San Luis Rey River Park
Vegetation Management Plan

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1.0 INTRODUCTION

The County of San Diego (County) Department of Parks and Recreation (DPR) prepared a master plan in 2007 establishing the framework for the acquisition and development of the San Luis Rey River Park (SLRRP; Park) in northern San Diego County. The SLRRP Master Plan was approved in 2008 and per the Park implementation process outlined in the plan, the County has begun acquiring parcels and now owns approximately 500 of the 1,700 acres planned for the Park. The SLRRP is being assembled as part of the proposed North County Multiple Species Conservation Program (MSCP) preserve system. The DPR proposes to manage the Park in accordance with a Resource Management Plan (RMP), including Area-Specific Management Directives (ASMDs), being developed for the Park pursuant to the requirements of the Draft North County MSCP Plan.

The majority of the Park supports high-quality native vegetation communities within the San Luis Rey River channel; however, there are highly disturbed vegetation communities on the floodplains and buffers of the river channel. Invasive non-native plants present in these areas are outcompeting native species and reducing the biological functions and values of these communities. Approximately one-quarter of the Park was most recently burned during the 2007 Vuelta Fire, while the vast majority of the Park has not been burned within the fire history record (FRAP 2011).

1.1 Purpose and Need

The purpose of this Vegetation Management Plan (VMP) is to describe the current site conditions within the SLRRP and provide recommendations for vegetation management within the Park including: 1) invasive species management; 2) habitat restoration; and 3) fire management. While this VMP is intended to be a standalone document, the information and recommendations presented will be used by DPR to develop ASMDs as part of the RMP being prepared for the Park. In addition, the VMP provides fire response personnel with critical site information for emergency fire response within and immediately adjacent to the Park boundaries and identifies targeted fuel management actions that can be implemented as preventative measures.

The Invasive Species Management section of this VMP lists the non-native invasive plant species observed on the Park, identifies and prioritizes target species for removal, and outlines standard removal methods. The Habitat Restoration section of this VMP identifies potential restoration opportunities within the Park and outlines standard restoration methods. The Fire Management section of this VMP outlines a framework to address wildfire risk and enables environmental documentation of strategic fuels management that may be needed. The framework includes discussion of fire prevention, suppression, and post-suppression fire control activities within and adjacent to the Park.

The goals and objectives, as well as the recommendations in this VMP, are consistent with the County's MSCP and the County of San Diego Vegetation Management Report (County of San Diego 2009), which addresses vegetation management criteria for wildland and urban areas of unincorporated San Diego County. It is anticipated that this VMP will be revised once every five years, as needed, in conjunction with anticipated Park RMP updates. The VMP may be revised on a shorter timescale if there is a change in circumstance, for example, acquisition of additional Park land.

1.2 Site Location and Description

The SLRRP is generally located along an 8.5-mile stretch of the San Luis Rey River from just east of Interstate 15 (I-15) to the eastern boundary of the City of Oceanside in northern San Diego County, California (Figure 1). The current extent of the Park is mapped within the Bonsall, California U.S. Geological Survey (USGS) 7.5-minute quadrangle and is located in: Township 10 South, Range 3 West, Sections 14, 20, and 29–31; and the Monserate Land Grant (Figure 2).

The Park is currently composed of three separate non-contiguous parcels totaling approximately 460.1 acres. It encompasses all of Assessor Parcel Numbers (APNs) 123-381-07, 124-150-30, 124-150-31, 124-150-33, 125-080-20, 125-080-22, 125-131-55, 126-060-80, and 126-060-81, and the portions of APNs 126-080-69, 126-100-18, 126-100-21, and 126-320-14 that are located outside of the Caltrans right-of-way along State Route 76 (SR-76).

The three parcels that comprise the Park are located along the San Luis Rey River in the community of Bonsall (Figure 2). Specifically, the Park parcels are located south of SR-76 and east of I-15. The Park parcels are surrounded by the following uses: commercial and office, commercial recreation, extensive and intensive agriculture, public facilities and utilities, and low density, rural residential development.

The Park is located in the Draft North County MSCP Plan area within the designated Lower San Luis Rey River Linkage planning segment. The Park is located in the management district of one senior park ranger, one park ranger, one park maintenance worker, and three seasonal employees. Park rangers patrol the Park a minimum of three times a week and at times daily.

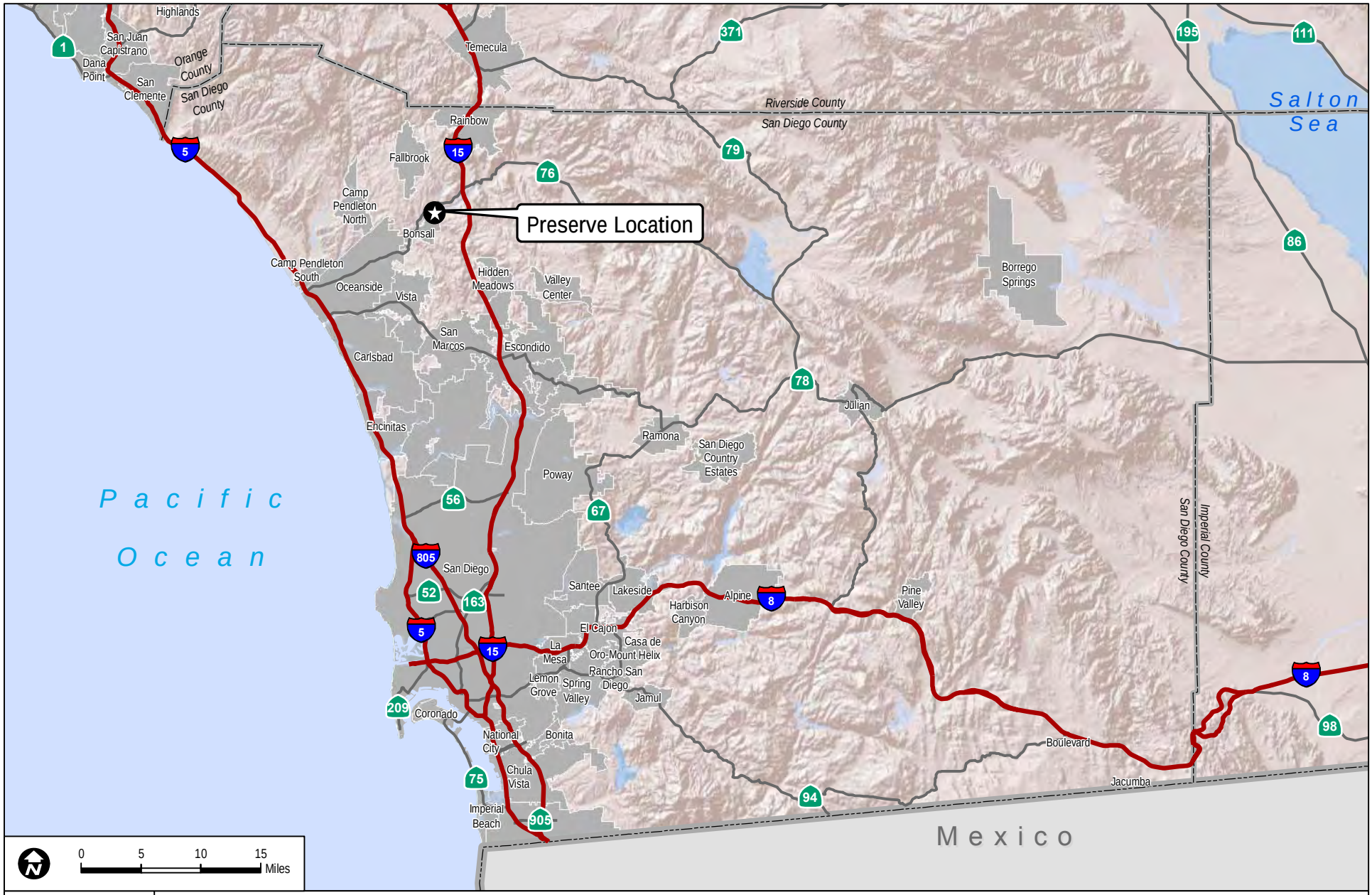

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FIGURE 1

Regional Map

San Luis Rey Riverpark - Vegetation Management Plan

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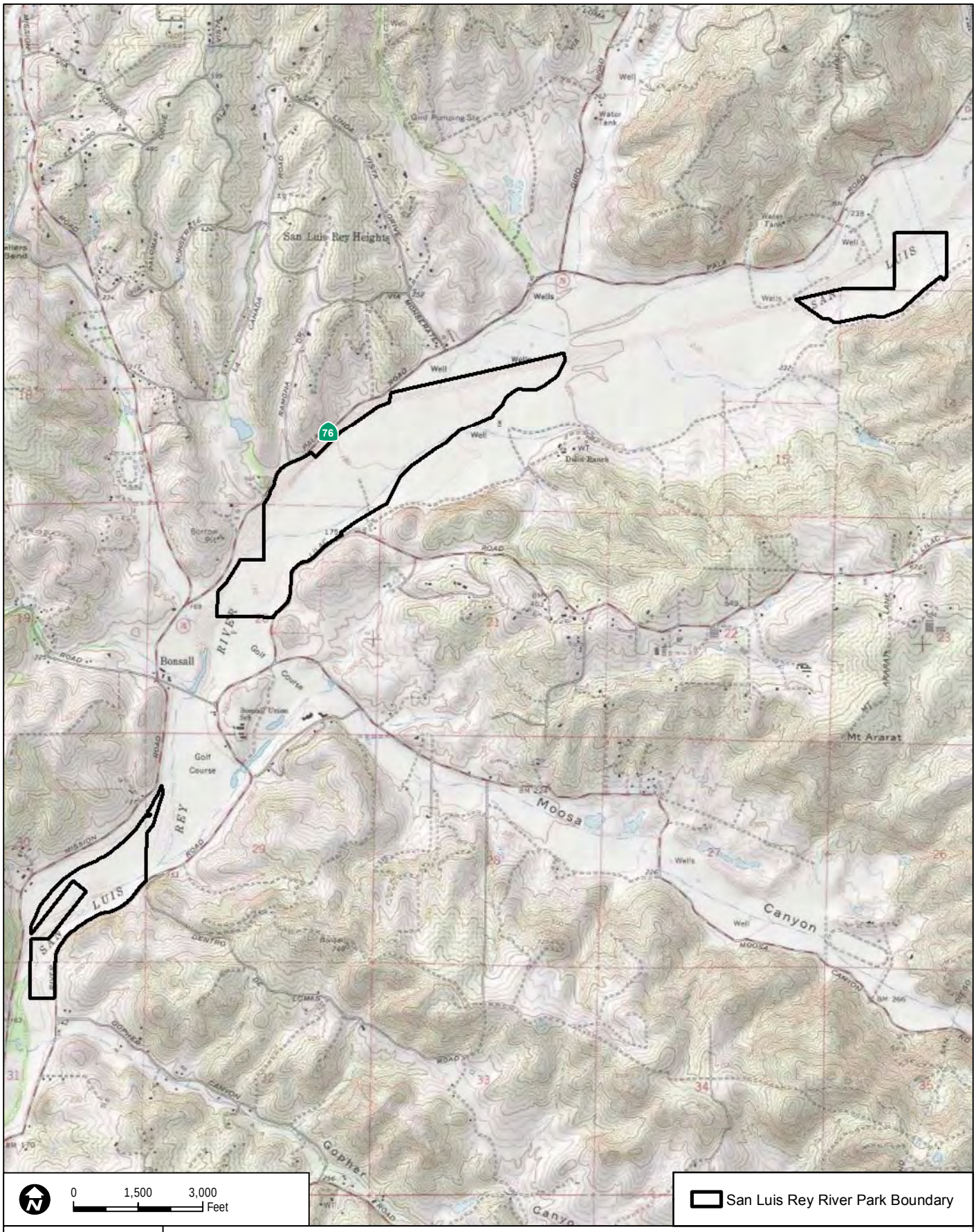

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SOURCE: USGS 7.5-Minute Series Quadrangle.

FIGURE 2
Vicinity Map

San Luis Rey Riverpark - Vegetation Management Plan

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The Park is located in the coastal foothills of the Peninsular Ranges in northern San Diego County and is comprised of relatively flat terrain ranging in elevation from 37 meters (120 feet) above mean sea level (AMSL) to approximately 73 meters (240 feet) AMSL. The Park consists primarily of southern cottonwood–willow riparian forest and is classified as a High or Very High Fire Hazard Severity Zone by the California Department of Forestry and Fire Protection (CAL FIRE) (FRAP 2011). The Park is designated a state responsibility area (SRA) and lies within the service area of the North County Fire Protection District (NCFPD).

1.3 Vegetation Management Goals and Objectives

This VMP aims to develop management strategies consistent with those of the larger Draft North County MSCP Plan. To that end, the vegetation management goals for the Park are focused on environmental resource preservation and enhancement of existing native habitat. The vegetation management goals for the Park include:

- Ensure the long-term viability and sustainability of native ecosystem function and natural processes.
- Protect the existing biological and cultural resources from disturbance-causing, incompatible activities within and adjacent to the Park.
- Manage invasive non-native species to ensure native vegetation community and resource preservation.
- Restore and/or enhance the quality of degraded vegetation communities in a manner consistent with overall species or habitat preservation goals.
- Develop fuel-load reduction methods that are consistent with overall Park management goals.

To achieve these long-term vegetation management goals for the Park, the following objectives have been formulated to achieve desired levels of resource protection, and public and firefighter safety:

- Maximize native vegetation community quality.
- Identify and prioritize removal/control of invasive non-native plant species on the Park.
- Provide methods for removal/control of invasive non-native plant species.
- Address current and long-term vegetation community restoration needs.
- Minimize adverse impacts to sensitive and high-value habitats.
- Utilize available fuel and invasive non-native plant reduction techniques, such as grazing, mowing, herbicide application, and prescribed fire, consistent with Park goals for habitat preservation, enhancement, and restoration, and asset and cultural resource protection.

- Provide site information on fire behavior to local fire agencies, including North County Fire Protection District and CAL FIRE San Diego Unit, for inclusion in existing or future wildland pre-response plans.
- Establish vegetation management units (VMUs) based on topography or other clearly discernable landscape boundaries to facilitate fire management.
- Minimize likelihood of Park-wide, catastrophic wildfires.
- Identify wildland urban interface (WUI) areas and associated fuel management goals with a dual role of preventing wildfire from impacting urban areas, as well as protecting Park lands from fire originating in urban areas.
- Provide education for local firefighting personnel regarding sensitive resources and overall management considerations associated with the Park.
- Provide local fire agencies maps of sensitive biological and cultural resources to be avoided to the maximum extent possible.
- Prepare Park maps depicting relevant fire management data, including property boundaries, topography, vegetation and fuel types, access, and other major features, such as roads and structures.
- Prepare fire restoration management guidelines for each VMU including discussion of prevention, suppression, and post-suppression activities.
- Provide appropriate contact information to responding fire personnel in the event fire management activities may affect priority resources.

2.0 ENVIRONMENTAL RESOURCES

Baseline biological surveys of the Park were conducted between September 2010 and May 2011 (Dudek 2011). Field studies included vegetation mapping (including mapping invasive non-native plants), rare plant surveys, butterfly surveys, pitfall arrays, aquatic amphibian surveys, avian point counts, bat surveys, small mammal trapping, and tracking and camera stations. Brief descriptions of the existing vegetation communities, sensitive wildlife species, and cultural resources documented within the Park during the baseline surveys are provided below.

2.1 Biological Resources

2.1.1 Vegetation Communities

The predominant vegetation community within the Park is southern cottonwood–willow riparian forest; however, seven other vegetation communities and land cover types were mapped within the Park during the 2010-11 surveys including: agriculture, developed land, disturbed habitat, orchard, non-native grassland, Diegan coastal sage scrub, southern cottonwood–willow riparian forest, disturbed southern cottonwood–willow riparian forest, and tamarisk scrub (Table 1, Figures 3a–d).

Table 1
Vegetation Communities

Vegetation Community/Land Cover Type (Holland Code*)	Acres On Site1	Percentage
Southern Cottonwood–Willow Riparian Forest2 (61330)	322.58	70.1%
Disturbed Habitat (11300)	83.66	18.2%
Non-native Grassland (42200)	39.88	8.7%
Developed Land (12000)	2.47	0.5%
Orchard (18100)	9.39	2.0%
Tamarisk Scrub (63810)	1.66	0.4%
Agriculture (18000)	0.41	0.1%
Diegan Coastal Sage Scrub (32500)	0.06	<0.1%
Total	**460.11**	**100.0%**

* Holland 1986, updated by Oberbaur et al. 2008.
[1] Does not include 100-foot buffer acreage
[2] Includes 36.03 acres of disturbed southern cottonwood–willow riparian forest

2.1.2 Sensitive Plant Species

No special-status plant species were documented within the Park during the 2010-11 surveys (Dudek 2011).

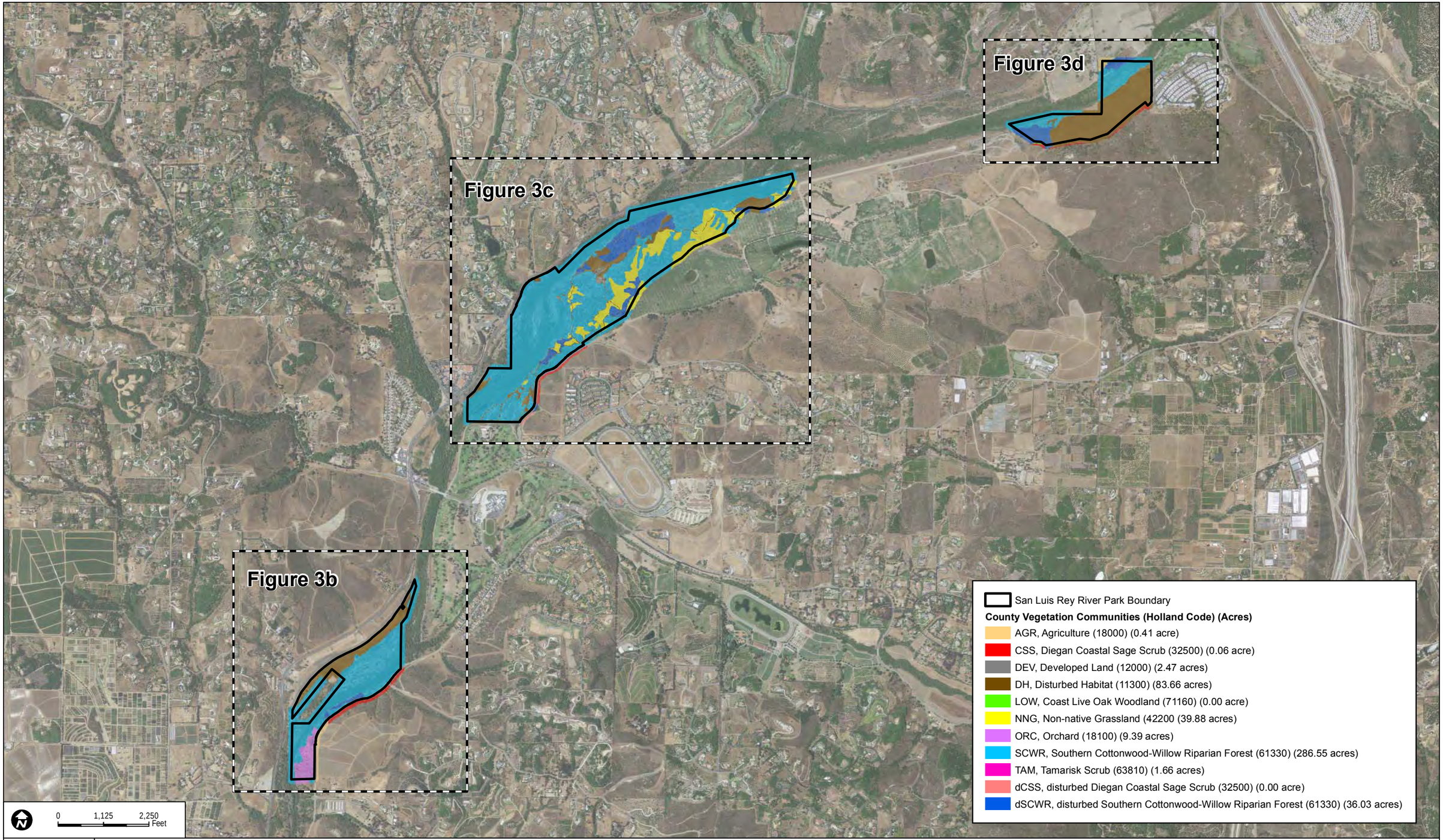
2.1.3 Sensitive Animal Species

Overall, 18 special-status wildlife species were observed or detected within the Park during the 2010–11 surveys. Table 2 presents the special-status animal species observed in the Park. Special-status animal species locations are presented on Figures 4a–d.

