat for spineflower, such as might occur due to the invasion and spread of exotic plants, increases in shrub or tree cover, and degradation of habitat due to trespassing, among other factors. However, spineflower abundance is greatly influenced by annual climate, the variability of which could cause temporary reductions in abundance from which populations are expected to rebound over time.

The following are a series of additional analyses and associated remedial actions that could be followed in the event that trend analysis reveals significant declines in spineflower abundance of 20% (the threshold), or persistent trends toward such a decline. They are designed to first determine the likelihood that the decline is the result of one or more anthropogenic factors and, if so, determine appropriate remedial management actions.

1. Determine whether declines in abundance might be due to prolonged drought.

Spineflower cover could be reduced in low rainfall years, and a series of drought years as periodically occur within the region could cause a prolonged decline in aboveground abundance by reducing spineflower establishment, survivorship, growth, and/or fecundity. If declines in abundance are observed throughout the preserve system, rainfall and temperature data will be examined to evaluate the extent to which declines are correlated with climate. Ideally, climate data would be collected within the preserves, or the Newhall Ranch region.

2. Evaluate whether habitat degradation might have caused abundance declines.

Multiple regression can be used to test the hypotheses that increases in exotic plants, soil disturbances, woody plant encroachment, or other factors quantified within the abundance sampling plots have contributed to observed declines in spineflower cover, by regressing the percent change in abundance of spineflower on the percent change in the cover of each of the threats. Management will be initiated to reduce and repair the effects of any detected anthropogenic stressors affecting spineflower abundance.

3. If population declines are not linked to climate or increases in currently known anthropogenic threats, research will be completed to identify other causes.

Even though the declines in abundance may not be attributable to anthropogenic factors, they might still influence persistence and thus merit remedial management action. Additional monitoring and/or research will be initiated to examine potential causes for the declines. This may be facilitated by partnering with universities and other local researchers.

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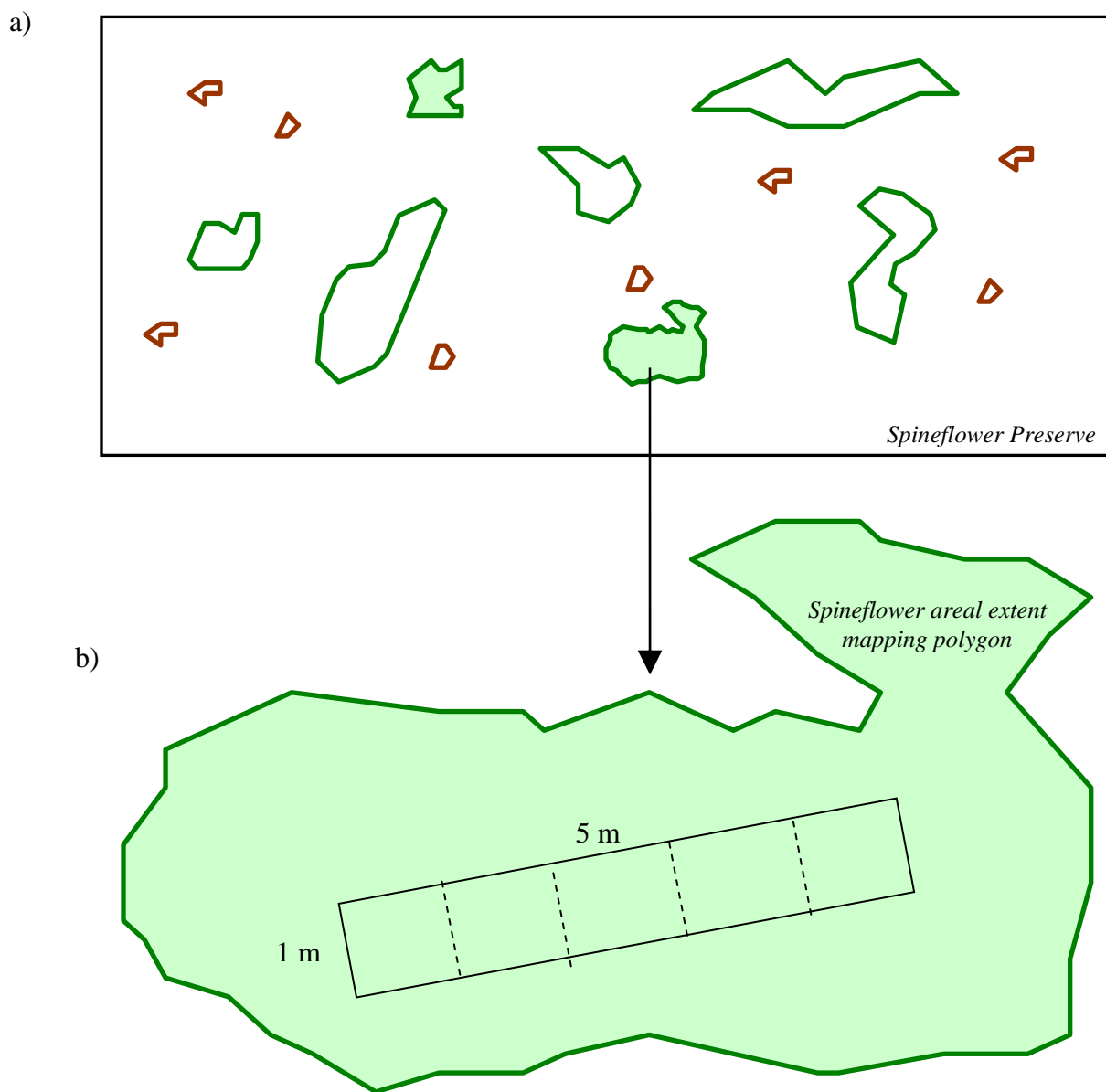