Table 2
Special-status Animal Species Known to Occur in the San Luis Rey River Park

Common Name	Scientific Name	Status (Federal/State/County/MSCP)1
Birds		
Barn Owl	*Tyto alba*	–/–/Group 2/–
Cooper's Hawk	*Accipiter cooperii*	–/SWL/Group 1/–
Great Blue Heron	*Ardea herodias*	–/–/Group 2/–
Least Bell's Vireo	*Vireo bellii pusillus*	FE/SE/Group1/MSCP
Red-Shouldered Hawk	*Buteo lineatus*	–/–/Group 1/–
Turkey Vulture	*Cathartes aura*	–/–/Group 1/–
Vaux's Swift	*Chaetura vauxi*	–/SSC/–/–
Yellow Warbler	*Dendroica petechia brewsteri*	–/SSC/Group 2/–
White-Faced Ibis	*Plegadis chihi*	–/SWL/Group 1/MSCP
Western Bluebird	*Sialia mexicana*	–/–/Group 2/–
Mammals		
Dulzura (California) Pocket Mouse	*Chaetodipus californicus femoralis*	–/SSC/Group 2/–
Northwestern San Diego Pocket Mouse	*Chaetodipus fallax fallax*	–/SSC/Group 2/–
Western Mastiff Bat	*Eumops perotis californicus*	–/SSC/Group 2/–
Western Red Bat	*Lasiurus blossevillii*	–/SSC/Group 2/–
Yuma Myotis	*Myotis yumanensis*	–/–/Group 2/–
Pocketed Free-Tailed Bat	*Nyctinomops femorosaccus*	–/SSC/Group 2/–
Southern Mule Deer	*Odocoileus hemionus*	–/–/Group 2/–
Invertebrates		
Monarch Butterfly	*Danaus plexippus*	–/–/Group 2/–

[1] Status – Federal Designations
FE: Federally Endangered
State Designations
SE: State Endangered
SSC: Species of Special Concern
SFP: State Fully Protected
SWL: State Watch List
County Designations
Group 1: Animals of high sensitivity (listed or specific natural history requirements)
Group 2: Animals declining, but not in
Immediate threat of extinction or extirpation
MSCP: Proposed for coverage under the Draft North County MSCP



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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 3a

Vegetation Communities/Habitats - Index Map

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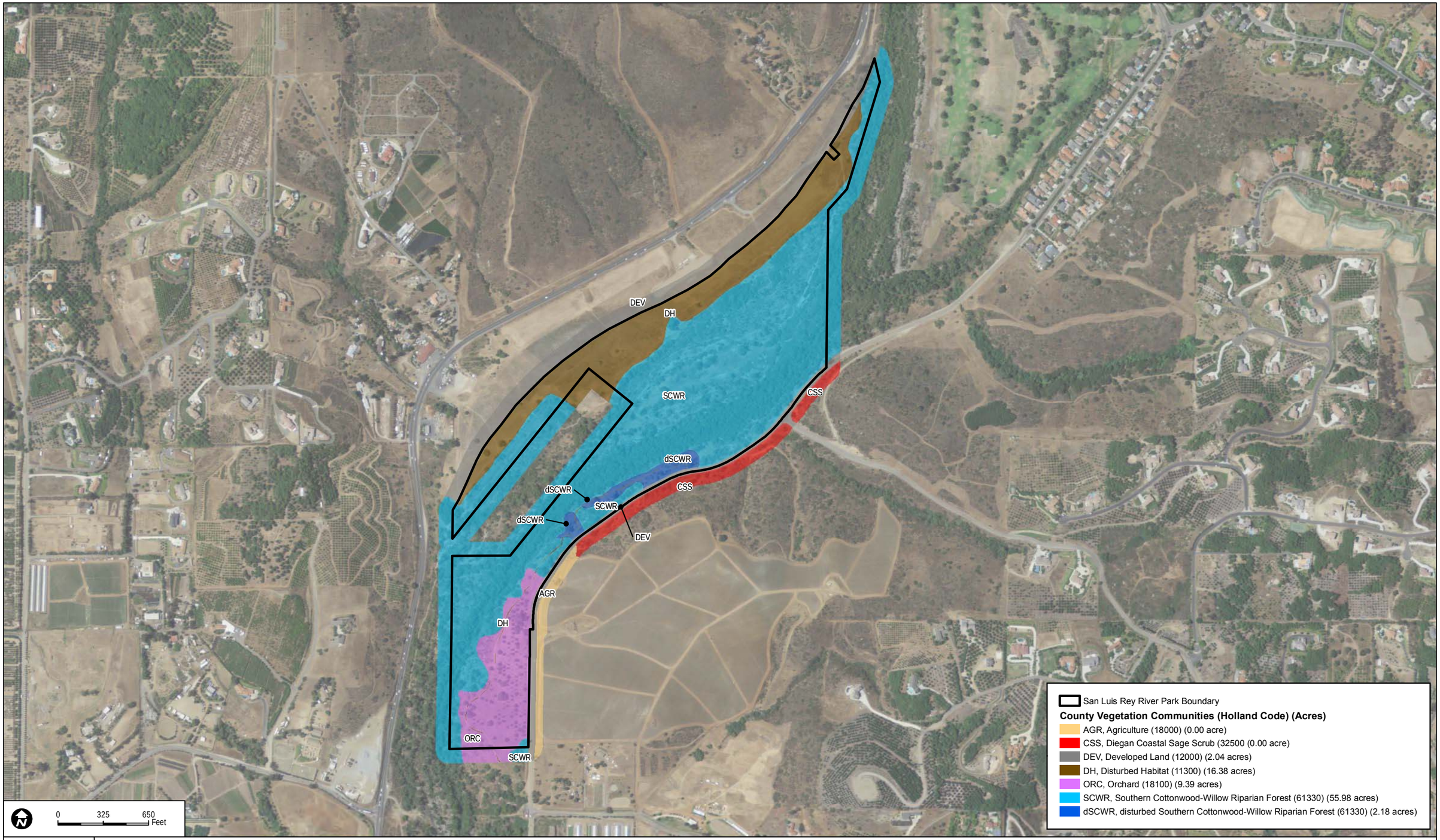

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 3b

Vegetation Communities/Habitats

San Luis Rey Riverpark - Vegetation Management Plan

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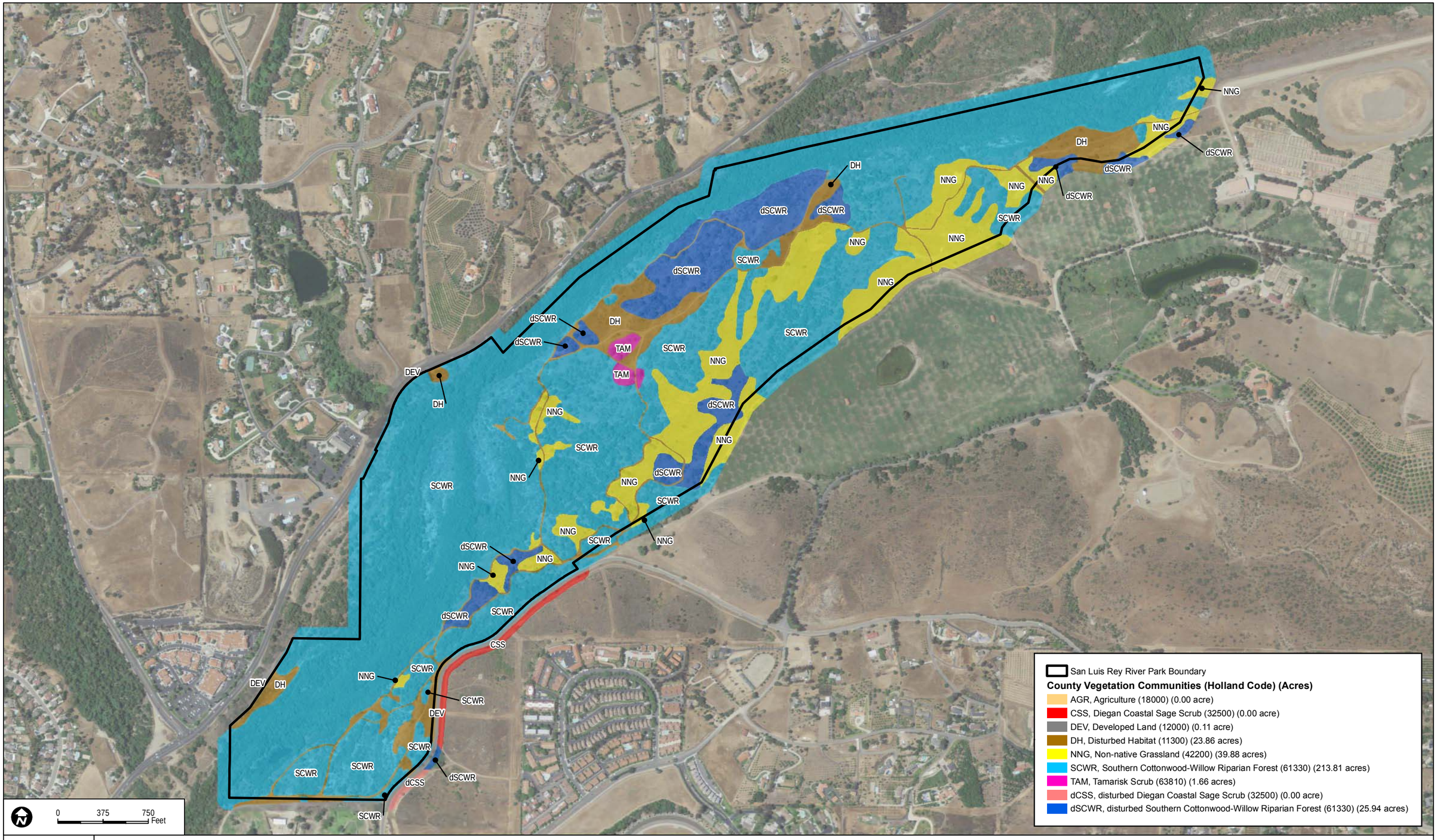

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 3c

Vegetation Communities/Habitats

San Luis Rey Riverpark - Vegetation Management Plan

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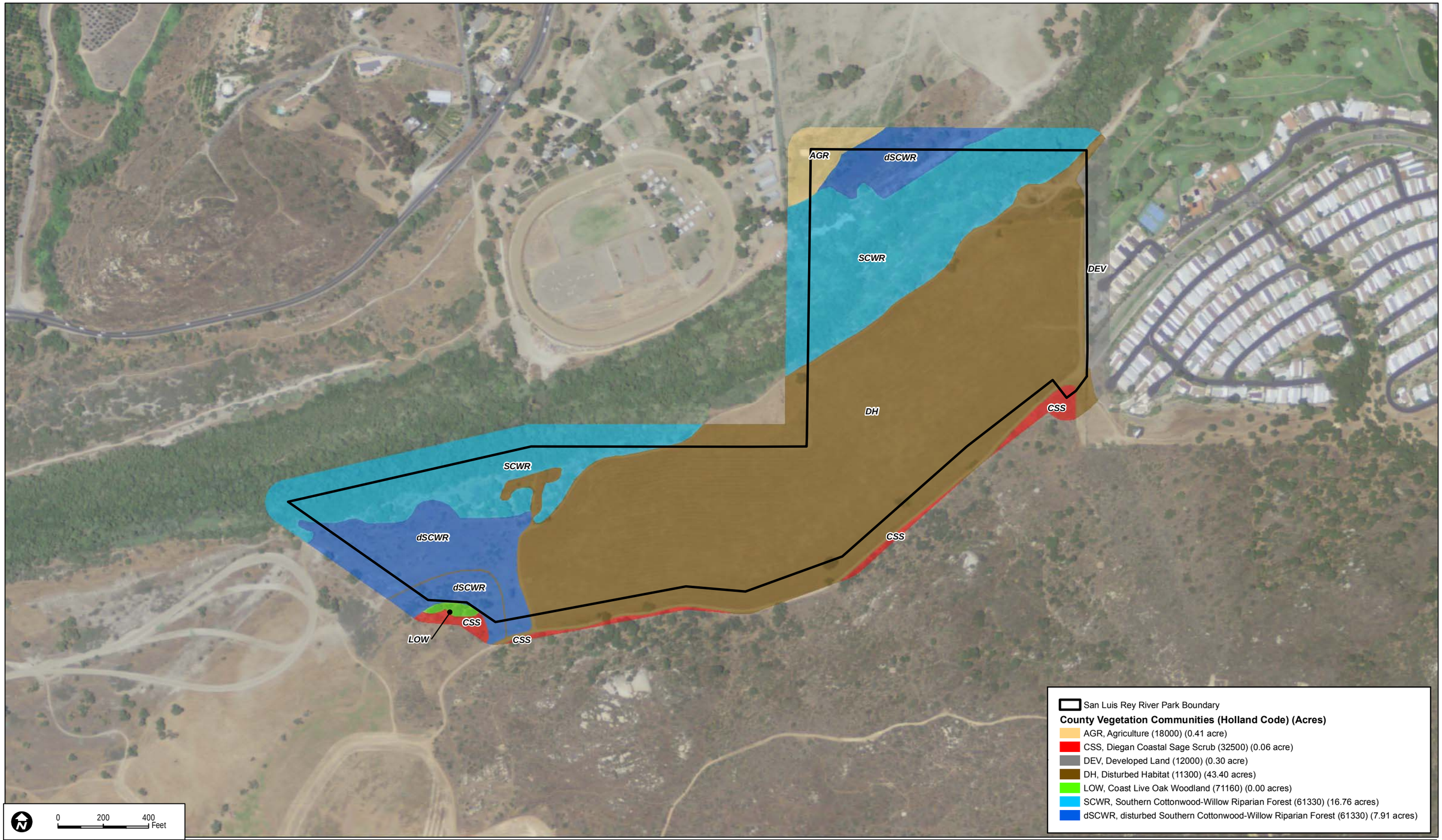

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 3d

Vegetation Communities/Habitats

San Luis Rey Riverpark - Vegetation Management Plan

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 4a

Special Status Wildlife Species - Index Map

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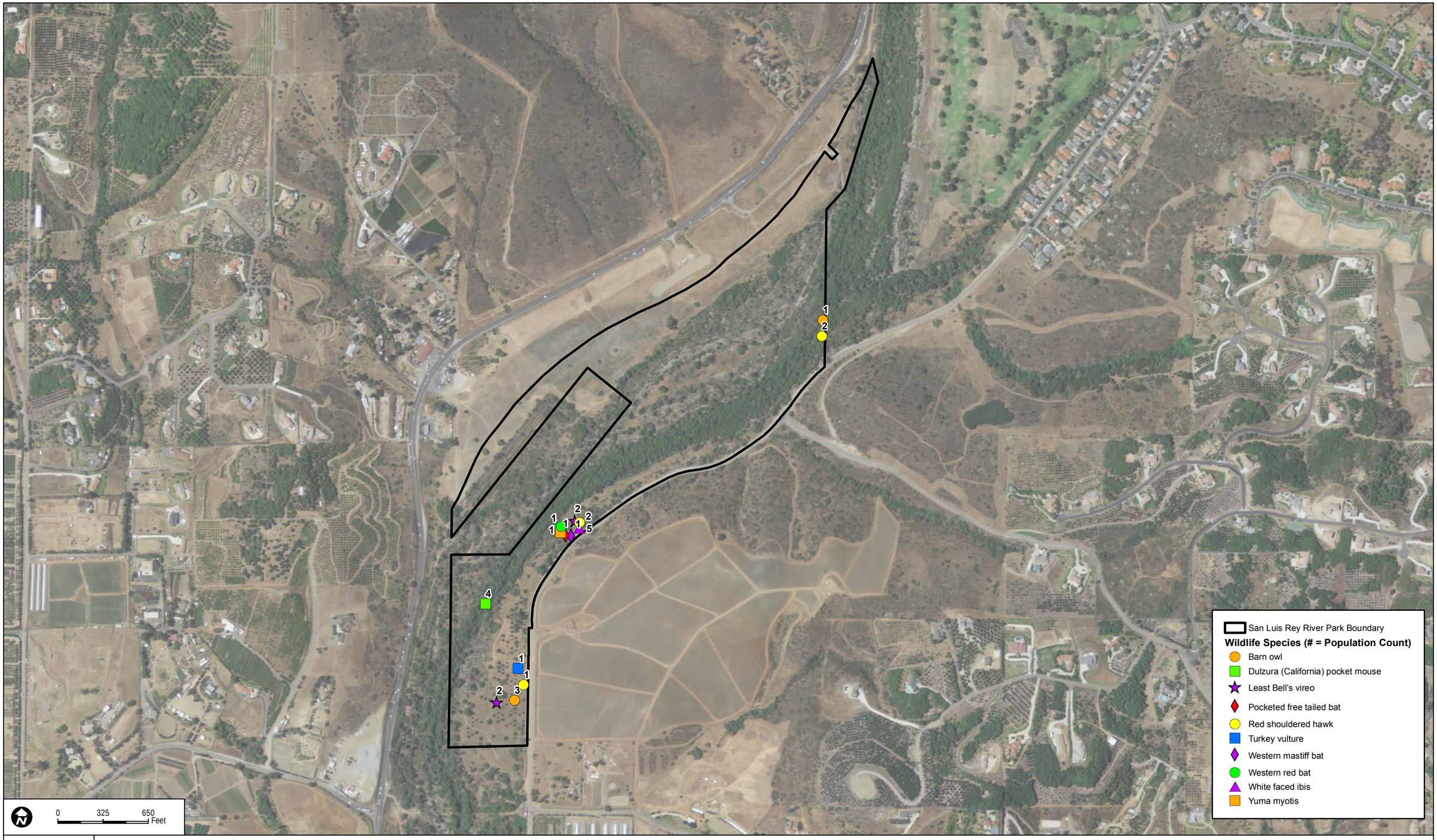

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 4b

Special Status Wildlife Species

San Luis Rey Riverpark - Vegetation Management Plan

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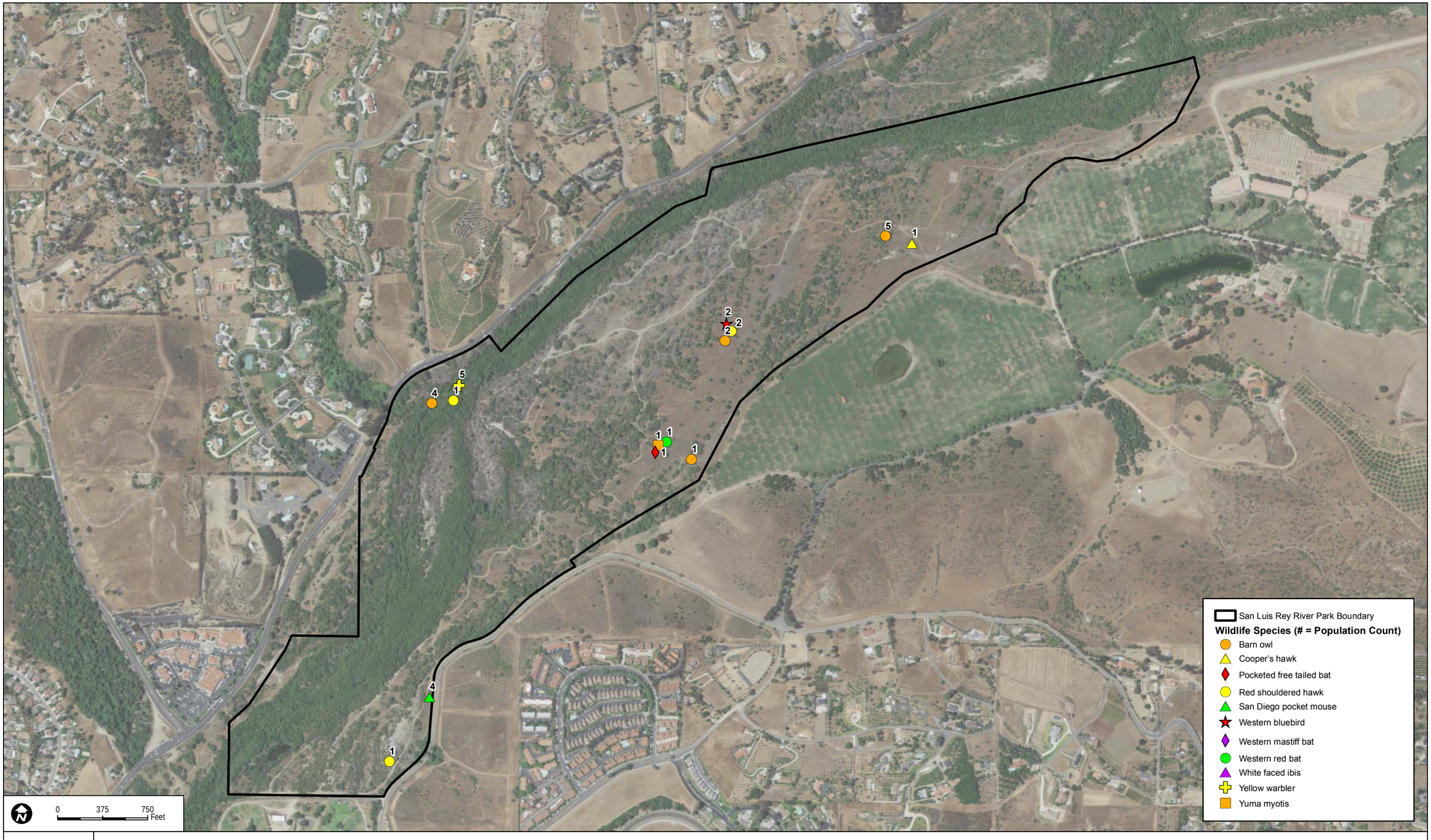

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 4c

Special Status Wildlife Species

San Luis Rey Riverpark - Vegetation Management Plan

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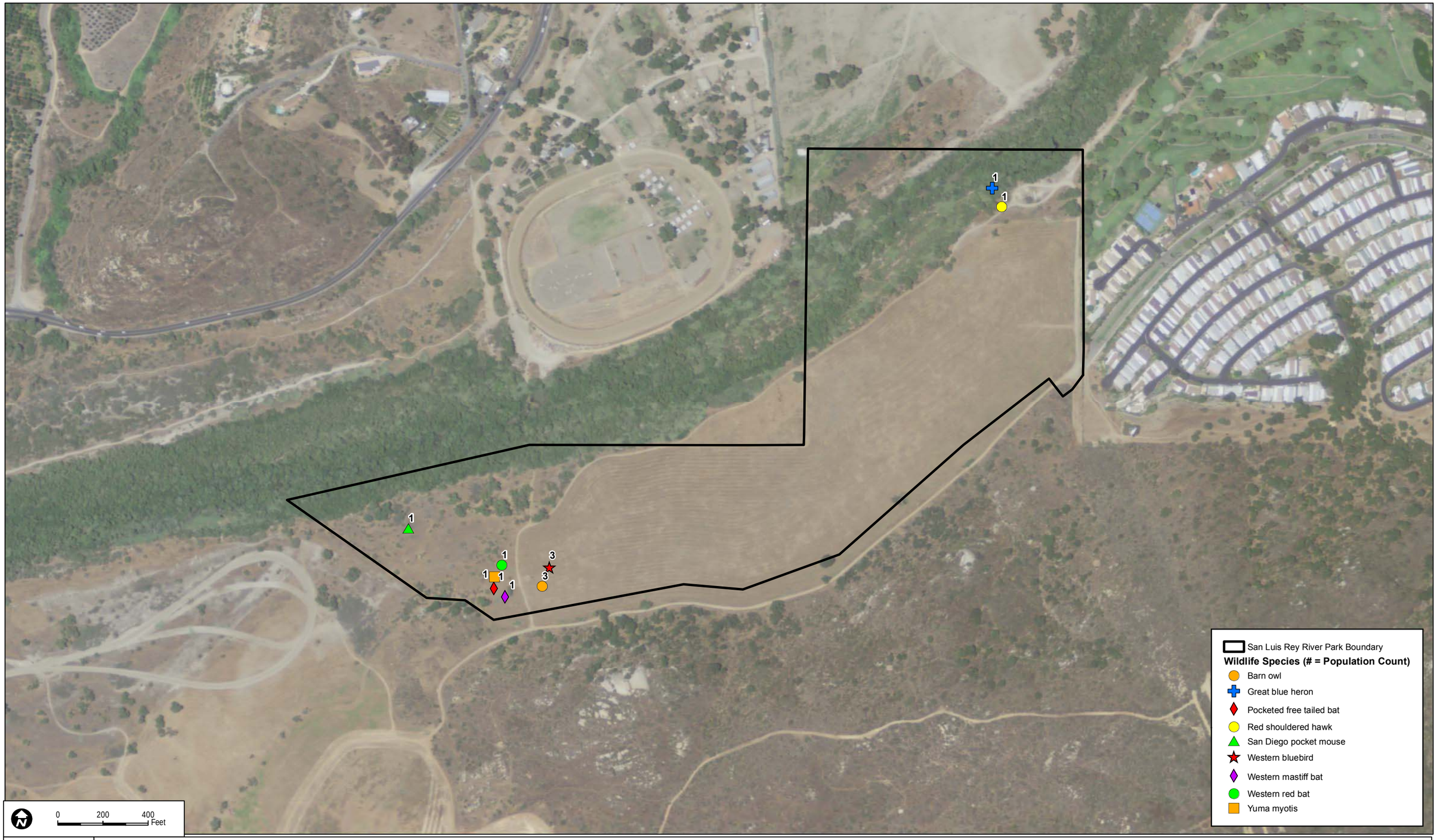

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 4d

Special Status Wildlife Species

San Luis Rey Riverpark - Vegetation Management Plan

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2.2 Cultural Resources

Seven significant or potentially significant cultural resources have been identified within the Park including: an unpaved historic road, concrete standpipes, retaining walls, cisterns, an earthen dam, irrigation features, and fences (ASM 2011). Table 3 presents the cultural sites identified in the Park, which should be considered sensitive until further evaluated for significance. Cultural resources within the Park are discussed in greater detail in the *Archaeological Survey Report for the San Luis Rey River Park* (ASM 2011). Locations of documented cultural resources in the Park are presented in the confidential appendices included in the aforementioned report.

Table 3
San Luis Rey River Park Sensitive Cultural Sites

Primary or Trinomial Site#	Description	Significance Evaluation
P-37-028134	Unpaved historic road	Not evaluated – Considered significant
CA-SDI-20,172 (P-37-031756)	Concrete standpipes, base, pad and retaining wall	Not evaluated – Considered significant
P-37-031757	Earthen dam/irrigation feature	Not evaluated – Considered significant
P-37-031758	Concrete standpipe	Not evaluated – Considered significant
CA-SDI-20,173 (P-37-031760)	Two sets of double concrete stand pipes, fence, and well	Not evaluated – Considered significant
CA-SDI-20,174 (P-37-031761)	Cistern and concrete water pipes	Not evaluated – Considered significant
P-37-031762	Two cisterns	Not evaluated – Considered significant

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3.0 INVASIVE SPECIES MANAGEMENT

Because invasive non-native plant species can have significant impacts on native plant associations, ecosystem processes and biodiversity, special management measures are needed for their removal and control. Non-native plants have few ecological controls on their population sizes, and they tend to thrive under disturbed conditions. They often exhibit aggressive growth, out-compete or otherwise harm sensitive species, and can alter natural fire regimes by increasing the frequency and intensity of wildfire (Bell 2009).

Seventy-three non-native plant species were identified in the Park during the 2010-11 surveys (Dudek 2011). The non-native shrub/tree species within the Park were mapped and are included in Table 4 along with their associated California Invasive Plant Council (Cal-IPC) Inventory rating. Invasive non-native shrub/tree locations are shown on Figures 5a–5d.

Table 4
Non-Native Shrub/Tree Species at the San Luis Rey River Park

Common Name	Scientific Name	U.S./California Weed List	Cal-IPC Rating*
Athel Tamarisk	*Tamarix aphylla*	–/–	Limited
Castor Bean	*Ricinus communis*	–/–	Limited
Giant Reed	*Arundo donax*	–/–	High
Indian Fig	*Opuntia ficus-indica*	–/–	–
Mexican Fan Palm	*Washingtonia robusta*	–/–	Moderate
Pampas Grass	*Cortaderia selloana*	–/–	High
Peruvian Peppertree	*Schinus molle*	–/–	Limited
Eucalyptus	*Eucalyptus* spp.	–/–	Moderate
Tamarisk (Salt Cedar)	*Tamarix ramosissima*	–/–	High
Tree Tobacco	*Nicotiana glauca*	–/–	Moderate

* Source: Cal-IPC California Invasive Plant Inventory Database, updated December 2010. Overall rating listed for southwest region, factoring impact, invasiveness, distribution and documentation level.

Inventory Categories

High: Species have severe ecological impacts, are conducive to moderate to high rates of dispersal/establishment and most are widely spread.

Moderate: Species have substantial and apparent, but generally not severe, ecological impacts, are conducive to moderate to high rates of dispersal, though establishment is generally dependent on ecological disturbance, and distribution may range from limited to widespread.

Limited: Species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score, have low to moderate rates of invasiveness, and are generally limited but may be locally persistent and problematic.

Non-native invasive herbaceous species are common throughout the Park, and comprise the majority of species in the non-native grassland on site, which is dominated by wild oat (*Avena fatua*), bromes (*Bromus* spp.), and filaree (*Erodium* spp.). While non-native grassland consists primarily of non-native plant species, it is considered a natural vegetation community under the County's MSCP because it is a naturalized community that provides habitat for native and sensitive plants and animal species. Therefore, non-native grassland plant species are not included in this management plan as target species for removal or control.

Much of the understory vegetation on the floodplain along the San Luis Rey within the Park is highly disturbed, and composed primarily of non-native herbaceous species. These non-native plant species were not mapped because of their high abundance and broad distribution across the site. Abundant and widespread species included poison-hemlock (*Conium maculatum*), bur-chervil (*Anthriscus caucalis*), Italian plumeless thistle (*Carduus pycnocephalus*), crown daisy (*Glebionis [Chrysanthemum] coronarium*), Russian thistle (*Salsola tragus*), milk thistle (*Silybum marianum*) and curly dock (*Rumex crispus*). Non-native herbaceous plant species within the Park are included in Table 5.

Table 5
Non-Native Herbaceous Plant Species at the San Luis Rey River Park

Common Name	Scientific Name	U.S./California Weed List*	Cal-IPC Rating**
annual cudweed	*Gnaphalium luteo-album*	–/–	–
annual rabbit's-foot grass	*Polypogon monspeliensis*	–/–	Limited
Baccone's sand-spurrey	*Spergularia bacconei*	–/–	–
Bermuda grass	*Cynodon dactylon*	–/CW	Moderate
Bird's foot trefoil	*Lotus corniculatus*	–/–	–
black mustard	*Brassica nigra*	–/–	Moderate
blessed milkthistle	*Silybum marianum*	–/–	Limited
blessed thistle	*Centaurea benedicta*	–/–	–
bristly oxtongue	*Helminthotheca echioides*	–/–	Limited
bull thistle	*Cirsium vulgare*	–/–	Moderate
bur-chervil	*Anthriscus caucalis*	–/–	–
burclover	*Medicago polymorpha*	–/–	Limited
celery	*Apium graveolens*	–/–	–
cheeseweed mallow	*Malva parviflora*	–/–	–
common chickweed	*Stellaria media*	–/–	–
common plantain	*Plantago major*	–/–	–
Crete weed	*Hedypnois cretica*	–/–	–

Table 5
Non-Native Herbaceous Plant Species at the San Luis Rey River Park

Common Name	Scientific Name	U.S./California Weed List*	Cal-IPC Rating**
crown daisy	*Glebionis [Chrysanthemum] coronarium*	–/–	Moderate
curly dock; clustered dock	*Rumex crispus; R. conglomeratus*	–/–	Limited, –
English ivy	*Hedera helix*	–/–	High
Sweet Fennel	*Foeniculum vulgare*	–/–	High
four-leaved allseed	*Polycarpon tetraphyllum*	–/–	–
gopher plant	*Euphorbia lathyris*	–/–	–
horehound	*Marrubium vulgare*	–/–	–
Hyssop loosestrife	*Lythrum hyssopifolia*	–/–	Limited
Italian plumeless thistle	*Carduus pycnocephalus*	–/CW	Moderate
Italian ryegrass	*Lolium multiflorum*	–/–	Moderate
lamb's quarters	*Chenopodium album*	–/–	–
little hogweed	*Portulaca oleracea*	–/–	–
Mediterranean grass	*Schismus barbatus*	–/–	Limited
mouse barley	*Hordeum murinum*	–/–	Moderate
narrowleaf cottonrose	*Filago gallica*	–/–	–
nettleleaf goosefoot	*Chenopodium murale*	–/–	–
perennial pepperweed	*Lepidium latifolium*	–/BW	High
petty spurge	*Euphorbia peplus*	–/–	–
pineapple weed	*Chamomila suaveolens*	–/–	–
poison hemlock	*Conium maculatum*	–/–	Moderate
prickly lettuce	*Lactuca serriola*	–/–	–
prickly sowthistle; common sowthistle	*Sonchus asper; S. oleraceus*	–/–	–
purple false brome	*Brachypodium distachyon*	–/–	Moderate
rat-tail fescue	*Vulpia myuros*	–/–	Moderate
redstem filaree; broadleaf filaree, whitestem filaree	*Erodium cicutarium*; *E. botrys*; *E. moschatum*	–/–	Limited, –, –
ripgut brome; soft brome; red brome; downy brome	*Bromus diandrus; B. hordeaceus; B. madritensis* ssp. *rubens; B. tectorum*	–/–	Moderate, Limited, High, High
Russian thistle	*Salsola tragus*	–/CW	Limited
scarlet pimpernel	*Anagallis arvensis*	–/–	–
shortpod mustard	*Hirschfeldia incana*	–/–	Moderate
slender oat; wild oat	*Avena barbata; A. fatua*	–/–	Moderate, Moderate
smooth cat's ear	*Hypochaeris glabra*	–/–	Limited
yellow sweetclover; annual yellow sweetclover	*Melilotus albus; M. indica*	–/–	–, –
tocalote	*Centaurea melitensis*	–/–	Moderate

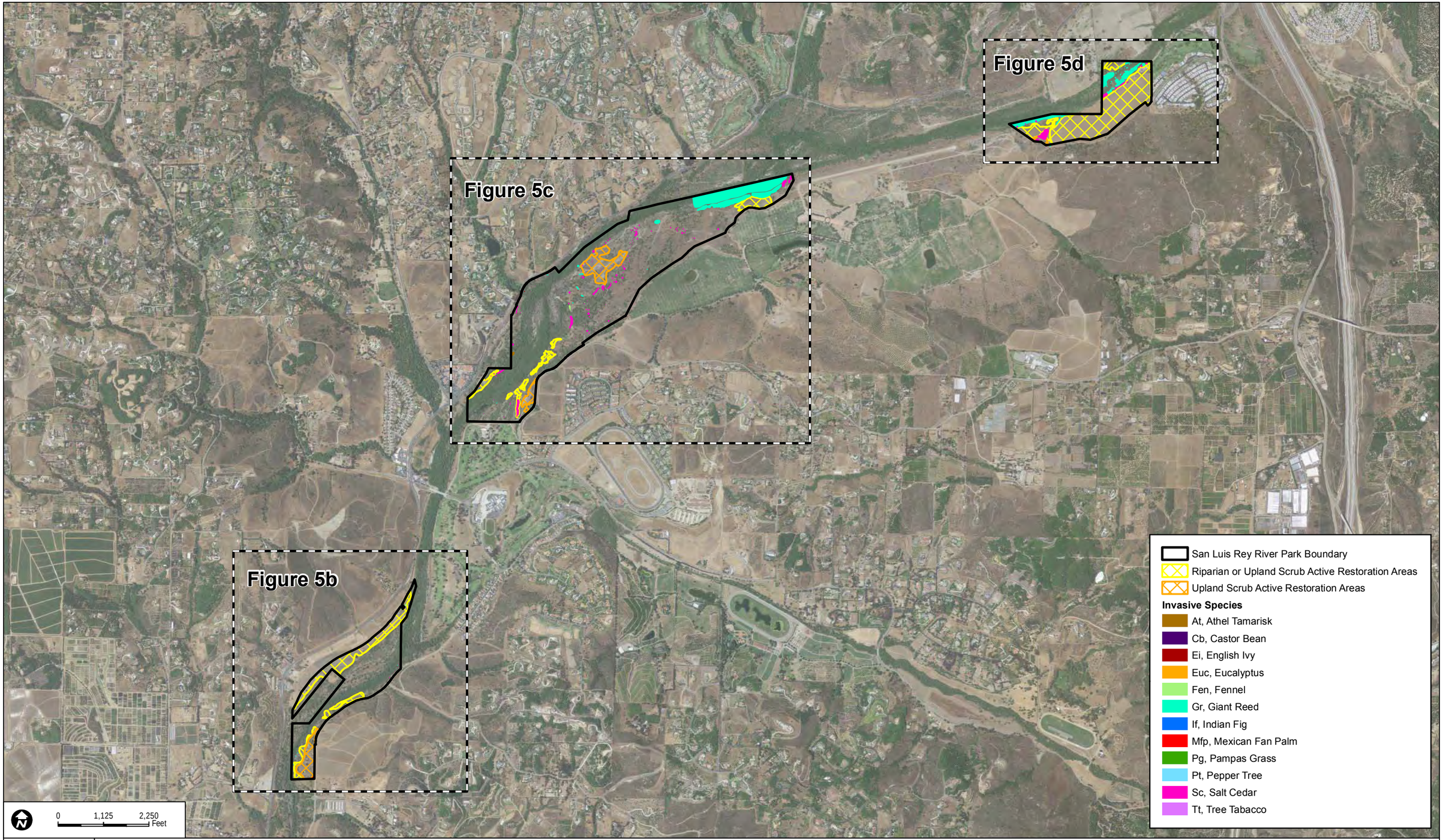
Table 5
Non-Native Herbaceous Plant Species at the San Luis Rey River Park

Common Name	Scientific Name	U.S./California Weed List*	Cal-IPC Rating**
water speedwell	*Veronica anagallis aquatica*	–/–	–
wavyleaf sea lavender	*Limonium sinuatum*	–/–	–
wild radish; cultivated radish	*Raphanus raphanistrum; R. sativus*	–/–	Limited, –

* California Weed List
BW: B List (Noxious Weed)
CW: C List (Noxious Weed)
** Source: Cal-IPC California Invasive Plant Inventory Database, updated December 2010. Overall rating listed for southwest region, factoring impact, invasiveness, distribution and documentation level.
Inventory Categories
High: Species have severe ecological impacts, are conducive to moderate to high rates of dispersal/establishment and most are widely spread.
Moderate: Species have substantial and apparent, but generally not severe, ecological impacts, are conducive to moderate to high rates of dispersal, though establishment is generally dependent on ecological disturbance, and distribution may range from limited to widespread.
Limited: Species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score, have low to moderate rates of invasiveness, and are generally limited but may be locally persistent and problematic.

3.1 Target Invasive Species

Certain invasive non-native plant species observed within the Park have been identified as target species in need of removal and control. A removal priority ranking system was established for these target species to assist management efforts. The criteria used for assigning removal priority rankings for the invasive non-native species included an evaluation of the Cal-IPC rating, the current cover and distribution in the Park, the potential for invading sensitive habitat, the practicality of successful control, and the potential for increasing fire intensity. These species and associated management/control recommendations are presented below in Table 6 along with a removal priority ranking. It should be noted that although several of the common non-native herbaceous species in Table 5 above have a Cal-IPC rating of moderate or high, many of these species are impractical to control on a large scale (e.g., annual grasses), and thus were not included as target invasive species at the Park. Species ranked as high priority are recommended for control as soon as possible; species ranked as moderate priority are recommended for control as soon as high priority species are under control; and species ranked as low priority are recommended for control after high and moderate priority species are under control.



DUDEK

6680-3D

SOURCE: CDFG NAIP Imagery (2009)

FIGURE 5a

Target Invasive Non-native Plant Species Locations and Potential Restoration Areas - Index Map

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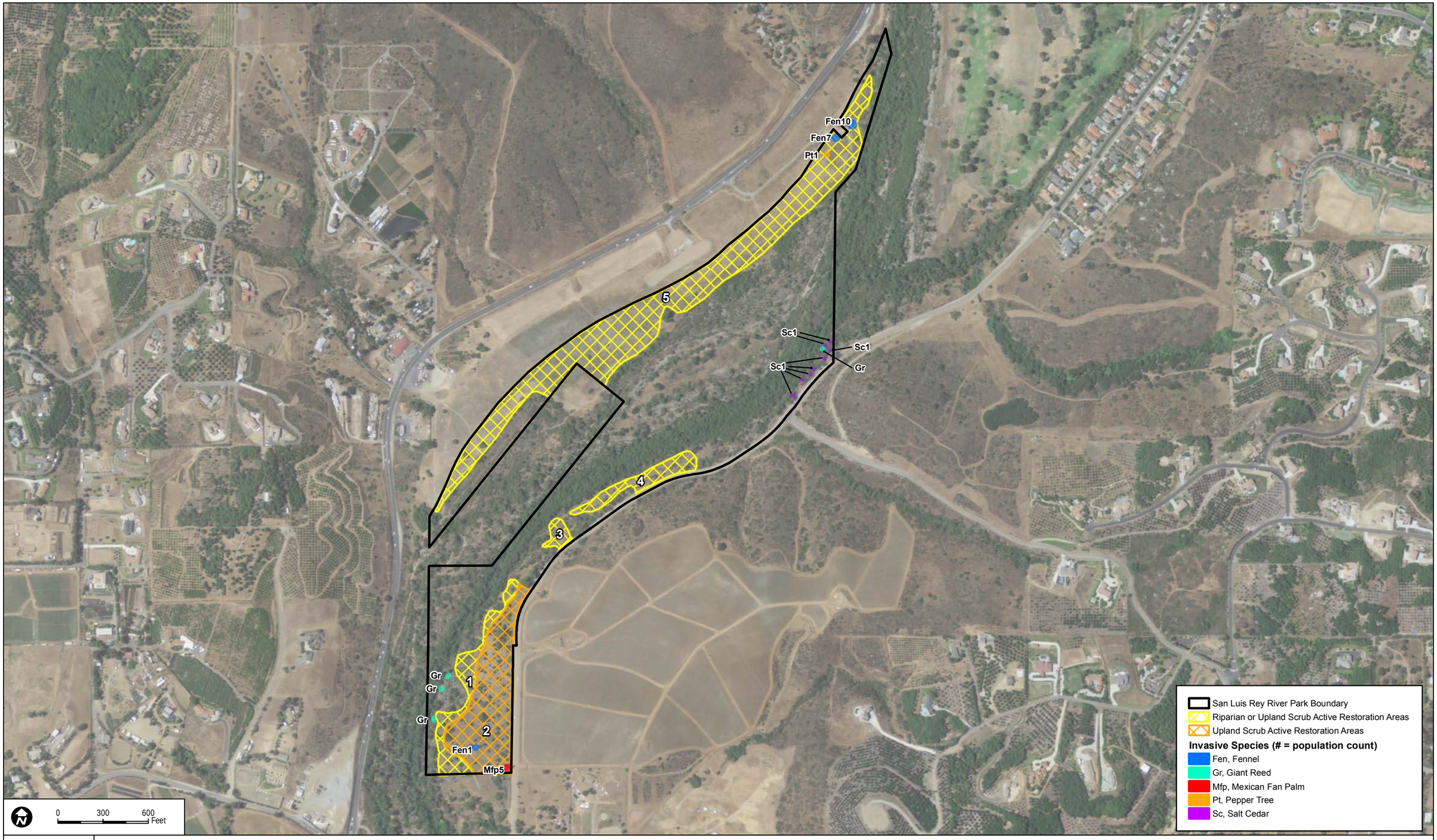

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6680-01

SOURCE: CDFG NAIP Imagery (2009)

FIGURE 5b

Target Invasive Non-native Plant Species Locations and Potential Restoration Areas

San Luis Rey River Park - Vegetation Management Plan

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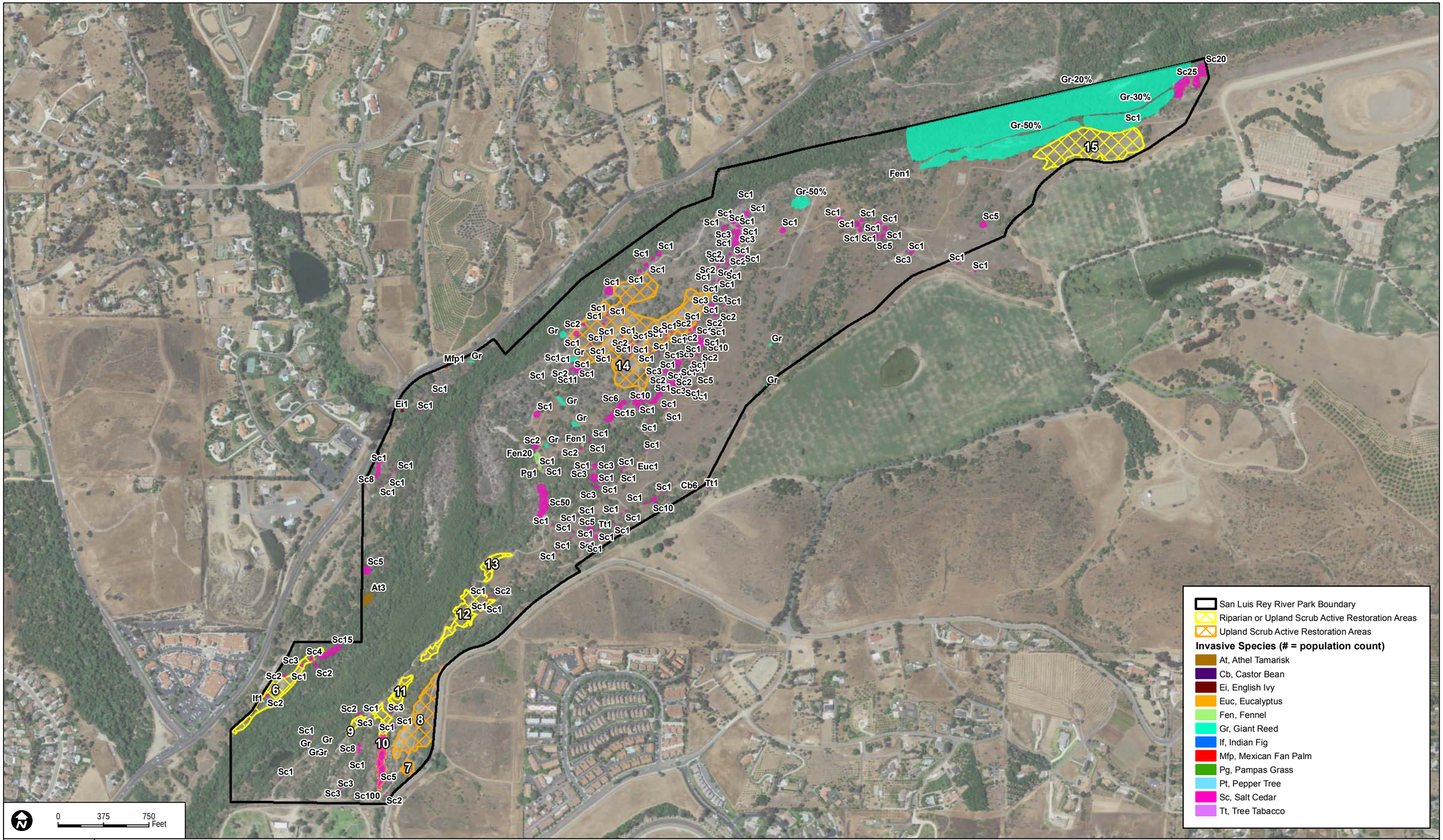

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6680-01

SOURCE: CDFG NAIP Imagery (2009)

FIGURE 5c

Target Invasive Non-native Plant Species Locations and Potential Restoration Areas