Figure 2: Schematic illustrations of aspects of the abundance sampling monitoring protocol design: a) spineflower areal extent polygons mapped within a spineflower preserve, showing those that are too small for inclusion in abundance sampling (red outline), those that were eligible for inclusion in abundance sampling (green outline), and the randomly selected polygons to be sampled (green fill); and b) a randomly selected spineflower areal extent mapping polygon with an abundance sampling plot (1 m x 5 m), showing the five, nested 1 m² quadrats.

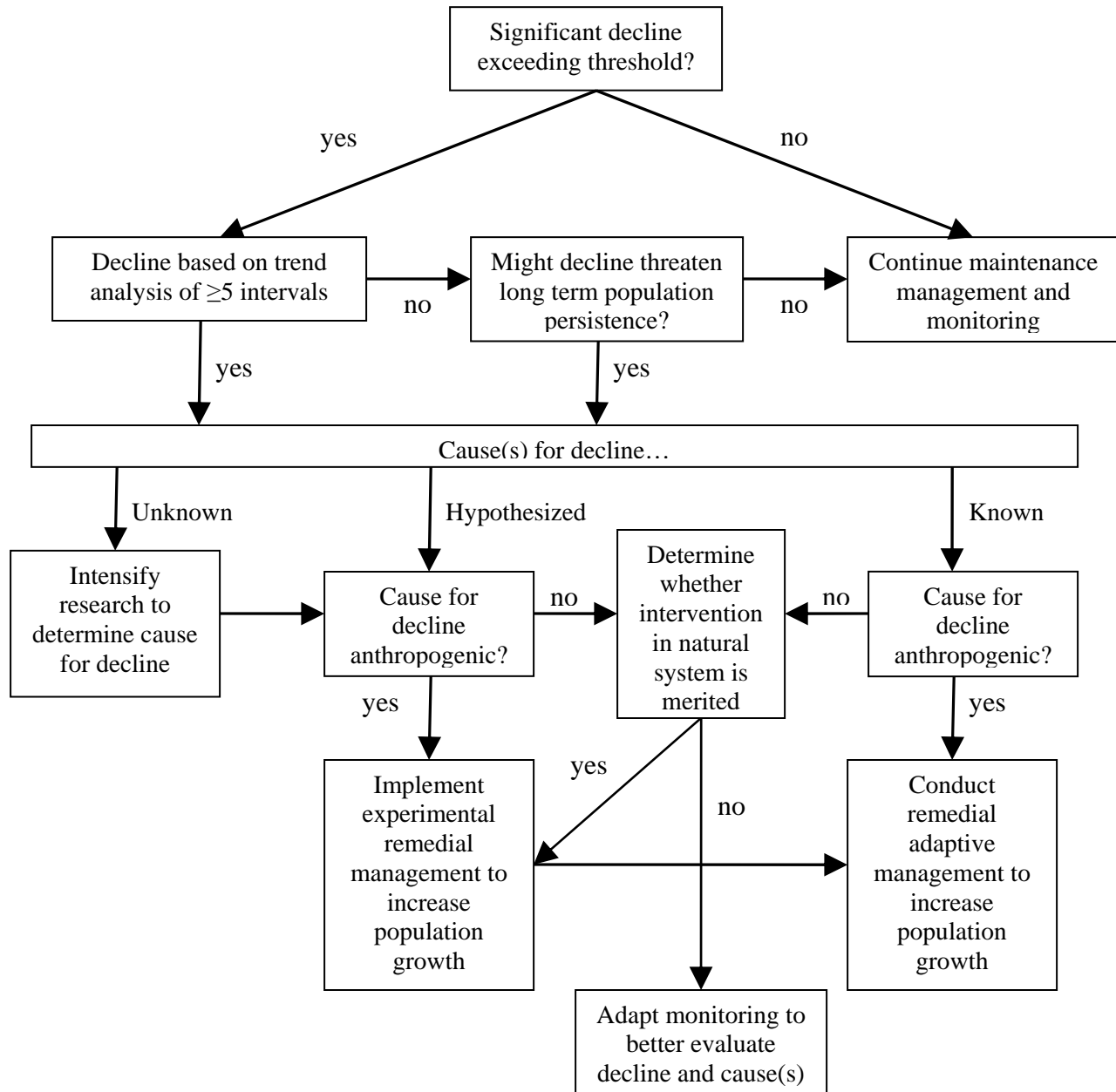


Figure 3: Decision tree to trigger remedial management based on monitoring results.