San Luis Rey River Park - Vegetation Management Plan

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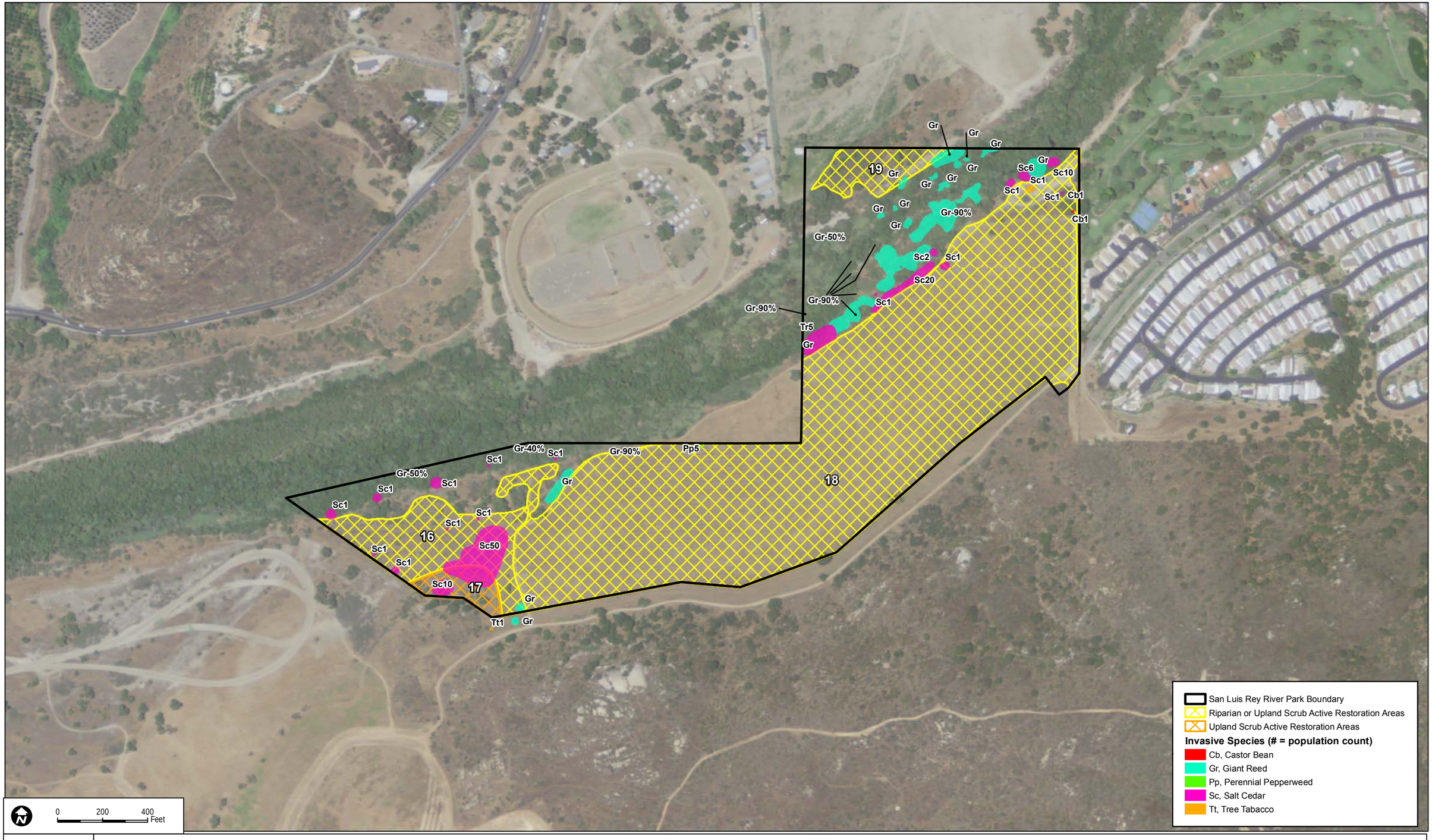

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SOURCE: CDFG NAIP Imagery (2009)

FIGURE 5d

Target Invasive Non-native Plant Species Locations and Potential Restoration Areas

San Luis Rey River Park - Vegetation Management Plan

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Table 6
Removal Priority of Target Invasive Non-Native Species

Common Name	Scientific Name	Cal-IPC Rating	Removal Priority
Castor Bean*	*Ricinus communis*	Limited	High
English ivy	*Hedera helix*	High	High
Giant Reed*	*Arundo donax*	High	High
Pampas Grass*	*Cortaderia selloana*	High	High
Perennial pepperweed	*Lepidium latifolium*	High	High
Sweet Fennel *	*Foeniculum vulgare*	High	High
Tamarisk (Salt Cedar)*	*Tamarix ramosissima*	High	High
black mustard	*Brassica nigra*	Moderate	Moderate
bull thistle	*Cirsium vulgare*	Moderate	Moderate
crown daisy	*Glebionis [Chrysanthemum] coronarium*	Moderate	Moderate
Eucalyptus*	*Eucalyptus* spp.	Moderate	Moderate
Italian plumeless thistle	*Carduus pycnocephalus*	Moderate	Moderate
Mexican Fan Palm*	*Washingtonia robusta*	Moderate	Moderate
poison hemlock	*Conium maculatum*	Moderate	Moderate
shortpod mustard	*Hirschfeldia incana*	Moderate	Moderate
tocalote	*Centaurea melitensis*	Moderate	Moderate
Tree Tobacco*	*Nicotiana glauca*	Moderate	Moderate
Athel Tamarisk*	*Tamarix aphylla*	Limited	Low
Peruvian Peppertree*	*Schinus molle*	Limited	Low

* Observed locations of invasive trees/shrubs were mapped (see Figures 5a–5d).

3.1.1 High Priority Species

Castor Bean (*Ricinus communis*)

Castor bean is a large shrub which is sometimes cultivated as an ornamental and for oil contained in the seeds. It has escaped cultivation in California and become a noxious weed (DiTomaso and E.A. Healy 2007). This perennial non-native can become aggressive when proper growing conditions are present, creating monotypic stands, and displacing native vegetation along wetland margins, or moderately dry upland areas. It produces a substantial tuberous root, in which it can store moisture and energy through times of drought, and/or if above ground plant parts are damaged, removed, or stressed. Castor bean was observed in two locations, covering only a few square feet (Figures 5c and 5d). While its current footprint is discrete within the Park, and it is rated as "limited" by Cal-IPC, it is ranked as a high priority for control due to its relatively close proximity to the San Luis Rey River riparian corridor, as well as its capacity to spread rapidly. Recommended control for this species includes cutting and removal of above

ground plant parts prior to seed maturity for larger specimens that have developed a thick stem or trunk, and hand pulling for smaller seedlings and juveniles. Application of an appropriate herbicide is recommended for remaining stumps and plant parts, as these can regenerate. Removed invasive plants should be properly disposed of at off-site facilities.

English Ivy (*Hedera helix*)

English ivy is a perennial vine that can escape cultivation and establish in riparian habitats. It has creeping stems that have roots at leaf nodes that allow the plant to climb up vertical surfaces. It can affect all strata of riparian forest habitat as it grows up through the tree canopy and can crowd out native species. English ivy was observed in one location on the northern edge of the riparian area within the Park (see Figure 5c for approximate location). The Cal-IPC inventory categorizes English ivy as having an overall rating of "high" and given its potential to spread within the riparian areas of the Park, it is ranked as a high priority for control. The best method for control of English ivy may be hand removal of vines (Bossard et. al. 2000). The vines can be cut and pulled up from the ground and down from the canopy. Application of an appropriate herbicide may also be effective, but the waxy leaf surface makes herbicide treatments difficult. Removed invasive plants should be properly disposed of at off-site facilities. The area from which the English ivy would be removed would not require any replanting or restoration.

Giant Reed (*Arundo donax*)

Giant reed is a tall perennial grass that forms dense stands on disturbed sites, sand dunes, riparian areas, and wetlands. This species invades by outcompeting native species, such as willows, for water and reduces habitat for sensitive species such as least Bell's vireo and southwestern willow flycatcher. It also has the ability to stabilize stream terraces, deepening flood channels, which can result in unsuitable habitat for arroyo toads. Along with tamarisk, giant reed presents a substantial risk of reducing habitat quality within riparian areas in the Park. Giant reed has been partially controlled within the Park during prior weed control efforts conducted by the Mission Resource Conservation District. However, there is still a significant presence of this species within a portion of the Park, with scattered re-sprouting individuals observed in several areas. Over 27 acres of habitat was mapped with giant reed (Figures 5a–5d). The Cal-IPC inventory categorizes giant reed as having an overall rating of "high" and given its considerable presence in the Park, it is ranked as a high priority for control. Because giant reed forms an extensive root system, it is difficult to control by mechanical methods. Application of an appropriate systemic herbicide is recommended to treat the plants since stems and root fragments can regenerate. Removed invasive plants should be properly disposed of at off-site facilities. The area from which giant reed would be removed will likely eventually re-establish with native riparian plant species, however supplemental planting in larger areas may be necessary to speed up the process and minimize the potential for re-establishment of additional invasive plant species.

Perennial Pepperweed (*Lepidium latifolium*)

Perennial pepperweed is an herbaceous perennial plant that typically grows on moist or seasonally wet sites. It is an aggressive, spreading perennial herb with extensive creeping roots. Plants are highly competitive and can form dense colonies that displace native vegetation and wildlife (DiTomaso and Healy 2007). It reproduces vegetatively from creeping roots and by seed. The Cal-IPC inventory categorizes perennial pepperweed as having an overall rating of "high" and it is ranked as a high priority for removal/control within the Park because of its capacity to spread rapidly in riparian areas. This species was observed in only one location within the Park encompassing only a few square feet (Figure 5d). Treatment and control of perennial pepperweed can be challenging. The most effective method is chemical control (Bossard, et. al. 2000). Treatment is recommended to occur prior to seed-set, and if viable seed is present at the time of treatment, seed heads should be carefully cut and bagged to prevent seed spread.

Pampas Grass (*Cortaderia selloana*)

Pampas grass is a large, clumping perennial grass, about 6 to 8 feet (1.8 to 2.4 meters) tall. It is an aggressive spreading, ornamental species that produces significant amounts of biomass, which is extremely flammable, thus increasing the potential for fire ignition and/or spread. This species produces an abundance of seed, which is light, and can be windblown into the surrounding areas. The Cal-IPC inventory categorizes pampas grass as having an overall rating of "high" and it is ranked as a high priority for removal/control within the Park because of its capacity to spread rapidly in riparian areas. This species was observed in only one location within the Park encompassing only a few square feet (Figure 5c). Treatment and removal of pampas grass involves either hand digging or pulling/winching plants out of the ground. If complete removal of the plant is not feasible, it may be cut to near the ground surface and treated with an appropriate herbicide. Treatment is recommended to occur prior to seed-set, and if viable seed is present at the time of treatment, plumes should be carefully cut and bagged to prevent seed spread.

Sweet Fennel (*Foeniculum vulgare*)

Sweet fennel is a perennial herb common throughout California. It can drastically alter the composition and structure of many plant communities, including grasslands, coastal scrub, riparian and wetland communities. In addition it can also alter fire regimes creating an intense, fast-moving fire. Sweet fennel was observed in six locations encompassing approximately 0.2 acre (Figures 5b and 5c). The Cal-IPC inventory categorizes fennel as having an overall rating of "high" and it was ranked as a high priority for control due to its capacity to spread rapidly. Recommended control methods include a foliar application of a systemic herbicide, or cutting of

the plants to near the ground, and treatment of the stems with an appropriate herbicide. Control should be performed prior to seed-set; however, if viable seed is present at the time of control, seed heads should be bagged, and disposed of appropriately off site. Follow up herbicide applications may be necessary for control.

Tamarisk (*Tamarix ramosissima*)

Tamarisk (also known as salt cedar) is a shrub or tree typically found along waterways, drainages and riparian areas. Its presence can affect geomorphology, groundwater availability, soil chemistry, fire frequency, plant community composition and native wildlife diversity (Bossard et. al. 2000). Approximately 477 individuals covering approximately 6 acres were mapped within the Park (Figures 5a-5d). The Cal-IPC inventory categorizes tamarisk as having an overall rating of "high" and given its considerable presence in the Park, it is ranked as a high priority for control. Because tamarisk is a sizable plant, the biomass can be removed by mechanical methods. However, application of an appropriate systemic herbicide may be necessary to control. The species readily regenerates from cut stumps and root fragments (Bossard et. al. 2000). Removed invasive plants should be properly disposed of at off-site facilities. The area from which tamarisk would be removed may potentially passively regenerate with native plant species, but supplemental planting may be necessary to effectively restore the habitat, particularly in large areas.

3.1.2 Moderate Priority Species

Eucalyptus Trees (*Eucalyptus* spp.)

Eucalyptus is group of large trees that have been widely planted throughout California. Some species commonly escape into natural areas and can spread rapidly, particularly in riparian habitat. Only one eucalyptus tree was observed within the Park encompassing only a few square feet (Figure 5c). The Cal-IPC inventory categorizes Eucalyptus as having an overall rating of "moderate." It is ranked as a moderate priority for removal/control in the Park because of the species' tendency to spread rapidly and displace native vegetation communities. In addition this species is also of concern for fire hazard since its physical characteristics (resin content) can increase fire intensity, transition ground fire to crown fires, and propagate spot fires through the dislodging of canopy material during windy conditions. Therefore, the best treatment for eucalyptus removal is through a combination of mechanical removal and herbicidal treatments. Eucalyptus trees may be cut and sprayed with an appropriate herbicide, or trees may be controlled with the use of girdling and herbicidal treatment. Herbicides should be applied within the first 1 to 2 minutes following cutting. Trees can be girdled past the xylem/phloem and treated with an appropriate herbicide. Follow-up herbicidal treatment may be necessary since sucker growth may occur.

Mexican Fan Palm (*Washingtonia robusta*)

Mexican fan palm is a species of palm tree commonly used for landscaping, which has become invasive in riparian areas, orchards, and landscaped areas. It is known to create monotypic stands in riparian areas, and dead fronds of the tree can create a fire hazard. It can spread into native vegetation communities through seeds being washed downstream in drainages, or birds dispersing seeds into areas with sufficient soil moisture for the palm to germinate and establish. The Cal-IPC inventory categorizes Mexican fan palm as having an overall rating of "moderate" and designates it as an Alert species, indicating it has significant potential to invade new ecosystems. This species is ranked as a moderate priority for removal/control within the Park due to its potential for additional colonization within the riparian corridor. Six palm trees within an area approximately 0.5 acre were mapped on site (Figures 5b and 5c). Control for this tree species may include mechanical removal of the tree and treatment of the stump with an appropriate herbicide. Alternatively, the palms may be drilled, injected with an appropriate herbicide, and left in place to die if removal is not desired. Complete removal of the trees would be preferable from a fire management perspective since this would reduce the available deadwood fuel load present.

Tree Tobacco (*Nicotiana glauca*)

Tree tobacco is an invasive tree/shrub that was first introduced in California as an ornamental but has escaped and frequently colonizes areas of soil disturbance in a variety of upland habitats. It is a prolific seed producer and has a high rate of spread. The Cal-IPC inventory categorizes tree tobacco as having an overall rating of "moderate", and it is ranked as a moderate priority for removal/control within the Park because of the species' tendency to establish in disturbed areas. Only three tree tobacco plants were mapped in the Park encompassing only a few square feet (Figures 5c and 5d). Mechanical removal is recommended, with an appropriate herbicide applied to remaining stump and plant parts. Follow-up treatments may be necessary.

Invasive Annual Herbs (*Brassica nigra, Cirsium vulgare, Glebionis coronarium, Carduus pycnocephalus, Conium maculatum, Hirschfeldia incana,* and *Centaurea melitensis*)

Several invasive annual herbs were grouped together because of their common overall abundance, distribution and control strategy. All species within this group were rated by Cal-IPC as "moderate." Each of the species was ranked as moderate priority for control within the Park due to their high abundance and broad distribution across the site, as well as their ability to spread and re-establish quickly in disturbed areas. Control of these species could include either mechanical or herbicide treatment. Each of the species produces abundant seed. Thus, removal of plant material that has seed present is important. Control should be focused during the winter and early spring months before the species develop seed. Young plants can be pulled, cut or treated

with an appropriate herbicide to control. Recurring management and control of these species would be necessary to prevent re-establishment. Large areas where these species are controlled should be planted with native species to minimize re-establishment of the invasive species.

3.1.3 Low Priority Species

Athel Tamarisk (*Tamarix aphylla*)

Athel tamarisk is a shrub or tree typically found along streams and lakeshores. It is similar to *Tamarix ramosissima* described above, except that Athel tamarisk is less invasive. Three large individuals of Athel tamarisk were mapped within the Park, encompassing approximately 0.14 acre (Figure 5c). This species is ranked as a low priority for control since the Cal-IPC inventory categorizes Athel tamarisk as having an overall rating of "limited" and the species is limited in abundance in the Park. The large trees could be cut down and stump treated, or treated in place with a systemic herbicide through drilling. The area from which Athel tamarisk would be removed will likely regenerate with native riparian plant species.

Peruvian Peppertree (*Schinus molle*)

Peruvian peppertree is an ornamental tree that can invade into natural areas with suitable soil moisture through shoot sprout or seed dispersal by birds or stream flows in drainages; however, it is reported as only mildly invasive. The Cal-IPC inventory categorizes Peruvian peppertree as having an overall rating of "limited" and it is ranked as a low priority for removal/control within the Park because only one tree was observed, it spreads slowly, and presents only a mild threat to displace native habitat. Peppertree can be difficult, or require repeated, regular follow-up treatments for control. Recommended control methods include mechanical removal, and application of an appropriate herbicide to remaining stump and plant parts. Follow-up herbicide control may be required.

3.2 Removal Methods

The selection of the appropriate removal methodology should be determined with consideration of many variables, including the time of year, severity of infestation, the presence of sensitive plants and wildlife, the degree of intermixing of invasive species with sensitive native habitats, access, and proximity to surface water. The U.S. Army Corps of Engineers and California Department of Fish and Game should be consulted regarding potential permitting requirements if invasive removal will occur in waterways or wetlands under their jurisdiction. General recommendations for control of invasive species within the Park are provided below.

3.2.1 Manual Removal

Manual vegetation removal (e.g., hand pulling, grubbing and hoeing) is a low-impact method of controlling non-native species within a focused area dominated by native vegetation. Appropriate applications for manual removal are for small occurrences of annual weeds and seedlings of perennial species when complete removal of the root system is possible. More mature perennial plants will limit the ability for manual removal based on their size and root mass. Manual removal should be incorporated where herbicide application alone is inadequate, or proximity of sensitive plant species prevents safe application (e.g., overspray or drifting of herbicides). Weeds or non-native plants in early stages of growth may be routinely pulled or removed when found along trails or in other areas of the Park. Removed non-native plant material should be disposed of properly off site as feasible, particularly if the plant parts have the capacity to regenerate or contain viable seed; however, portions of trees may be too large to remove without significant effort or impact.

3.2.2 Mechanical Removal

Mechanical removal may be necessary for control of some larger target invasive species, such as eucalyptus, fan palms, pampas grass, and tamarisk, and is recommended to be combined with herbicide application. Cutting and removal of the aboveground plant material can be conducted with chainsaws and/or hand saws. The resulting material should be chipped and hauled off site. Subsequent application of herbicides should follow product guidelines for safe transport, storage, and application. Stumps remaining on site after cutting and herbicide application are not recommended for removal or grinding, but should be left to decompose in place.

3.2.3 Herbicides

The application of herbicides to control target invasive species may be used on its own, or as a secondary treatment following manual or mechanical removal for controlling sprout growth and regeneration. Herbicide application is recommended following removal of all target invasive tree species, and other perennial species with the ability to regenerate root fragments when removal of all plant material is not feasible. Herbicide use should be limited to localized applications rather than foliar applications to eliminate the possibility for drift and impacts to neighboring desirable species. A wide range of herbicides are available for such types of treatment. Herbicide labels and material safety data sheets (MSDS) list susceptible target plant species and provide proper direction in the use and handling of the products. Herbicides should be applied by state licensed applicators.

3.2.4 Cut and Daub

Cut and daub treatment is recommended for larger invasive plants to control re-growth and kill the portion of the plant remaining below ground. Cut and daub involves the cutting of invasive plant stalks and then the direct application of an appropriate herbicide directly to the freshly cut stump or severed stems. Other related methods include drill and fill where holes are drilled into the trunk of a tree and herbicide is injected; or the glove method, where an herbicide soaked glove is used to apply directly to plant foliage or freshly cut stumps. It is critical that the herbicide treatment occur immediately after the plants are severed so that the herbicide is carried into the plant tissue. If enough time elapses to allow the cut surface of the severed plant to dry out, a fresh cut should be made prior to herbicide application.

4.0 HABITAT RESTORATION

The goal of habitat restoration is to reestablish or enhance the biological functions and values of vegetation communities that have been degraded by either human or natural causes. Restoration methods range from active revegetation (involving soil preparation and planting), to passive management (involving weed control and allowing time for natural recruitment to occur). Active restoration may assist the recovery of an area that has been disturbed and is showing difficulty in recovering. Any proposed restoration activity should utilize current, accepted techniques and avoid/minimize impacts to sensitive species or native vegetation communities. Any proposed revegetation activities should use only local native species.

The purpose of restoration within the Park is to reclaim native vegetation community acreage lost or compromised due to human or other induced disturbance involving the clearing or grading of native vegetation. Restoring disturbed areas will provide an overall increase of acreage of native vegetation, connectivity of existing native vegetation, and erosion control in areas of disturbance. Restoration of these areas is important to the integrity of the surrounding vegetation communities, as cleared areas can provide opportunity for non-native species to colonize (many non-native annuals are flashy fuels that can increase fire danger), provide opportunity for erosion by exposing the soil surface, reduce acreage of native vegetation communities, and sever connectivity among vegetation communities.

4.1 Proposed Restoration Areas

The Park is generally composed of high quality native vegetation communities within the San Luis Rey River channel, and highly disturbed vegetation communities on the floodplains and buffers. Restoration opportunities within the river channel include invasive species control and passive restoration. Restoration opportunities within the floodplain and buffer habitat are abundant, but would require active restoration to be successful. Within the Park, a total of 101.3 acres of disturbed habitat are proposed for active restoration. These areas are numbered 1–24, as shown in Figures 5a–5d. Passive restoration is recommended for all areas where invasive species control occurs within native habitat.

4.2 Restoration Methods

Two methods of restoration are proposed within the Park: (1) passive restoration, and (2) active restoration. The majority of the locations where invasive species were mapped will likely fill in with native species once the invasive species are controlled. These areas are classified as "passive restoration areas," and planting, seeding, and irrigation are not necessary. Areas designated as "active restoration areas" include areas mapped as disturbed habitat or that contain significantly disturbed components within native vegetation communities.

4.2.1 Passive Restoration

Passive restoration involves performing invasive weed control and allowing natural recruitment of native plant species to occur naturally. Passive restoration is most successful when the surrounding vegetation is composed of predominantly native species. Passive restoration is recommended for almost all of the locations of invasive species mapped on site. Based on individual site conditions, erosion and sediment control measures may be necessary to facilitate passive restoration. Erosion control features will help to limit further erosion and soil loss and, if installed correctly, will capture sediments that can create areas for native plants to establish. Passive restoration areas should be maintained weed free to allow native recruitment to continue until the area is reincorporated back into the surrounding habitat. Should natural recruitment slow, or stop over time, seed application and/or container plants could be incorporated through active restoration as described below.

4.2.2 Active Restoration

Active restoration involves soil preparation and planting of disturbed or degraded areas where native vegetation recruitment is not actively occurring. Active restoration is recommended in large areas of disturbed habitat. These areas are numbered 1–19 (Figures 5a–5d) and acreage for each area is listed in Table 7.

Table 7
Areas Identified as Potential for Active Restoration

Restoration Area	Vegetation Type*	Acres
1	Riparian or Upland Scrub	2.3
2	Upland Scrub	7.2
3	Riparian or Upland Scrub	0.5
4	Riparian or Upland Scrub	1.6
5	Riparian or Upland Scrub	16.2
6	Riparian or Upland Scrub	1.6
7	Upland Scrub	0.2
8	Upland Scrub	2.1
9	Riparian or Upland Scrub	0.2
10	Riparian or Upland Scrub	1.0
11	Riparian or Upland Scrub	0.4
12	Riparian or Upland Scrub	1.4
13	Riparian or Upland Scrub	0.4
14	Upland Scrub	10.8
15	Riparian or Upland Scrub	4.1
16	Riparian or Upland Scrub	4.9

Table 7
Areas Identified as Potential for Active Restoration

Restoration Area	Vegetation Type*	Acres
17	Upland Scrub	1.2
18	Riparian or Upland Scrub	43.3
19	Riparian or Upland Scrub	1.8
	Total	**101.2**

* Areas identified as having potential for riparian restoration were determined based on proximity to existing riparian communities and to the channel. Further studies (e.g., groundwater and hydrological studies) would be necessary to determine the feasibility of successfully converting these areas, or portions of these areas, to riparian habitat.

These areas should be prepared prior to planting by clearing out non-native vegetation and evaluating the soil conditions. Soil amendments may be necessary if the soils are highly disturbed or severely nutrient deficient. Soil samples should be collected prior to planting/seeding to determine if soil amendments would be necessary. If soil amendments are required, they should be incorporated into the top 6–12 inches of soil.

Following soil preparation "grow and kill" events should be conducted to reduce the weed seed bank. "Grow and kill" events consist of allowing germination and early growth of weeds before spraying with an herbicide. Several "grow and kill" events are recommended prior to planting. "Grow and kill" events are best achieved when there is an irrigation system installed.

A temporary irrigation system will likely be needed to establish the plant materials, particularly in upland habitats. The irrigation system should be constructed as an on-grade system so that it can be removed after establishment.

Appropriate erosion control measures should be installed after site preparation activities to limit potential erosion and soil loss.

Upon completion of site preparation activities, native seed and container plants may be installed. Plant materials should be native species from San Diego County, originating within 25 miles from the site. Most of the sites identified for active restoration are located on the river floodplain. These areas could be restored as native upland scrub plant communities, such as coastal sage scrub, California buckwheat scrub, or coyote brush scrub. Alternatively, in some locations (sites 1, 3-6, 9-13, 15-16 and 18-19) grade modifications (i.e., creating a lower elevation grade to allow hydrologic connectivity to the river) would allow for establishment or enhancement of riparian habitats, such as southern cottonwood willow riparian forest, southern willow scrub or mule fat scrub. Tables 8 and 9 provide a general upland scrub seed mix and plant palette and Tables 10 and 11 provide a general riparian scrub seed mix and plant palette for areas of active restoration. These tables include native species that are common to the floodplain habitat found in the Park. Plant

quantities, rates, and composition should be customized on an individual basis, based on the existing plant composition around the restoration sites and target plant communities. Additional native species appropriate to the adjacent vegetation community may be added as appropriate.

Table 8
Upland Scrub Seed Mix

Scientific Name	Common Name	%Purity	%Germination	Lbs/Acre
Artemisia californica	California sagebrush	10	65	5
Encelia californica	California encelia	40	60	5
Eriogonum fasciculatum	California buckwheat	10	65	4
Eriophyllum confertifolium	golden yarrow	30	50	1
Eschscholzia californica	California poppy	98	75	1
Lasthenia californica	California goldfields	50	60	1
Lessingia filaginifolia	sand aster	2	4	2
Lotus scoparius	deerweed	95	40	3
Malosma laurina	laurel sumac	95	60	1
Mimulus aurantiacus puniceus	sticky monkeyflower	2	60	1
Nassella lepida	foothill needlegrass	90	60	1
Plantago erecta	dot seed plantain	98	75	1
Rhus integrifolia	lemonade berry	90	60	4
Salvia apiana	white sage	70	35	3
Salvia mellifera	black sage	70	50	4
Vulpia microstachys	small fescue	90	80	1
			Total	**38**

Table 9
Upland Scrub Container Plant Species

Scientific Name	Common Name	Average Spacing, Feet on Center
Eriogonum fasciculatum	California buckwheat	4
Heteromeles arbutifolia	toyon	12
Malosma laurina	laurel sumac	8
Mimulus aurantiacus puniceus	sticky monkeyflower	5
Rhus integrifolia	lemonade berry	8
Salvia mellifera	black sage	5
Sambucus mexicana	Mexican elderberry	15

Table 10
Riparian Scrub Seed Mix

Scientific Name	Common Name	%Purity	%Germination	Lbs/Acre
Ambrosia psilostachya	Western ragweed	15	30	2
Artemisia douglasiana	Mugwort	10	30	4
Artemisia palmeri	San Diego sagewort	15	50	2
Leymus triticoides	Wild rye	95	80	3
Juncus bufonius	Toad rush	90	40	1
Juncus mexicanus	Mexican rush	95	60	3
Pluchea odorata	Marsh fleabane	35	60	0.5
Verbena lasiostachys	Common vervain	50	50	1
			Total	**16.5**

Table 11
Riparian Scrub Container Plant Species

Scientific Name	Common Name	Average Spacing, Feet on Center
Anemopsis californica	Yerba mansa	4
Baccharis salicifolia	Mule fat	8
Iva hayesiana	San Diego marsh elder	4
Leymus triticoides	Creeping wild rye	4
Muhlenbergia rigens	Deergrass	4
Platanus racemosa	California sycamore	15
Populus fremontii	Fremont cottonwood	15
Quercus agrifolia	Coast live oak	15
Rosa californica	California wild rose	6
Rubus ursinus	California blackberry	8
Salix exigua	Narrow-leaved willow	6
Salix gooddingii	Black willow	8
Salix laevigata	Red willow	8
Salix lasiolepis	Arroyo willow	8
Sambucus mexicana	Mexican elderberry	10

The proposed Restoration areas are adjacent, or reasonably near a primary or secondary road for access. This may provide opportunity for irrigation, either from a tanker truck sprayer, or from existing utilities within the road right-of-ways, should they exist at the given locations. Seed application should occur prior to the onset of the winter rainy season to take advantage of the full growing season. An effective seed application technique would be to imprint seed with an imprinting machine, as the terrain is generally amenable to equipment.

If container plants are installed, they should be installed in the fall at the onset of the rainy season. Without supplemental irrigation, installation of container plants would likely have limited success. Standard planting procedures should be employed for installing container plants. All container plants should be checked for viability and general health prior to installation. Holes approximately twice the size of the rootball of the plant should be dug using a shovel, post hole digger or power auger. Holes should be filled with water and allowed to drain immediately prior to planting. Backfill soil containing amendments (such as a fertilizer tab, or equivalent) should be placed in every planting hole following soaking, and container plants should be installed so that the top of the root ball is at grade or slightly above grade. Plants should be monitored for signs of stress or mortality. In the months following planting, and especially if dryer than average conditions exist, periodic hand watering may be necessary to help establish the plants.

Weed control is a critical element for successful restoration and should be performed regularly. Careful weed control is critical to allow container plants and seedlings to establish so that the area can transition to native vegetation.

5.0 FIRE MANAGEMENT

5.1 Current Fire Management Practices

Currently, fire management or fuel reduction practices being conducted on Park property include the following:

- Fuel modification zone along the entire eastern boundary of the northeastern parcel. This fuel modification zone provides the adjacent residences in the neighboring mobile home property a 100-foot buffer as measured from the residential structures.
- The previous agricultural field in the northeastern parcel is regularly mowed to reduce flashy fuels.
- 30-foot fuel modification zone along Dulin Road.
- 30-foot fuel modification zone along the dirt access road along the southern boundary of the central parcel adjacent to the San Luis Rey Downs Golf Course.

Based on the configuration and location of Park parcels, vehicular access is limited primarily to public roads adjacent to portions of the Park perimeter. Vehicular access is very limited within the interior portions of Park parcels.

An analysis of the fire environment has been conducted as part of this VMP. This analysis, presented in the following sections, provides the basis for evaluation of existing fire management practices and their adequacy for meeting Park goals and providing for public safety.

5.2 Fire Environment

Several factors comprise the fire environment. Fires can occur in any environment where conditions are conducive to ignition and fire movement. The three major components of fire environment are climate, topography, and vegetation/fuels. The state of each of these components and their interaction with each other determine the potential characteristics and behavior of a fire at any given moment. Understanding these existing conditions is necessary to understanding the potential for fire within and around the Park.

Wildfires are a regular and natural occurrence in most of Southern California. However, increasing numbers of fires and acres burned annually has been experienced over the last decade. These wildfires are mostly human-caused, suggesting that the historic fire interval has been artificially affected across large areas. In addition, wildfire suppression efforts over the last several decades may have aided in the accumulation of fuels in some natural communities (Minnich 1983; Minnich and Chou 1997) resulting in larger and more intense wildfires. Large

wildfires have had, and will continue to have a substantial and recurring role in native California landscapes (Keeley and Fotheringham 2003), in part because (1) native landscapes become highly flammable each fall, (2) the climate in the region has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with Santa Ana winds occurring during autumn after a 6-month drought period each year, and (3) ignitions via anthropogenic sources have increased or are increasing in many wildland or wildland-urban interface (WUI) areas.

Based on available information and an understanding of the fire environment of the region, it is expected that wildfires will occur again and will burn within the Park.

5.2.1 Climate

As with most of Southern California, the Park area is influenced to a certain extent by the Pacific Ocean and is frequently under the influence of a seasonal, migratory subtropical high pressure cell known as the Pacific High. Typical of a Mediterranean climate, wetter winters and dry summers, with mild seasonal changes, generally characterize the Southern California region. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds.

Additionally, the local vegetation and the seasonal drying produce climatic conditions that result in fuel-driven wildfires and fire-associated climatic changes. This type of condition is referred to as a plume-dominated wildfire. Plume-dominated wildfires are fires where the energy produced by the fire in conjunction with atmospheric instability creates significant convective forces and increased winds. Such fires are extremely unpredictable, spread in various directions simultaneously, and exhibit extreme fire behavior. These fires are extremely dangerous and are often large in size.

The inland location of the Park affects the degree of influence of the Pacific Ocean, resulting in less regulated temperatures. The average high temperature calculated from August 1957 to December 2005 for the Vista area is approximately 74.0º Fahrenheit (F), with higher temperatures in summer and early fall (July–September) reaching up to 83.1°F (Western Regional Climate Center 2011). The mean precipitation for the area is 13.22 inches per year, with the most rainfall concentrated in the months of January (2.80 inches), February (2.55 inches), and March (2.43 inches) (Western Regional Climate Center 2011).

The prevailing wind pattern is from the west, but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are typically from the west–southwest (sea), and at night, winds are from the northeast (land). During the summer season, the diurnal winds can be slightly stronger than the winds during the winter

season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The relative flat topographic condition of the Park would limit the effect on local wind patterns; however, the location of the Park may increase its susceptibility to increased wind velocities within the San Luis Rey River valley and other nearby tributary canyons (e.g., Moosa Canyon, Keys Canyon, and Gopher Canyon). The highest wind velocities are typically associated with downslope, canyon, and Santa Ana winds.

The fire season in Southern California typically starts in June as vegetation begins to dry out after winter and spring rains, and typically ends in October, although fire weather may be present year round (Schroeder and Buck 1970). The highest fire danger for this area coincides with the Santa Ana winds. Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. They are dry, warm winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors.

5.2.2 Topography

The topography of the Park includes relatively flat terrain (the majority of the study area has a slope less than 10º) with elevation ranges from approximately 120 to 240 feet (37 to 73 meters) AMSL. The topography of the project site is determined primarily by the San Luis Rey River, which creates relatively flat terrain. The study area is a characterized by slopes of varying aspects, with primarily northwest, southeast, southwest, and west-facing gentle slopes where not flat.

5.2.3 Watershed Description

The Park is located within the San Luis Rey Watershed and all waters from Park lands drain to the San Luis Rey River. The San Luis Rey River flows approximately 12 miles from the study area to the Pacific Ocean in Oceanside, California.

5.2.4 Fire History

Fire history is an important component in understanding fire frequency, fire type, significant ignition sources, and vulnerable areas. The topography, vegetation, and climatic conditions associated with the Park combine to create a unique situation capable of supporting large-scale, high-intensity wildfires. While fire history within the Park is limited, fire occurrences in the region indicate the potential for future fires burning within or onto Park property. The history of wildfires on the in the Park region is graphically portrayed in Figure 6.

Based on historical fire perimeter data (FRAP 2011)[1], most of the Park has not burned during the recorded data period (1897 to 2010). Two individual fires have been recorded on Park property (the 1957 Clancy Fire and the 2007 Vuelta Fire). The burn area of these two fires did not overlap so no portions of the Park have burned more than once over the recorded fire period (Figure 6). Table 12 presents the quantity of times the Park has burned by land area (acreage).

Table 12
Quantity of San Luis Rey River Park Wildfires

Quantity of Times Burned*	Acreage	Percentage
0	338.67	73.6
1	121.48	26.4
Total	**460.15**	**100.0**

* FRAP 2011

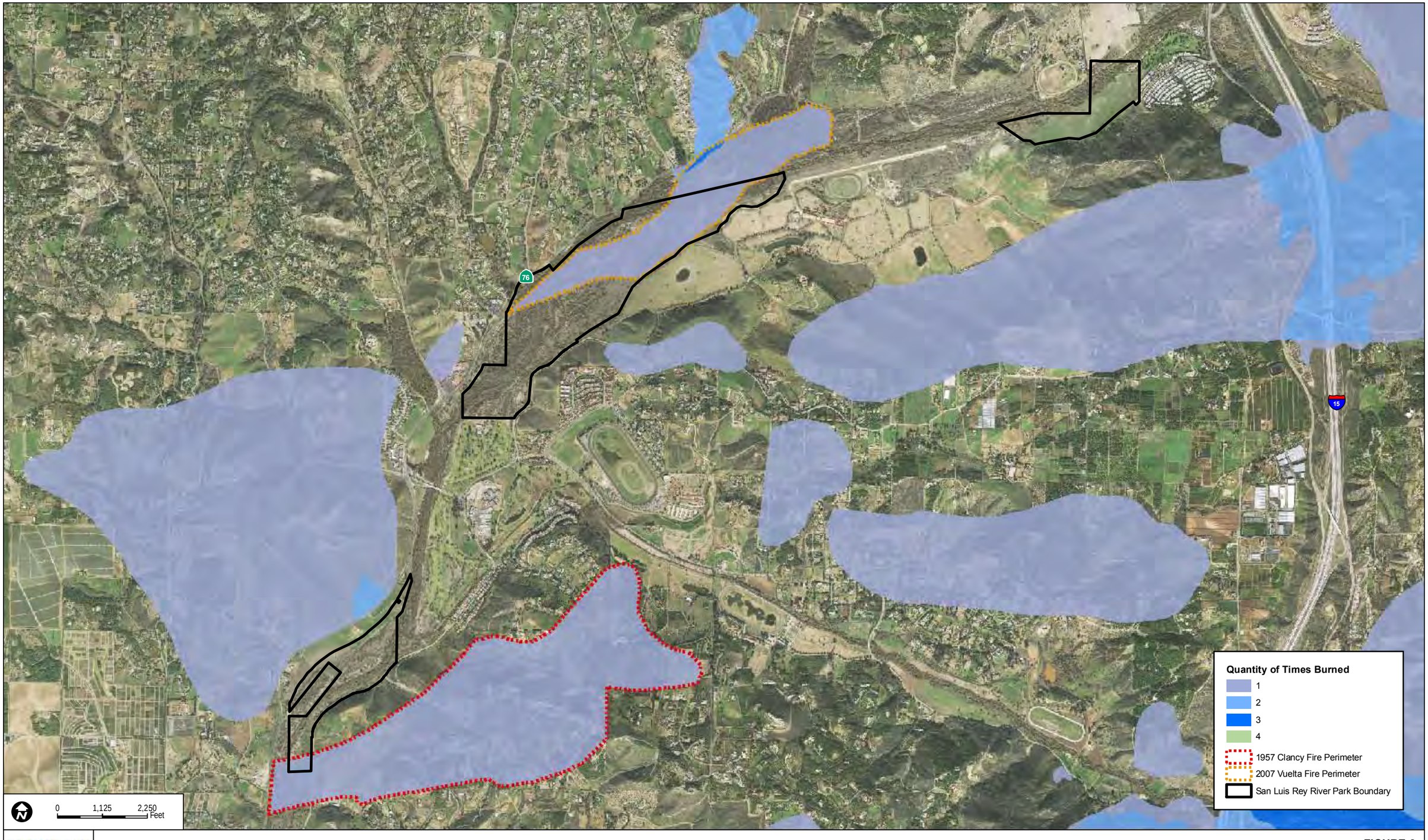
Based on an analysis of this fire history data set, the interval between these two wildfires was 50 years. Given the relative lack of burning, it is expected that the Park may be subject to wildfire occurrence in the future, with the realistic possibility of shorter interval occurrences due to the proximity of urban development and transportation corridors. Table 13 presents the fire interval data for the Park.

Table 13
Fire Intervals for the San Luis Rey River Park

Fire Year*	Fire Name	Interval (years)	Acreage Burned on Park	Percent of Park Burned**
1957	Clancy Fire	N/A	5.2	1.1
2007	Vuelta Fire	50	116.3	25.3

* FRAP 2011
** Based on total Park acreage of 460.15

[1] Based on polygon GIS data from CAL FIRE's Fire and Resource Assessment Program (FRAP), which includes data from CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1878 and 2008.



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SOURCE: Digital Globe 2008
FRAP 2011

FIGURE 6

Fire History

San Luis Rey Riverpark - Vegetation Management Plan

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5.2.5 Vegetation Dynamics and Fuel Loads

Utilizing site vegetation maps, field evaluations were conducted to evaluate fuel loading and classify vegetation types into fuel models (Anderson 1982, Scott and Burgan 2005, Weise and Regelbrugge 1997). Fuel model assignments are presented in Table 14 by vegetation type and are graphically presented in Figure 7. Certain vegetation types increase fire hazard based on plant physiology (resin content), biological function (flowering, retention of dead plant material), and/or physical structure (leaf size, branching patterns).

In addition, non-native invasive plants can increase the frequency of fires by providing more continuous fuels that are more easily ignited (Brooks et al. 2004). Invasive plants also present hazards when located adjacent to neighboring structures or within fuel modification zones that are meant to provide defensible space. Non-native invasive species of the greatest concern within the Park include: tamarisk, giant reed, sweet fennel, and tree tobacco (Figures 5a–5d).

Table 14
Vegetation Communities and Associated Fuel Models for the San Luis Rey River Park

Vegetation Community/Land Cover	Fuel Model	Acres	Percentage
Agriculture	98	0.4	0.1
Developed	98	2.5	0.5
Diegan Coastal Sage Scrub	SCAL18	0.1	0.0
Disturbed Habitat	1	83.7	18.2
Non-native Grassland	1	39.9	8.7
Orchard	9	9.4	2.0
Southern Cottonwood – Willow Riparian Forest	8	322.6	70.1
Tamarisk Scrub	SH5	1.6	0.4
	Total	**460.2**	**100.0**

Vegetation Dynamics

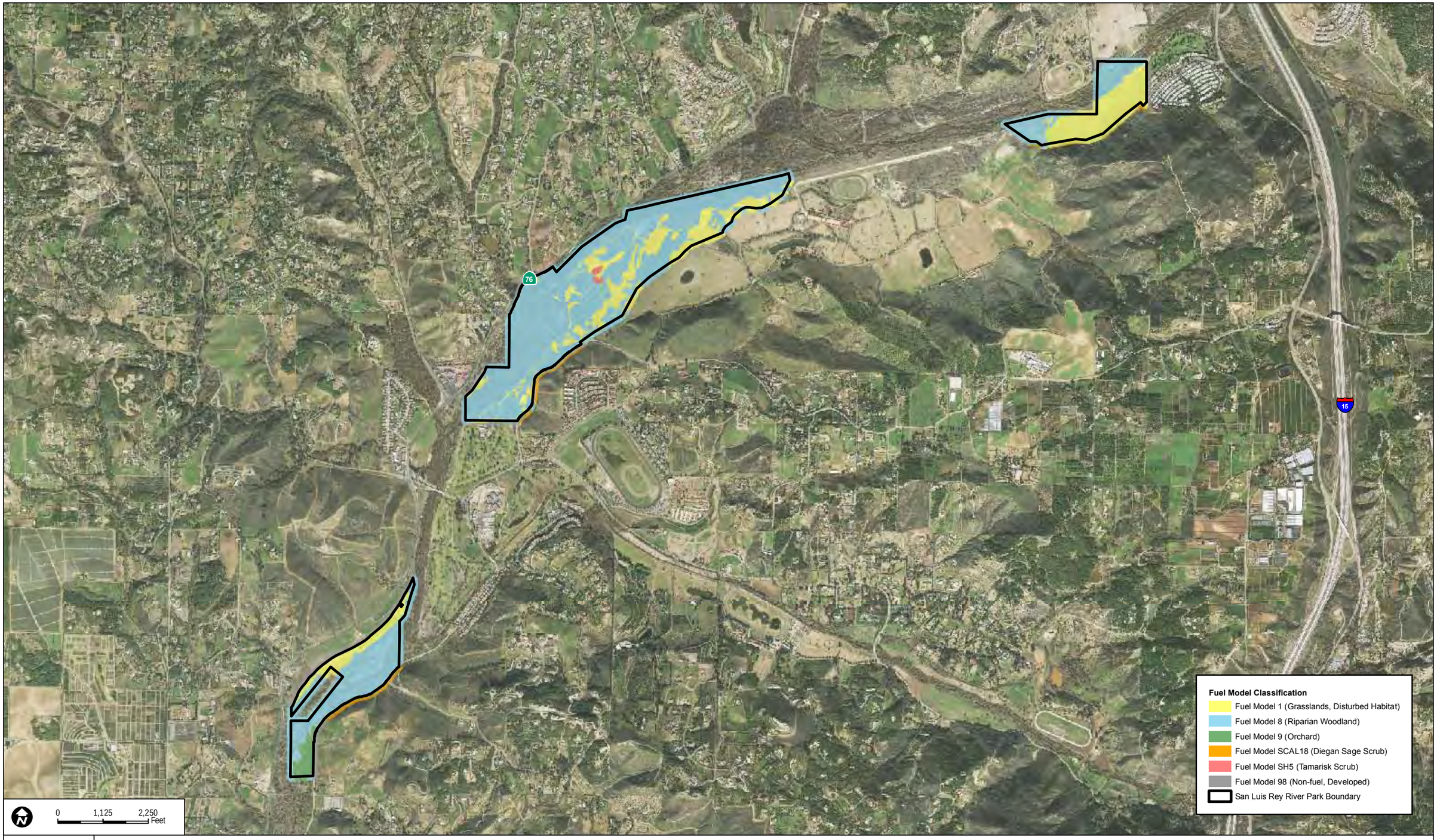
Vegetation plays a significant role in fire behavior and is an important component of the fire behavior models discussed in this report. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes affect plant community succession, or the natural sequential replacement of vegetation types over time. Succession of plant communities is highly dependent on fire characteristics, including intensity, duration, and return interval. Additionally, encroachment and establishment of non-native plant species into wildland areas is already occurring and is expected to continue based on the proximity of urban development to the Park. Consequently, routine maintenance of the fuel modification zones and defensible space in some areas is needed to maintain reduced hazard conditions.

Biomass and associated fuel loading will increase over time, assuming that disturbance or fuel reduction efforts are not realized. Depending on factors such as fire exclusion activities and mechanical treatments, among others, the current vegetation composition and density will continue to change, through increased volume and the establishment of non-native species.

The Park is dominated by southern cottonwood-willow riparian forest, with patches of non-native grassland (in the central parcel) and disturbed habitat (in the northeastern parcel). While riparian forest habitats are not typically susceptible to annual burning, grass cover can burn yearly (Minnich and Scott 2005). Riparian forests tend to limit ground fuel accumulation with age. Canopy closure serves to "shade out" understory plants, resulting in mature riparian forests characterized by a dense canopy layer and an understory consisting primarily of leaf and twig litter and downed woody debris. Edges of riparian forest along ecotones or roadways often include shrub or grass understory creating ladder fuels that allow the potential for canopy fire spread. The primary concern for vegetation type conversion and increased fire hazard in the Park is the presence and encroachment of non-native/exotic plants into open space areas. This condition has increased the overall fuel load and likelihood for higher intensity fire.

Southern Cottonwood-Willow Riparian Forest Fire Effects

Southern cottonwood-willow riparian forest covers 322.6 acres of the Park. Wildfires in riparian forest types are typically not isolated to the riparian system itself, but typically originate in more flammable upland vegetation types and burn into riparian areas. Riparian forests either do not burn or burn at lower intensities due to higher fuel moisture levels (Rundel and Gustafson 2005) and can act as a buffer between more flammable upland vegetation types. Indirect effects of fire to riparian forest systems include the transport and deposition of soils and debris from upland areas subject to burning. Fire behavior in riparian forests is typically much less intense than wildfires burning in chaparral and sage scrub communities. Low, compacted leaf litter understory, canopy shading of ground fuels, and wind velocity reduction resulting from tree canopies significantly reduce the intensity and spread rates of surface fires in forest vegetation types. However, transition from ground to canopy fire increases fire intensity, spotting, and tree mortality potential.



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SOURCE: Digital Globe 2008

FIGURE 7

Fuels Distribution

San Luis Rey Riverpark - Vegetation Management Plan

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Grassland Fire Effects

Non-native grassland occupies 39.9 acres within the Park. Annual grassland responses to fire are varied. A review and analysis of the response to burning and grazing of California grasslands indicates that prescribed burning temporarily reduces non-native annual grasses, but also results in increased non-native and native forbs (Rice 2005; Bainbridge and D'Antonio 2003; D'Antonio et al. 2003). These studies indicate that single prescribed burns often decrease non-native annual grasses, but they recover by the third year in the absence of additional disturbance. Grazing or follow-up burns hinder the recovery of non-native annual grasses and maintain forb cover.

One effect that appears to be fairly common among non-native grasses is that lower-intensity grassland fires rarely damage seeds on or near the soil surface (Daubenmire 1968). Since seeds on the soil surface are not generally exposed to high enough temperatures to cause mortality in a grassland environment, burn timing is most effective after desirable species have dispersed their seeds, but when target invasive species have their seed heads directly exposed to flames (DiTomaso et al. 2006). For management purposes, non-native grassland burning must be timed appropriately so that the target seeds are consumed, resulting in decreased re-establishment of non-natives and reduced competition for annual forbs.

Fire Behavior

Fire behavior modeling provides reasonably accurate representations of how wildfire would move through available fuels in high-fire hazard areas. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. Current and accepted fire research data from several programs that specialize in the study of wildland fire were utilized for the completion of this analysis for the Park. To objectively predict flame lengths and intensities, the FlamMap fire behavior fuel modeling system was applied using predominant fuel characteristics from representative fuel models observed on the Park. In addition to fuels data, topographic and weather data were utilized in developing fire behavior models for two separate weather conditions: summer (on-shore flow) and fall (off-shore flow). Results of fire behavior modeling efforts for the Park are presented in Appendix C.

5.3 Fuel Management Methods

Successful fire management requires pre-planning and utilization of fire prevention techniques and strategies. Based on the proximity of the Park to residential development and transportation corridors, selective management of fuels is an important component of overall Park management. To that end, vegetation management units (VMUs), based on parcel boundaries, have been delineated on for the Park to assist with fuel management planning. Figure 8 illustrates the VMU boundaries. VMU specific fuel reduction recommendations are provided in Section 6.3. A list of general fuel management methods and their suitability for use in the Park are discussed below.

5.3.1 Grazing

Grazing is an effective fuel reduction method and can be compatible with Park management goals. Focused grazing is a feasible alternative on the Park, but would need to be highly managed to avoid introducing and spreading non-native species, overgrazing, or impacts to stream channels and sensitive habitats. Grazing would be most applicable to the non-native grassland and disturbed areas on site to reduce annual flashy fuel accumulation. Currently there is no pressing need to introduce grazing. However, the method should remain in the management tool box for specific applications adjacent highly sensitive habitats, adjacent roadways and potentially in areas that are considered fuel modification zones.

5.3.2 Mowing/Trimming

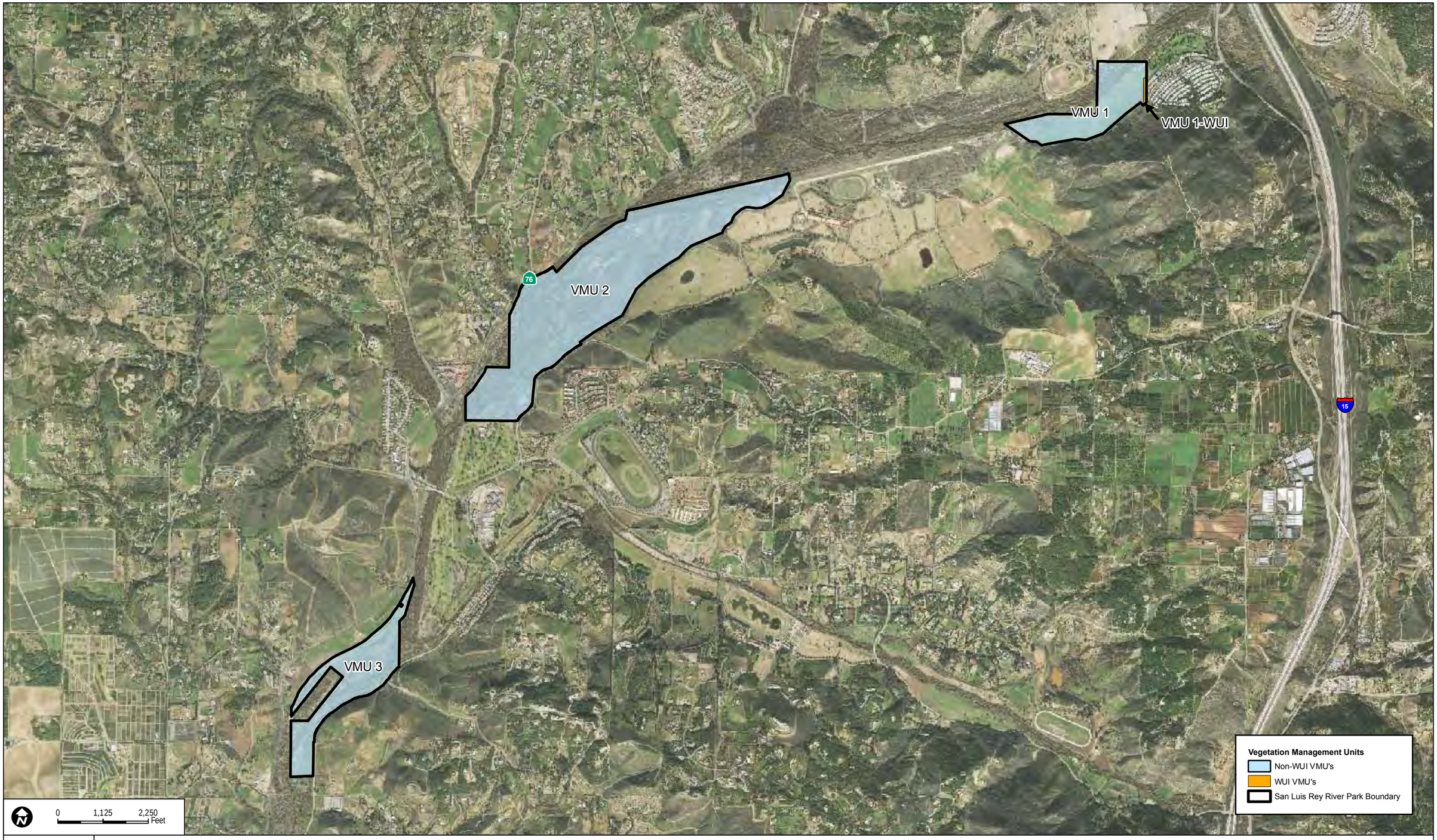
Mowing/trimming is one of the most common and successful methods for reducing flashy fuels and is compatible with Park management goals. Mowing or trimming (line trimming) is a feasible option for the Park to meet roadside fuel treatment objectives. Mowing or trimming should be conducted in late spring after weedy annuals have stopped growing, but have not yet produced viable seed (Bell 2009).

5.3.3 Herbicides

Chemical means to control fuels/non-native plants are an effective method, but one that has a negative connotation, potential toxicity for humans and wildlife, and can affect water quality. Focused chemical selection and application minimizes the detrimental effects and makes the use of chemicals, such as glyphosate and other selective chemicals, a feasible alternative.

5.3.4 Prescribed Fire

Prescribed fire occurs in two forms: (1) natural fire, occurring primarily through lightning strikes that are then allowed to burn; and (2) intentional, managed fires. Natural fires are rare in San Diego County due to a general lack of lightning. However, natural fires may occur and if allowed to burn as part of a fire plan, would then be considered a prescribed fire. Although considered unlikely, if natural fire occurs on the Park and the fire is determined to pose no threat to life or high-value resources, the fire may be allowed to burn, if it meets fire authority objectives. If unsafe conditions exist (e.g., high winds, low humidity, high temperature) and, without suppression, it has a high likelihood of burning into areas of fire exclusion or is threatening valuable resources on or off site, then assertive suppression would be pursued.



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SOURCE: Digital Globe 2008

FIGURE 8

Vegetation Management Units

San Luis Rey Riverpark - Vegetation Management Plan

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Intentionally managed fires are planned ignitions for purposes of reducing fuels primarily for public safety or habitat improvement, are regulated by all applicable laws, and are managed by CAL FIRE's Vegetation Management Program. Where prescribed burning is feasible, it shall be conducted under permit from CAL FIRE, or under contract with CAL FIRE under the statewide Vegetation Management Program.

Prescribed fire in the Park is not considered a realistic management option. Prescribed fire can only be implemented by CAL FIRE, or a similar fire authority with experience and certifications to conduct burns. Prescribed fire can be the least expensive form of fuel reduction, but considering the relatively small parcel sizes and proximity to residential development and transportation corridors, is not feasible for SLRRP.

5.3.5 Hand Tool or Mechanical Equipment Thinning

Thinning can reduce fuel continuity and loading by selective removal of dead and dying, overly dense horizontal and vertical bunches, and non-natives. This type of fuel reduction is most useful in the interface and intermix areas around high-value resources, such as residences, and along the interface between the Park and transportation corridors. Adjacent residences would have to maintain their own defensible space off site, but one on site extension is provided by the Park in the northeastern-most parcel. Thinning is recommended to occur on an annual basis prior to June for fuel modification areas associated with off-site residences or other habitable structures. Thinning is appropriate anywhere in the Park where insect or disease outbreaks, frost or drought kill occurs resulting in dense, dead vegetation.

5.3.6 Fuel Breaks

Fuel breaks provide areas of removed fuels that play an important role in helping contain wildfires. The local fire departments and CAL FIRE attempt to minimize impacts to sensitive resources when fighting fires in wildlands, when possible; and where feasible, fires are allowed to run to natural breaks including trails and roads. These locations then serve as a defensive position for fighting the fire. The existing perimeter road network around the Park provides a level of containment mimicking a fuel break scenario.

5.4 Fire Response Plan

The NCFPD and CAL FIRE are the primary responders to the Park. It is expected that NCFPD and CAL FIRE would be the primary agencies involved in wildland fire suppression on the Park property. These fire agencies, as well as the other agencies that would respond via automatic or mutual aid, are extremely qualified and experienced for responding to wildfires in this area. The NCFPD has two stations that would respond to wildfires on Park property. Station 4 is located at

the intersection of Pala Mesa Drive and Old Highway 395, approximately 2.1 miles north of the northeastern Park parcel along Dulin Road. Station 5 is located on Old River Road approximately 0.8 miles from the central Park parcel (via W. Lilac Road) and 0.8miles from the southwestern Park parcel (via Old River Road).

CAL FIRE provides response to wildfires in the SRA, including the Park, and the NCFPD provides response to structure fires, wildfire, medical and associated emergencies. CAL FIRE has a vast arsenal of firefighting personnel and apparatus throughout San Diego County that can be called upon for responding to wildfires within or in the vicinity of the Park, including:

- Air tankers
- Helicopters
- Air-tactical aircraft (AA)
- Various engine types
- Crew transports
- Bulldozers
- Communications centers.

CAL FIRE utilizes three levels of dispatch and response based upon weather conditions and time of year. The three levels are:

- Low – includes two engines with three personnel each
- Medium – includes three engines (Type III) with three personnel each, one Battalion Chief, One mid-sized bulldozer, one type III Helicopter, and one 16 person hand crew
- High – includes five engines with three personnel each, one Battalion Chief, two medium bulldozers, one AA, two Air Tankers, and one Type III Helicopter.

Dispatch levels are based on weather conditions. Low dispatch occurs during the winter months from November–May. Medium and High dispatch occur during the normally declared fire season, June–October. There is some variation in the timing of the dispatch levels, based entirely on weather.

NCFPD currently employs the following firefighting apparatus with associated firefighting personnel at Stations 4 and 5:

Station 4

- 1 Medic Engine
- 1 Brush Rig
- 1 Medic Ambulance
- 1 Captain
- 1 Engineer
- 2 Firefighter/Paramedics
- 1 Reserve Firefighter

Station 5

- 1 Engine
- 1 Brush Rig
- 1 Captain
- 1 Engineer
- 1 Firefighter/Paramedic

Fire Response

This VMP stresses the need for fire-fighting response to minimize impacts to natural resources, when possible, by using pre-planned fire suppression tactics and actions within the boundary of the Park. Fire Suppression Air Support with fire retardant drops may be a component of responses to the entire Park for achieving goals and objectives, especially under conditions that would accelerate wildfire spread. Under extreme conditions, or at night, air support may not be available, and in these situations, response categories may become secondary to public safety. Fires occurring within open space areas have demonstrated the potential to move through the Park into urban areas, consequently overwhelming available fire resources.

Response to a fire within the Park will likely include the use of existing perimeter access roads, public streets, and highways for firefighting personnel, type I engines (limited to paved roadways), type III engines, fire crews, air attack and fire retardant, helicopters, and air tankers. Fire suppression actions may include one or more of the following: direct attack with engines, fire crews, helicopters, and firing operations. Line construction activities within the Park would be best carried out by hand crews. Dozers/road graders may be activated but should not be put into operation on the Park itself unless necessary for improving existing roads for engine access or constructing line or secondary line for preservation of high-value resources, including plant and animal species, habitats, people, or property.

5.4.1 Fire Hazard and Current Fire Management Practices Evaluation

Based on site specific data analysis, discussions with fire agencies responsible for fire suppression, and fire behavior modeling results, the Park includes an ongoing fire hazard that can result in significant fire intensity and spread during extreme weather events. This section presents a discussion of fire hazard situations for the Park. This information was collected during initial site analysis and reviews of project data, fire behavior modeling results, and high-resolution aerial imagery and was integrated into the preparation of this document and associated recommendations.

1. Based on topography, vegetation, and fire history of the region, a large conflagration during Santa Ana wind conditions will likely enter the Park from the north east, traveling down the San Luis Rey River corridor or through the open space to the east and north of the Park, as seen in the 2007 Vuelta Fire. Fires during typical on-shore wind patterns are likely to enter the Park parcels from the adjacent SR-76 transportation corridor, or from open space areas south or west of the Park.
2. The Park vicinity can be primarily classified as wildland urban intermix area, with a less well-defined interface between residential development and open space. Some higher-density residential and commercial developments also occur in the Park area, along with golf courses and horse stable operations. Intermix areas consist of low-density development with non-maintained fuels between structures providing for easier fire spread and reduced containment ability.
3. The primary ignition threat for the Park is the SR-76 corridor, resulting from car fires, catalytic converters, tossed cigarettes, etc. Other potential ignitions in the vicinity of the Park include a variety of residential, commercial, or agricultural related sources including structure fire, hot works, and yard machines, amongst others. Additional ignition sources in the vicinity include electrical transmission lines and arson.
4. Wildfires fueled by Santa Ana winds may move rapidly across the Park. Grasslands and non-native exotics will be the predominant carriers of fire across the site. Fires in grassland fuels will be fast-moving ground fires with lower flame lengths (less than 20 feet) while ground fires burning in riparian forest fuels will move more slowly and will produce lower flame lengths (less than 20 feet). Should a transition occur from ground to canopy fire, more extreme behavior is expected within the Park, which would significantly affect and limit the options for fire response personnel. Fire behavior modeling for the Park indicates that transition from a ground fire burning in grass fuels to a crown fire can be expected with a surface fuel to canopy height difference of 10 feet. Canopy fire spread rate during extreme weather conditions may exceed 4 mph. This analysis emphasizes the importance of minimizing ignitions and maintaining the fuel management areas adjacent Park boundaries.

5. A fire originating in a structure within approximately a one-mile radius of the Park could result in burning embers landing within the Park before they decay to the point of being unable to ignite fuels, potentially resulting in vegetation ignition if there is a receptive fuel bed.

Based on current roadways, firefighting access is primarily limited to the perimeter of Park parcels on paved roadways. In the central parcel, a network of dirt trails/access roads is accessible from the west side of West Lilac Road. Access to the central portions of the Park parcels is restricted. Consequently, firefighting may be difficult in much of the Park due to lack of roads, or presence of only dirt roads that are not designed to accommodate typical responding fire apparatus. For the northeastern Park parcel, access is good via the dirt road extension of Dulin Road and the agricultural perimeter road immediately south of the San Luis Rey River. For the central Park parcel, access is good along West Lilac Road and the network of dirt roads within the Park. Fuels in this area are non-native grassland and riparian forest. The southwestern parcel is accessed from Old River Road or SR-76.

Firefighting on the Park parcels is expected to be driven primarily by structure or asset protection efforts. Additionally, given the relative lack of access roads through the Park, it is expected that existing roads or other breaks (e.g., golf courses, irrigated agricultural fields) will be utilized as anchor points during firefighting operations. Air attack in this area may also be an important component depending on fire intensity and spread rate, but may not be available or usable, depending on the extent of the fire event, the time of day, weather conditions, and proximity to overhead power lines.

The catastrophic wildfire threat for the Park is extreme when severe fire weather occurs, which will coincide with Red Flag Warning periods. Red Flag Warnings are declared by the National Weather Service. The Park is located in Fire Weather Zone 250 (San Diego County Inland Valleys). For this zone, Red Flag Warnings are issued when sustained winds are greater than 25 miles per hour (mph) (with gusts greater than or equal to 35 mph) and relative humidity is 15% or lower (for at least six hours) or dry lightning occurs with more than isolated coverage (National Weather Service, San Diego Office 2011).

Beyond these provisions, fire management practices are restricted to response and tactical suppression efforts associated with wildfires originating on or burning onto Park parcels. No active fire or fuels management plans are currently employed on site.

5.4.2 Primary Actions and Contacts for Wildfire Emergency

The following persons/agencies should be contacted in the event of a wildfire on the Park or for information regarding fire management activities.

CAL FIRE
San Diego Unit
Emergency: 911
Non-Emergency – Unit Chief, El Cajon: 619.590.3100
Website: http://www.fire.ca.gov/

North County Fire Protection District
Emergency: 911
Non-Emergency – Fire Chief: 760.723.2012
Website: http://www.ncfireprotectiondistrict.org/

5.4.3 Roads/Access

Road access to Park parcels is limited primarily to existing non-gated, paved public roads adjacent parcel perimeters, with the exception of an internal dirt trail/access road network within the central parcel. Detailed access descriptions to the different Park parcels and associated VMUs are presented in Table 15. Road and gate locations are graphically presented in Appendix B.

5.4.4 Fuel Breaks

No existing fuel breaks exist within the Park. The perimeter road network and adjacent land uses (e.g., golf courses, irrigated pasture) in most cases provide a break from non-maintained fuels adjacent the Park parcels. Consequently, the creation of additional fuel breaks at this time is not recommended. However, the need for fuel breaks is dependent on the specific conditions of a fire. If new fire breaks are required, the location should be coordinated with the Incident Command Team where possible. The Incident Command Team includes the District Park Manager and fire agency staff with access to location information on sensitive biological and cultural resources that should be avoided, if possible.

5.4.5 Emergency Staging Areas

Due to the fragmented nature of the Park parcels, it is anticipated that fire response staging locations will vary, depending on fire location and progression. Staging areas, important for incident command and to organize, plan, and implement firefighting strategies, typically cause higher ground disturbance from personnel, vehicles, and equipment in confined areas. Staging areas for fires that affect the Park will likely occur off site in well-defended, lower hazard areas.

5.4.6 Fire Hydrants

Fire hydrants are located within adjacent residential development areas and on the periphery of the Park along existing roadways. Fire hydrants may be utilized during a fire event to refill engines, as necessary.

5.4.7 Other Water Sources

No large water bodies are located in the vicinity of the Park, so it is expected that fire suppression activity will rely on the deployment of water tenders. However, Beck Reservoir, located approximately 2.8 miles from the northeastern-most Park parcel and no more than 6.8 miles from the furthest reaches of the Park (southwestern-most parcel), may provide helicopter dipping access. Several other small lakes or ponds exist within approximately 7 miles of the Park which may provide a source for helicopter dipping, depending on distance from the fire front, and the availability of other water resources.

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6.0 MANAGEMENT DIRECTIVES

This section provides recommendations for vegetation management within the Park including management directives specifically related to: invasive species management; habitat restoration; and fire management.

6.1 Invasive Species Removal

The short-term management directives below address high priority invasive species removal while longer term management directives consider invasive species for their risk of reducing vegetation community quality over time.

Management Directive Invasive 1 – Remove and Control High Priority Invasive Non-native Species. Remove aggressive, invasive non-native plant species and those with a high fire hazard within the Park, such as tamarisk, sweet fennel and pampas grass, as soon as possible.

Management Directive Invasive 2 – Identify and Pursue Funding for Long-term Invasive Non-native Plant Control. Coordinate with other agencies, non-profit organizations, and/or volunteer groups in order to seek funding and implement invasive, non-native plant removal projects for moderate and low priority non-native species within the Park.

Management Directive Invasive 3 – Conduct Invasive Non-native Species Monitoring. Continue to monitor other identified non-native species within the Park to determine if removal efforts are warranted in order to maintain and/or improve the quality of the existing native vegetation communities on site.

Management Directive Invasive 4 – Educational Outreach. Prepare and implement an invasive non-native plant species educational outreach program/materials to reduce use of these plants by adjacent property owners.

6.2 Restoration

The primary management directives for native vegetation community restoration include:

Management Directive Restoration 1 – Restore Native Vegetation Community Quality and Function. Restore the identified degraded areas to reestablish and/or enhance the biological functions and values of native vegetation communities in these areas.

1A – Passive Restoration. Perform weed and erosion control as needed in disturbed areas where natural recruitment of native plant species is actively occurring, as described in Section 4.2.1.

1B – Active Restoration. Conduct soil preparation and native planting of disturbed or degraded areas where native vegetation recruitment is not actively occurring (Figures 5a–5d; Restoration areas 1–19), as described in Section 4.2.2.

Management Directive Restoration 2 – Address Long-term Restoration Needs. Restoration activities should occur following landscape changing disturbances that remove, damage, degrade, or alter the existing native vegetation communities. Restoration methods should be customized to the Park, based on the type of disturbance, and will require preparation and implementation of a restoration plan. Restoration should incorporate active revegetation, including:

- Native vegetation community establishment/creation
- Native vegetation community enhancement
- Removal of invasive plants when they are young
- Application of herbicides, pesticides and fertilizers if needed
- Application of supplemental irrigation if needed.

Management Directive Restoration 3 – Monitor Invasive Non-native Plant Removal Sites. Continue to monitor invasive species removal sites to ensure that passive natural recruitment is successfully occurring in these areas.

Management Directive Restoration 4 – Monitor Native Vegetation Community Quality. Continue to monitor the quality of native vegetation communities throughout the Park using comparative vegetation mapping over time and evaluation of potential type conversions.

Management Directive Restoration 5 – Monitor Pests and Disease. Monitor the presence of disease or pest levels to determine outbreaks and prescribe an active treatment, as appropriate.

6.3 Fire Management

The long-term strategic fire management plan considers strategic fire prevention activities, fire suppression with regard to fire effects on habitat, and post-fire monitoring and rehabilitation. The long-term strategic fire plan for the Park must prioritize public safety while meeting habitat management goals. Management directives are as follows.

Management Directive Fire 1 – Fire Suppression: Fire suppression, in combination with invasive species and selective dead wood removal, is the priority for the Park. Given the lack of research regarding optimal fire frequencies for southern cottonwood/willow riparian forests and the disturbance forces of flooding, the primary fire management focus should be on suppression.

Management Directive Fire 2 –Maintain Fuel Modification Zones. Annually maintain the existing fuel modification zones within the Park including: the area adjacent to the neighboring mobile home park (Figure 8; VMU 1-WUI) as identified in Table 15; the previous agricultural field in the northeastern parcel, the 30-foot buffer along Dulin Road, and the 30-foot buffer along the dirt access road adjacent to the San Luis Rey Downs golf course.

Management Directive Fire 3 – Delineate Fuel Modification Areas. Install and maintain inconspicuous fuel modification extent markers for fuel modification zones to minimize additional thinning outside intended area.

Management Directive Fire 4 – Access Data Sharing. Signs should be installed indicating access limitations and extents (map form) and provide road quality to local fire responders. This information will be included in their wildland pre-response plans, resulting in more efficient responses. Information readily accessible by responders not familiar with the area, such as out-of-County or out-of-state responders, will improve fire fighter safety.

Management Directive Fire 5 – Control Illegal Access. Restrict off-highway vehicles and shooting access. These are potential ignition sources that must be managed through restricting access (e.g., installation of fences, gates, signage) and by establishing a high profile presence of park ranger staff. The primary location for unrestricted public access is in VMU 2, along the west side of West Lilac Road.

Management Directive Fire 6 – Educational Outreach. Private property owners in the interface or intermix (located adjacent to the Park) should be encouraged to play an active role in reducing the potential fire hazard. It will also be beneficial if the public understands the management actions occurring on Park property, such as mowing and herbicides, as

applicable. As such, this VMP recommends a concerted effort to reach property owners who are situated in locations that may be affected by wildfire on the Park or whose properties and actions may serve as Park ignition sources. Educational material can be customized for these homeowners to include discussion of the importance of the Park. Standard measures for implementing a 100-foot fuel modification/defensible space zone can be provided from materials available from CAL FIRE and from the County of San Diego Department of Planning and Land Use[2]. As part of the public education program, private property owners should be encouraged to participate as "eyes on the Park" to help curb illegal access and report potential problems.

Management Directive Fire 7 – Reduce Ignition Sources: Ignition sources are present adjacent the Park, including roadways with vehicular travel, especially SR-76, West Lilac Road, and Old River Road, adjacent residences, and recreational users, among many others. As such, it is not possible to remove all sources of ignition. Rather, reducing the potential spread of wildfire onto or throughout the Park is recommended. Fuel modification buffers on the Park edges near existing roads and homes are recommended for all adjacent ignition sources such that the source has 30–100 feet of fuel modification.

Management Directive Fire 8 – Conduct Recommended Fuels Management. Conduct fuels management using the identified VMUs, as feasible and as presented in Table 15. Table 15 provides a summary of the high-value resource areas acknowledged for the Park and the associated fire prevention strategy recommended for achieving long-term management goals.

Management Directive Fire 9 – Post-fire Management and Erosion Control. Provide controls following fire events to stabilize soils in the burn area and minimize potential for erosion. Erosion control best management practices (BMPs), such as mechanical rehabilitation treatments including straw mulch, hay bales, and jute rolls, should be in place as soon as possible after a fire and prior to the onset of the winter rainy season. Care should be taken to select and inspect these materials so they are not a source of invasive non-native plants. The use of certified weed-free hay is good policy (Bell 2009).

[2] On-line at: http://www.fire.ca.gov/cdfbofdb/pdfs/4291finalguidelines2_23_06.pdf and http://www.sdcounty.ca.gov/dplu/fire_resistant.html

Table 15
Fuel Management Activities by VMU

VMU	Sensitive Resources	Fuel Reduction Practice
1 Area: 67.3 acres APNs: 124-150-33, 125-080-20, 125-080-22, 125-131-55 Access: Via Dulin Road.	Sensitive Animal Species: Barn owl Great blue heron Pocketed free-tailed bat Red shouldered hawk San Diego pocket mouse Western bluebird Western mastiff bat Western red bat Yuma myotis Sensitive Cultural Sites: SDI-20,172 P-37-031757 P-37-028134	VMU 1 consists of disturbed habitat (previous agricultural field) in the southern portion of the VMU and southern cottonwood-willow riparian forest in the northern portion of the VMU along the San Luis Rey River. Access to this VMU is good via the dirt road extension of Dulin Road. Fuel treatment in VMU 1 should be dictated by dominant vegetation type. In disturbed habitat areas, the primary focus should be flashy fuel maintenance along the VMU perimeter and access roads. In the riparian forest portions of the VMU, vegetation management should be limited to invasive species removal and strategic removal of dead fuels. Down woody debris in stream systems provides for wildlife habitat, so removal should be conducted strategically and only where significant fuel loads are present. Establishment of exotic plants, disease or pest-caused mortality of adjacent plants, or other means that result in increased ignition potential may require strategic thinning. If vegetation removal is necessary near sensitive species, sensitive species locations should be flagged and avoided to the maximum extent possible. Vegetation should be removed via manual methods in these areas. In addition, cultural sites should be avoided and protected with an appropriate buffer during any thinning/fuel reduction efforts. If access to the cultural sites is necessary to control non-native species or to remove dead/dying vegetation, vegetation should be removed via manual methods. Any ground disturbance should be monitored by a County-approved archaeological and Native American monitor.
1-WUI Area: 1.5 acres APNs: 125-080-20, 125-080-22 Access: Via Dulin Road.	Residences Sensitive Cultural Sites: P-37-031758 P-37-028134	VMU 1-WUI is characterized by the adjacent residential property to the east of the Park and contains primarily disturbed habitat with a very small area of coastal sage scrub in the southern corner. Non-maintained disturbed habitat can convert to grass fuels. This VMU should continue to be routinely maintained by manual mowing and non-native plant removal to minimize fire spread and ignition potential from residential development.
2 Area: 305.3 acres APN: 123-381-07, 124-150-30, 124-150-31, 126-060-80, 126-060-81 Access: Via West Lilac Road or SR-76. Dirt trail/road access within VMU.	Sensitive Animal Species: Barn owl Cooper's hawk Pocketed free-tailed bat Red shouldered hawk San Diego pocket mouse Western bluebird Western mastiff bat Western red bat Yellow warbler Yuma myotis	VMU 2 consists primarily of southern cottonwood-willow riparian forest, with smaller sections of grassland and tamarisk. The 2007 Vuelta Fire burned a large portion of VMU 2. Fuel treatment in VMU 2 should be limited to invasive species removal and strategic removal of dead fuels. Down woody debris in stream systems provides for wildlife habitat, so removal should be conducted strategically and only where significant fuel loads are present. Establishment of exotic plants, disease or pest-caused mortality of adjacent plants, or other means that result in increased ignition potential may require strategic thinning.

Table 15
Fuel Management Activities by VMU

VMU	Sensitive Resources	Fuel Reduction Practice
	Sensitive Cultural Sites: P-37-031762 SDI-20,174 SDI-20,173 P-37-028134	The dirt trail/road network within VMU 2 may be used as access for conducting vegetation management actions, but public access should be restricted to minimize the likelihood of ignition and invasive species establishment. If vegetation removal is necessary near sensitive species, sensitive species locations should be flagged and avoided to the maximum extent possible. Vegetation should be removed via manual methods in these areas. In addition, cultural sites should be avoided and protected with an appropriate buffer during any thinning/fuel reduction efforts. If access to the cultural sites is necessary to control non-native species or to remove dead/dying vegetation, vegetation should be removed via manual methods. Any ground disturbance should be monitored by a County-approved archaeological and Native American monitor.
3 Area: 86.0 acres APN: 126-080-69, 126-100-18, 126-100-21, 126-320-14 Access: Via Old River Road.	Sensitive Animal Species: Barn owl Dulzura (California) pocket mouse Least Bell's vireo Pocketed free tailed bat Red shouldered hawk Turkey vulture Western mastiff bat Western red bat White faced ibis Yuma myotis Sensitive Cultural Sites: N/A	VMU 3 consists of southern cottonwood-willow riparian forest, disturbed habitat, and the remnants of an orchard in the southern portion of the VMU. The disturbed habitat and orchard areas are characterized by non-native grasses and flashy fuels. Fuel treatment in VMU 2 should be limited to invasive species removal and strategic removal of dead fuels. Down woody debris in stream systems provides for wildlife habitat, so removal should be conducted strategically and only where significant fuel loads are present (i.e., jackpots). Establishment of exotic plants, disease or pest-caused mortality of adjacent plants, or other means that result in increased ignition potential may require strategic thinning. If vegetation removal is necessary near sensitive species, sensitive species locations should be flagged and avoided to the maximum extent possible. Vegetation should be removed via manual methods in these areas.

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APPENDIX A

Glossary of Terms and Acronyms

APPENDIX A
Glossary of Terms and Acronyms

Glossary of Terms and Acronyms and Abbreviations

Acronyms and Abbreviations

AMSL – Above Mean Sea Level

ASMD – Area-Specific Management Directives

BMP – Best Management Practices

BTU – British Thermal Unit

CAL FIRE – California Department of Forestry and Fire Protection

Cal-IPC – California Invasive Plant Council

CEQA – California Environmental Quality Act

CNPS – California Native Plant Society

DPR – County of San Diego Department of Parks and Recreation

MSCP – Multiple Species Conservation Program

MSDS – Material Safety Data Sheets

NOAA – National Oceanic and Atmospheric Administration

NFFL – National Forest Fire Laboratory

NCFPD – North County Fire Protection District

RAWS – Remote Automated Weather Station

RMP – Resource Management Plan

SLRRP – San Luis Rey River Park

SRA – State Responsibility Area

USGS – United States Geological Survey

VMP – Vegetation Management Plan

VMU – Vegetation Management Unit

WUI – Wildland-Urban Interface

Terms

BehavePlus: Fire behavior prediction and fuel modeling computer program designed to model fire behavior characteristics based on fuel, weather, and topographic inputs. Model outputs include flame length values, fire spotting potential, and rate of fire spread.

Brush: A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.

Canopy: The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Combustible: Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

Conflagration: A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a wildland/urban interface, destroying structures.

Crown Fire: A fire that advances from top-to-top of trees or shrubs more or less independent of a surface fire.

Defensible Space: An area either natural or man-made, where material capable of allowing a fire to spread unchecked has been treated, cleared or modified to slow the rate and intensity of advancing wildfire. This will create an area for increased for emergency fire equipment and evacuating or sheltering civilians in place and a point for fire suppression to occur.

***Duff*:** The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles and leaves and immediately above the mineral soil.

Extreme Fire: A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Department: Any regularly organized fire department, fire protection district or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement, and location, that deter-mines the degree of ease of ignition and of resistance to control.

Fire Hydrant: A valved connection on a piped water supply system having one or more outlets that is used to supply hose and fire department pumpers with water.

Fire Prevention: Activities, including education, engineering, enforcement and administration that are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.

Fire Protection: The actions taken to limit the adverse environmental, social, political and economic effects of fire. Protection is relative, not absolute.

Fire Regime*:* Periodicity and pattern of naturally occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and area of extent.

Fire Retardant: Any substance, except plain water, that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Fire Season: (1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) A legally enacted time during which burning activities are regulated by state or local authority.

Fire Weather: Weather conditions which influence fire starts, fire behavior or fire suppression.

Fire Whirl: Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than 1 foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado.

Firebrand: Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pine cones, glowing charcoal, and sparks.

Firefighter: A person who is trained and proficient in the components of structural or wildland fire.

Flame: A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

Flammability: The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.

Fuel Break: An area, strategically located for fighting anticipated fires, where the native vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting.

Fuel Loading: The volume of fuel in a given area generally expressed in tons per acre.

Fuel Model: Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Modification: Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

Fuel Modification Zone: A strip of land, typically 100-feet-wide or more, between an improved property and wildlands, where combustible vegetation has been removed, thinned, or modified and may be partially or totally replaced with approved drought-tolerant, fire-resistant and/or irrigated plants to provide an acceptable level of risk from vegetation fires. Fuel modification reduces radiant and convective heat, thereby reducing the amount of heat exposure on the roadway or structure and providing fire suppression forces a safer area in which to take action.

Fuels: All combustible material within the wildland/urban interface or intermix, including vegetation and structures.

Hazard: The degree of flammability of the fuels once a fire starts. This includes the fuel (type, arrangement, volume and condition), topography and weather.

High Value Resource: High Value Resources are natural or manmade resources, including plant and animal species, cultural resources, and residences that form the basis for fire management planning in the Park.

Ignition Time: Time between application of an ignition source and self-sustained combustion of fuel.

Invasive Plant Species: A plant species which is not native to the region, and has demonstrated the ability to aggressively out-compete native plant species that would normally colonize a given area.

Ladder Fuels: Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Overstory: That portion of the trees in a forest which forms the upper or uppermost layer.

Peak Fire Season: That period of the year during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Prescribed Burning: Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area, and to produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Prescribed Fire: A fire burning within prescription. This fire may result from either planned or unplanned ignitions.

Red Flag Warning Conditions: A **Red Flag Warning** is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds which may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

Responsibility Area: That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the fire protection agent. Several agencies or entities may have some basic responsibilities without being known as the fire organization having direct protection responsibility.

Restoration (**of native vegetation communities*****):*** The act of restoring ecological functions and values of vegetation communities which have been adversely effected by human or nature induced impacts, causing decrease in ecological functions and values.

Sensitive Species: A plant or animal species with a special status listing from federal, state or local regulatory agencies.

Slope: The variation of terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

Smoke: (1) The visible products of combustion rising above a fire; (2) Term used when reporting a fire or probable fire in its initial stages.

Spotting: The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.

Structure Fire: Fire originating in and burning any part of all of any building, shelter, or other structure.

Suppression: The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.

Surface Fuel: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Tree Crown: The primary and secondary branches growing out from the main stem, together with twigs and foliage.

Uncontrolled Fire: Any fire which threatens to destroy life, property, or natural resources, and (a) is not burning within the confines of firebreaks, or (b) is burning with such intensity that it could not be readily extinguished with ordinary, commonly available tools.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

Urban Interface: Any area where wildland fuels threaten to ignite combustible homes and structures.

Vegetation Management Unit: Delineated Park unit based on topography, vegetation or other features used for internal invasive species, restoration, and fire management planning.

Weed: A plant species which interferes with a desired management objective. This term does not denote the native or non-native status of a plant species. Both native and non-native plants have the ability to interfere, depending on the objective (i.e., Native cattails can be considered a weed for flood control management objectives).

Wildfire: An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.

Wildland: An area in which development is essentially non-existent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Fire: Any fire occurring on the wildlands, regardless of ignition source, damages or benefits.

Wildland-Urban Interface (WUI): The area where structures and other human developments meet or intermingle with undeveloped wildland (as defined in the County Fire Code, County Consolidated Fire Code and County Building Code).

Sources: www.firewise.org, and County of San Diego Guidelines for Determining Significance and Report Format and Content Requirements, Wildland Fire and Fire Protection (2010).

APPENDIX B

Park Map with Access Gates and Transmission Line Locations

DUDEK

SOURCE: Digital Globe 2008

APPENDIX B

Preserve Map

6680-3D

San Luis Rey Riverpark - Vegetation Management Plan

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DUDEK

SOURCE: Digital Globe 2008

6680-3D

APPENDIX B

Preserve Map

San Luis Rey Riverpark - Vegetation Management Plan

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APPENDIX C

Fire Behavior Modeling Results

APPENDIX C
Fire Behavior Modeling Results

FUELS CLASSIFICATION

Reliable estimates of fire behavior must consider the relationship of fuels to the fire environment and the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content and chemical properties.

All vegetation is considered fuel. All vegetation will burn; however, some species require more heat in order to ignite and propagate flame. The moisture content of vegetation is an important component; dry vegetation will ignite more rapidly, whereas green vegetation must lose its moisture before it will ignite. Consequently, shrubland vegetation with high oil content (above 6%) will burn more quickly and hotter than vegetation with high leaf moisture levels and low oil content levels. More than 90% of the flaming front of a wildfire is composed of fuel less than 0.5 inch in diameter and is consumed in minutes. Fuels larger than 1 inch in diameter are termed "residual" fuel and may require several hours to burn out. This larger fuel does not contribute to the forward rate of spread of the fire. The following factors describe the relationship between vegetation characteristics that affect fire behavior:

Fuel loading is defined as the oven dry weight of fuels in a given area, usually expressed in tons per acre. Natural fuel loading varies greatly by vegetative or fuel types in addition to the different size classes of fuel particles. Vegetation types can be rated as light, moderate, or heavy. Each rating is an estimate of the dead or live surface fuels that are less than 3 inches in diameter. Although specific measurements were not taken, based on the vegetation types identified in the cursory survey of the San Luis Rey River Park (Park), the different vegetation types can generally be assigned a moderate rating.

> Measuring the intensity, force, and destructive potential of wildfire is accomplished by observing flame lengths produced by burning vegetation. A direct relationship exists between the amount of energy released during burning (per second) and the length of flame generated. The standard for measuring energy release in the United States is the British Thermal Unit (BTU). One BTU is defined as the amount of energy required to increase the temperature of 1 pound of water 1°F (a standard kitchen match or candle flame is approximately one BTU).

Size and shape affect the surface area to volume ratio of fuels. Small fuels have a greater surface area to volume ratio than larger fuels. Dead fuels are separated into four size classes: (1) grasses, litter, or duff less than 0.25-inch diameter; (2) twigs and small stems 0.25– to 1-inch diameter; (3) branches 1- to 3-inch diameter; and (4) large stems and branches greater than 3-inch diameter. The fine fuels less than 0.25 inch in diameter are most important for fire behavior analysis because their ignition time is less, and their fuel moisture content changes rapidly. This characteristic is typical for the grasses that were identified within and adjacent to the Park.

> The arrangement, size, and surface area of vegetative fuels play an important role in fire behavior and spread potential. Dense, concentrated biomass may burn evenly; however, when overall size decreases and surface area increases (as seen in native shrub stands), burning patterns change, resulting in faster ignition and spread. Live shrubland and grassland vegetation generally exhibit high surface to volume ratios. Standing grass, coastal sage scrub, and chaparral have high surface area to volume ratios, whereas forest litter and chipped or cut biomass exhibit very low surface to volume ratios.

Compactness, or spacing between fuel particles, affects the rate of combustion. For example, fuel particles that are closely compacted have less surface area exposed and less air circulation between particles and thus are slower to combust. The thick duff layer found underneath a mixed forest is an example of a tightly compacted fuel, whereas the open, dead branches on sagebrush or chaparral are considered a loosely compacted fuel. With the exception of the on-site grasslands and disturbed habitat, the fuels in the Park (notably the southern cottonwood/willow riparian forest) are generally compact.

Horizontal continuity is the extent of horizontal distribution of fuels at various levels or planes. The vegetative types within the Park were analyzed for horizontal continuity and vertical arrangement. Fuels are either rated as uniform or patchy. Uniform fuels are evenly distributed and occur in a continuous, non-interrupted cover across the landscape. Patchy fuels are not continuous.

Vertical arrangement is defined as the relative heights of fuels above the ground, as well as their vertical continuity. Both of these vegetation characteristics influence the ability of fire to reach various fuel levels or strata. Vegetation of various heights that can transport fire from the low-level brush to tree canopies is called a fuel ladder and may create what is called a “crown fire.” When tall grasses and shrubs grow around trees with low hanging branches, the result is a fuel ladder. When a ground fire climbs the fuel ladder into the crowns of trees, it can spread canopy to canopy, creating higher fire intensity and firebrands.

Fuel moisture content is defined as the amount of water in fuels. The moisture content of plant materials plays a major role in the ignition, development, and spread of fires. Fuel moisture controls the current flammability of fuels both living and dead. During the most active growing periods of spring, the moisture content of plant foliage may be quite high. As the season progresses, a plant's moisture content declines until late summer or early fall when the plant becomes dormant or completely dies. Fine fuels, less than 0.25 inch thick, are most responsible for the spread of fire and have highly variable fuel moisture contents depending on the relative humidity of the air. Live fuel moisture content during the peak fire season (October through December) is estimated to be 60% to 80% in the drier open areas. This can potentially drop to less than 60% under extreme, dry wildfire conditions.

> There are two types of fuel moisture values to consider: (1) dead fuel moisture, with measurements of 1-, 10-, 100-, and 1,000-hour time-lag; and (2) live fuel moisture.

Dead fuel moisture percentages are determined by temperature, aspect, time of day, relative humidity, and time of year. One-hour time-lag fuel is less than 0.5 inch thick, 10-hour time-lag fuel is between 0.5 inch and 1 inch thick, 100-hour time-lag fuel is between 1 and 3 inches thick, and 1,000-hour time-lag fuel is greater than 3 inches thick. One-hour time-lag fuel can reach equilibrium with the surrounding atmosphere in 1 hour, or within minutes when air temperature exceeds 80°F and relative humidity is below 25%. One-hour time-lag fuel moisture may be calculated using a set of tables that reference time of day, month, aspect, slope, temperature, and relative humidity. Ten-hour, 100-hour, and 1,000-hour time-lag fuel can take up to 10 hours, 100 hours, or 1,000 hours to reach equilibrium with the surrounding atmosphere, respectively. In Southern California, 1-hour, 10-hour, and 100-hour time-lag fuels are usually given equal value. One thousand hour time-lag fuel, which occurs in more heavily wooded environments (i.e., timber), is generally used in measuring drought effects. Forests are considered "critical" when 1,000-hour fuel measurements are less than 15% (as a frame of references, kiln-dried wood moisture averages 22%).

> Despite variations in the topography and disturbance history of the Park, vegetative cover is classified into four main types: grass, chaparral, coastal sage scrub, and woodland. Grasses and some invasive species occur in the 1-hour size class, while pockets of 10- and 100-hour fuels can be found on site, primarily in the riparian forest vegetation type on site.

Live fuel moisture is described as the moisture in leaves and woody portions of a plant. Field measurements of live fuel moistures are calculated by cutting small branches (less than 3 inches in diameter), weighing the branch, placing it in a low- temperature oven for 12 hours, removing the branch, and weighing it again. The difference in weight is the loss of moisture in the leaves

and woody portion of the branch. Consequently, live fuel moisture may exceed 100% of the dry weight of the plant. Live fuel moisture is the highest in the spring and early summer, and the lowest in late summer, fall, and early winter. This measurement is a valuable tool in predicting wildfire potential for a general area.

> Chaparral and coastal sage scrub are common Southern California vegetation types found in many upland locations and generally have reduced fuel moisture levels. Conversely, riparian vegetation, including willow (*Salix* spp.), cottonwood (*Populus* spp.), and mulefat (*Baccharis salicifolia*), has higher leaf moisture values than vegetation growing in drier, more xeric sites. The importance of fuel moisture in examining fire hazard is that higher moisture levels ultimately require higher BTU output to ignite or sustain ignition. Consequently, fuel arrangement, along with fuel chemical/moisture content, plays an important role in wildfire combustion, spread, and heat output. Fuel moisture is a significant component, as vegetation requires external heat and energy to reduce moisture levels before it will ignite. High winds, low relative humidity, and/or high temperatures begin the process of removing fuel moisture, thus allowing vegetation to ignite and burn more rapidly. Consequently, lower fuel moisture values, including both dead and live fuel moistures, result in increased fire intensity. Moisture-laden fuels inhibit complete combustion while simultaneously producing excessive smoke output.

Fuel chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. These also affect the rate of combustion. Chaparral and sage scrub vegetation have high amounts of these volatile substances that contribute to rapid rates of spread and high fire intensities.

> Oil and moisture contents vary between fuels and fluctuate depending on the time of year. For example, black sage may have an oil content approaching 20% of its weight in dry summer or autumn months, but, in the spring, when sufficient groundwater is available, moisture content values can exceed 300%. When stressed during extreme dry weather conditions, numerous chaparral and coastal sage scrub species may react explosively when moisture falls below 60%, whereas larger shrubs may require higher energy to sustain ignition.

FUEL MODELS

All nine fuels characteristics are descriptors that help define the 13 standard fuel models (Anderson 1982), the more recently developed 40 fuel models (Scott and Burgan 2005), and five custom fuel models developed for Southern California (Weise and Regelbrugge 1997). Five fuel models (models 1, 8, 9, SCAL 18, and SH5) were used in the FlamMap analysis for the Park and

are required inputs for the mathematical fire spread computations. Additionally, one non-burnable model (model 98) was utilized to represent non-fuel areas (e.g. developed areas, agriculture)). Table 1 provides details of the six fuel models used in the analysis conducted for the Park.

Table 1
Fuel Model Characteristics

Fuel Model	Description	Tons/acre; Btu/lb	Fuel Bed Depth (Feet)
1	Short grass	0.7 tons/acre; 8,000 Btu/lb	1.0
8	Closed timber litter	5.0 tons/acre; 8,000 Btu/lb	0.2
9	Hardwood litter	3.5 tons/acre; 8,000 Btu/lb	0.2
SCAL18	Sage/buckwheat	9.7 tons/acre; 9,200 Btu/lb	3.0
SH5	High load dry climate scrub	8.6 tons/acre; 8,000 Btu/lb	6.0

WILDLAND FIRE BEHAVIOR MODELING

Fire behavior was analyzed for the Park using FlamMap fire behavior modeling software and local topographic, fuels, and weather data. The FlamMap output data provide an indication of how vegetative fuels will burn under specific fuel, weather, and topographical conditions. The FlamMap (version 3.0) fire behavior software package (Finney 2004) is a geographic information system (GIS)-driven computer program that incorporates fuels, weather, and topography data in generating static fire behavior outputs, including values associated with flame length, rate of spread, and fireline intensity. It is a flexible system that can be adapted to a variety of specific wildland fire planning and management needs.

The calculations that result from FlamMap are based on the BehavePlus Fire Modeling System algorithms but result in a geographically distinct data set based on GIS inputs. FlamMap model outputs allow wildland resource managers to predict rate of spread, fireline intensity, and flame length, which provide important insights about the characteristics of wildfire spread within and adjacent to high-value areas, whether residential structures or preserved sensitive habitats. Each of the input variables used in FlamMap remain constant at each location, meaning that the input variables are applied consistently to each grid cell and the fire behavior at one grid cell does not impact that at a neighboring grid cell. Essentially, the model presents a "snapshot" in time and does not account for temporal changes in fire behavior or the movement of fire across the landscape. As such, the results of the models contained herein should be utilized as valuable information sources and tools to prioritize fuel treatment options rather than an exact representation of how a fire would behave in the Park.

The basic assumptions and limitations of FlamMap are:

- The fire model output describes fire behavior only in the flaming front. The primary driving forces in the predictive calculations are the dead fuels less than 0.25 inch in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect to carry fire, and fuels greater than 3 inches in diameter have no effect.

- The model bases calculations and descriptions on a wildfire spreading through surface fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.

- The software assumes that weather is uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel must be carefully considered to obtain useful predictions.

- The FlamMap fire behavior computer modeling system provides the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

Fuel models used in the FlamMap analysis are classified into four groups based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Fuel model classifications were made during field analysis and in conjunction with available vegetation maps of the Park. The following list of fuel types describes the classification of fuel models based on vegetation type:

- Grasses Fuel, Models 1 through 3. These models represent the fast moving, light, flashy fuels found in grassland landscapes.

- Brush Fuel, Models 4 through 7, SCAL 14 through 18. These models are designed to represent the higher-intensity chaparral and sage scrub dominated landscapes.

- Timber Fuel, Models 8 through 10. Timber models are selected to represent the riparian woodland or ornamental forested landscapes.

- Logging Slash, Fuel Models 11 through 13. These models are used to represent slash; none were utilized for the Park.

FLAMMAP FUEL MODEL INPUTS

FlamMap software requires a minimum of 5 input files that represent field conditions in the Park, including elevation, slope, aspect, fuel model, and canopy cover. Each of these files was created as a raster geographic information system (GIS) file in Arc View 9.3.1 software, exported as an ASCII grid file, then utilized in creating a FARSITE Landscape file that served as the base for the FlamMap runs. The resolution of each grid file and associated ASCII file that was used in the

models described herein is 3 meters, based on available digital elevation models (DEMs). In addition to the Landscape file, wind and weather data are incorporated into the model inputs. The output files chosen for each of the modeling runs included flame length (feet) and fireline intensity (BTU/ft/sec). Figures C-1 through C-4 depict the results of each of the four modeling runs and exhibit each of these output variables.

The following provides a description of the input and output variables used in processing the FlamMap models. In addition, data sources are cited and any assumptions made during the modeling process are described.

1. ***Elevation.*** Elevation data were derived from a 3 meter resolution Interferometric Synthetic Aperture Radar (IfSAR) measurement for coastal Southern California, acquired from the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center. This data were utilized to create an elevation grid file, using units of feet above mean sea level. The elevation data are a necessary input file for FlamMap runs and are necessary for adiabatic (i.e., a process that happens without loss or gain of heat) adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances (Finney 2004).
2. ***Slope.*** Using Spatial Analyst tools, a slope grid file was generated from the elevation grid file. Slope measurements are represented in percent of inclination from horizontal. The slope input file is necessary for computing slope effects on fire spread and solar radiance (Finney 2004).
3. ***Aspect.*** Using Spatial Analyst tools, an aspect grid file was generated from the elevation grid. Aspect values are presented in azimuth degrees and are important in determining solar exposure.
4. ***Fuel Model.*** Vegetation coverage data in the form of a GIS shapefile were used in this analysis to create a fuel model file. Derived from Dudek's vegetation mapping data (Dudek 2011), the vegetation types were classified according to existing National Forest Fire Laboratory (NFFL) and BehavePlus fuel models, and the data file was converted to a grid file for inclusion in FlamMap modeling. Table 2 presents the vegetation and associated fuel type classifications for the Park.
5. ***Canopy Cover.*** Canopy cover is a required file for FlamMap operations. It is necessary for computing shading and wind reduction factors for all fuel models. Canopy cover is the horizontal percentage of the ground surface that is covered by tree crowns. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy. Crown closure refers to the ecological condition of relative tree crown density. Stands can be said to be "closed" to recruitment of canopy trees but still only have 40% or 50% canopy cover (Finney 2004). Coverage units can be categories (0–

4) or percentage values (0–100). Table 2 presents canopy cover assignments for each vegetation type/fuel model

Table 2
Fuel Models and Associated Canopy Cover Values

Vegetation Community/Land Cover	Fuel Model	Canopy Cover Value
Agriculture	98	0
Developed	98	0
Diegan Coastal Sage Scrub	SCAL18	0
Disturbed Habitat	1	0
Non-native Grassland	1	0
Orchard	9	2
Southern Cottonwood – Willow Riparian Forest	8	3
Tamarisk Scrub	SH5	0

Weather

In order to utilize weather and fuel moisture variables for the Park, data from the Ammo Dump Remote Automated Weather Station (RAWS) was analyzed as it includes data for fuel moisture conditions. As of the date of this report, no RAWS are located on the Park property. The Ammo Dump RAWS is located approximately 7 miles to the north-northwest of the Park and is located in a similar inland position as the Park. The following summarizes the location and available data ranges for the Ammo Dump RAWS:

- Latitude: 33.381389
- Longitude: -117.285556
- Elevation: 1,068 feet
- Data years: 2001 to 2010.

Wind and weather data are a required component to fire behavior modeling efforts. The Ammo Dump RAWS data was processed with the FireFamily Plus v. 4.0.2 (FireFamily Plus 2007) software package to determine summer (50th percentile) and fall (97th percentile) weather conditions to be incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Wind direction and wind speed values for the two FlamMap runs were manually entered during the data input phase. All other weather data were held constant for each of the FlamMap runs. Table 3 summarizes weather and fuel moisture data inputs used for both summer and fall weather conditions.

Table 3
FlamMap Weather Input Variables

Model Variable	50th Percentile Weather	97th Percentile Weather (w/ Max. Wind)
1 h fuel moisture	7%	2%
10 h fuel moisture	9%	3%
100 h fuel moisture	16%	8%
Live herbaceous moisture	60%	30%
Live woody moisture	90%	60%
20 ft wind speed (mph)	10 mph	50 mph (maximum observed Fall wind speed)
Wind direction	225 degrees	45 degrees
Slope steepness	Variable by location	Variable by location

mph = miles per hour

FlamMap Fuel Model Outputs

Two output grid files were generated for each of the two FlamMap runs, and include representations of flame length (feet) and fireline intensity (BTU/feet/second), as shown in Figures C-1 through C-4. The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews, Bevins, and Seli 2004). It is a somewhat subjective and non-scientific measure of fire behavior, but is extremely important to fireline personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1991). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire and is another important variable in initial attack and fire suppression efforts. The information in Table 4 presents an interpretation of these fire behavior variables as related to fire suppression efforts.

Table 4
Fire Suppression Interpretation

Flame Length (feet)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4	Under 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 to 8	100 to 500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 to 11	500 to 1000	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11	Over 1000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Source: BehavePlus 3.0.2 fire behavior modeling program (Andrews, Bevins, and Seli 2004)

The fire behavior analysis results for the Park vary depending on fuel type. As FlamMap utilizes site-specific digital terrain data (including slope, vegetation, aspect, and elevation data) slight variations in predicted flame length and fireline intensity values can be observed based on fluctuations of these attributes across the landscape. As presented, wildfire behavior in each of the fuel types varies depending on weather conditions. Given the climatic, vegetation, and topographic characteristics along with the fire history and fire behavior modeling results discussed in this VMP, the Park is determined to be vulnerable to wildfire starting in, burning onto, or spotting onto the site. Based on this information, adjacent residential development, and the fire history of the area, it is expected that wildfires will occur in the Park in the future.

Under extreme fall weather conditions (97th percentile fuel moistures and maximum recorded wind speeds of 50 miles per hour), fire can move rapidly through the site's fuels. Worst-case flame lengths were calculated at approximately 48 feet in the small pockets of tamarisk scrub in VMU 2. Spread rates on site may exceed 8 miles per hour in dry flashy fuels (grasses) under extreme weather conditions. Finally, under extreme weather and wind conditions, fireline intensity values may exceed 24,000 Btu/feet/second in scrub fuels on site. The majority of the Park, however, exhibits moderate fire severity within the riparian forest vegetation types on site.

However, this moderate severity assumes that a ground fire transition to a canopy fire does not occur. Canopy fire occurrence within the riparian forest vegetation on site is possible and would significantly affect and limit the options for fire response personnel. Utilizing the BehavePlus software package and the extreme weather inputs discussed herein, transition from a ground fire burning in grass fuels to a crown fire can be expected with a surface fuel to canopy height difference of 10 feet. Canopy fire spread rate during extreme weather conditions may exceed 4 mph. This analysis emphasizes the importance of minimizing ignitions and maintaining the fuel management areas adjacent Park boundaries.

It should be noted that the modeling results depict values based on inputs to the FlamMap system. Variations in weather or pockets of different fuel types are not accounted for in this analysis. Additionally, the scale of analysis (3 square meters) limits fine-scale analysis and interpretation. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns that could not be obtained for this analysis.

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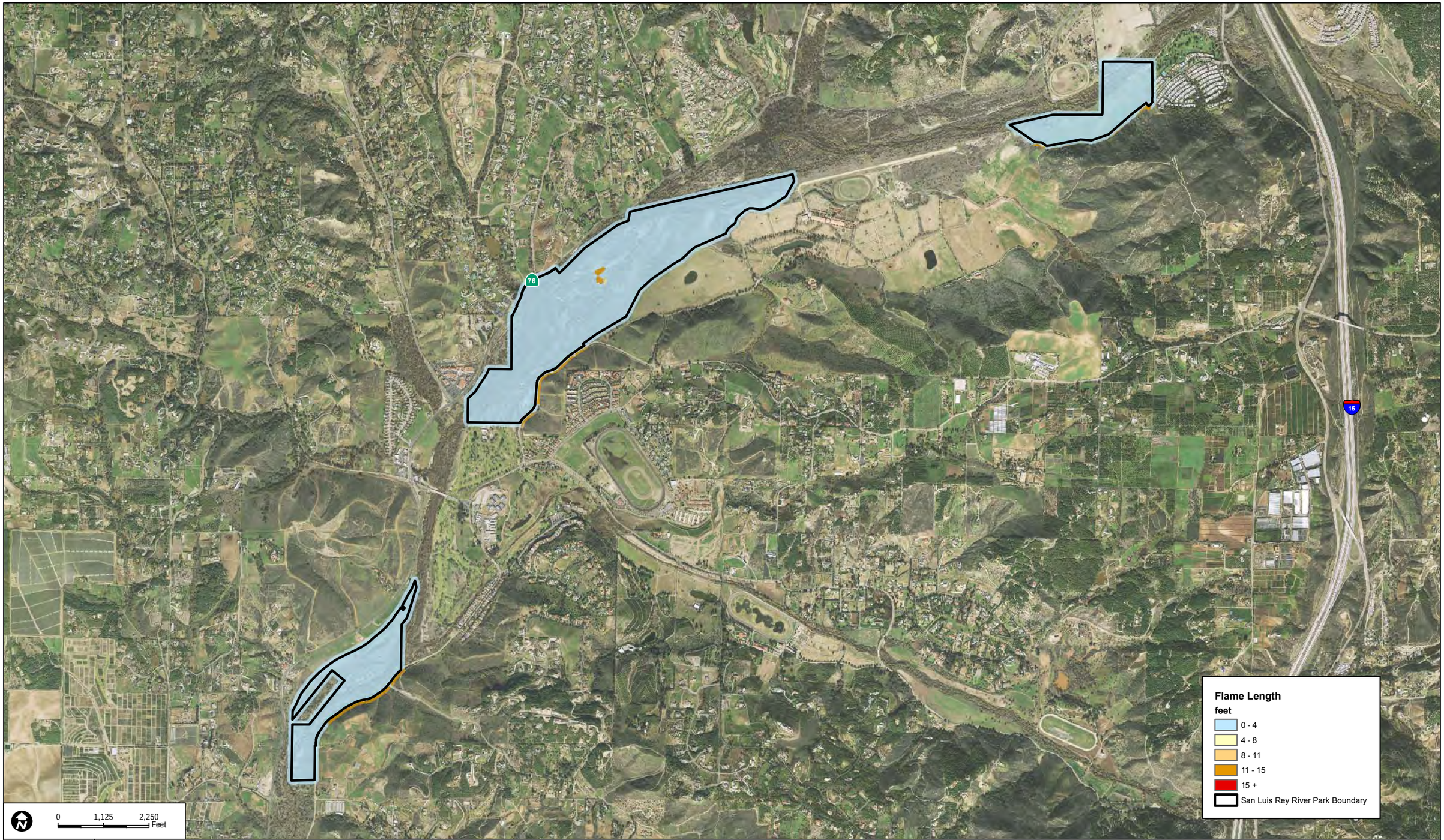

DUDEK

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SOURCE: Digital Globe 2008

APPENDIX C-1

Flame Length, Summer Fire

San Luis Rey Riverpark - Vegetation Management Plan

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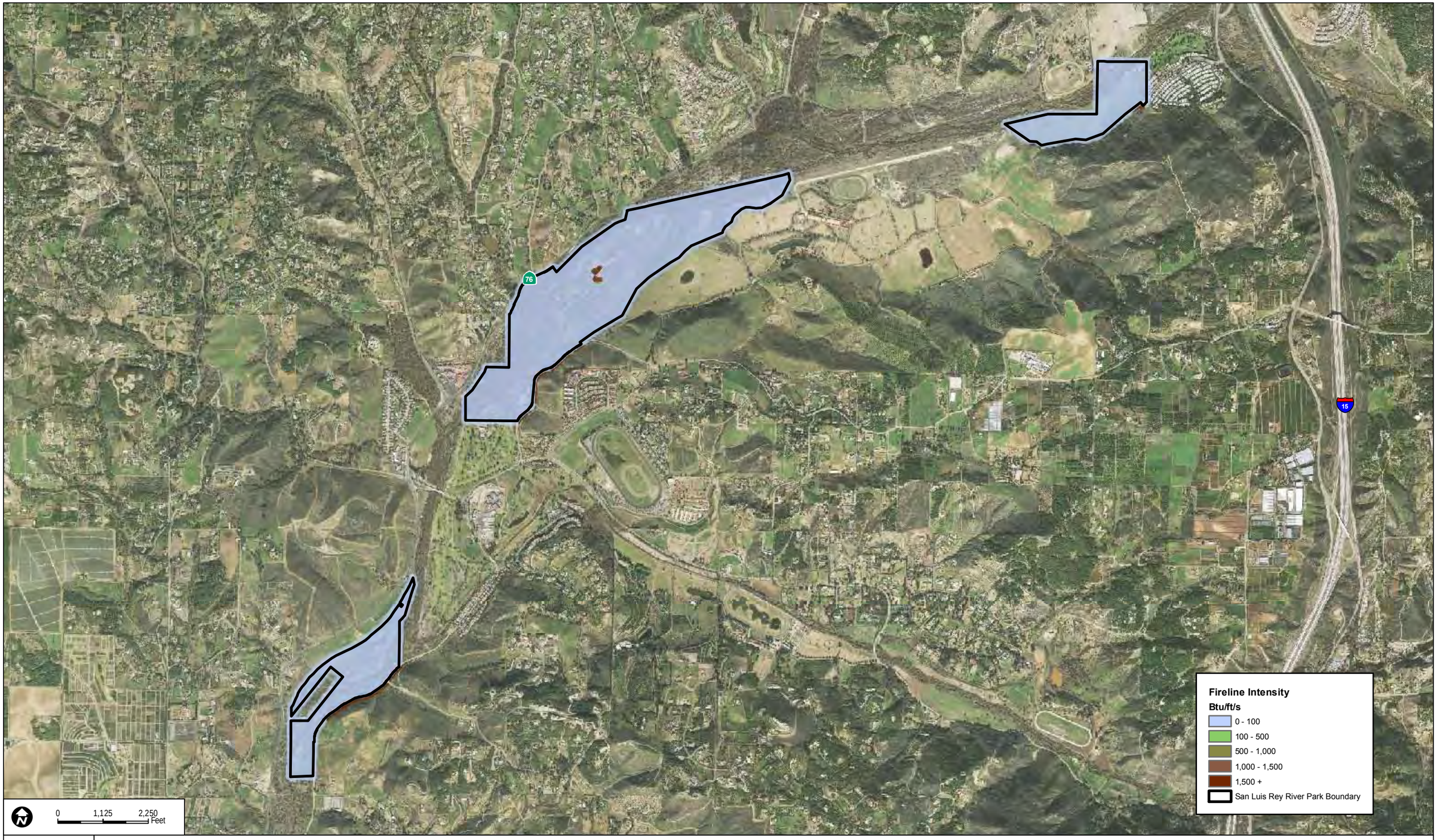

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SOURCE: Digital Globe 2008

APPENDIX C-2

Fireline Intensity, Summer Fire

San Luis Rey Riverpark - Vegetation Management Plan

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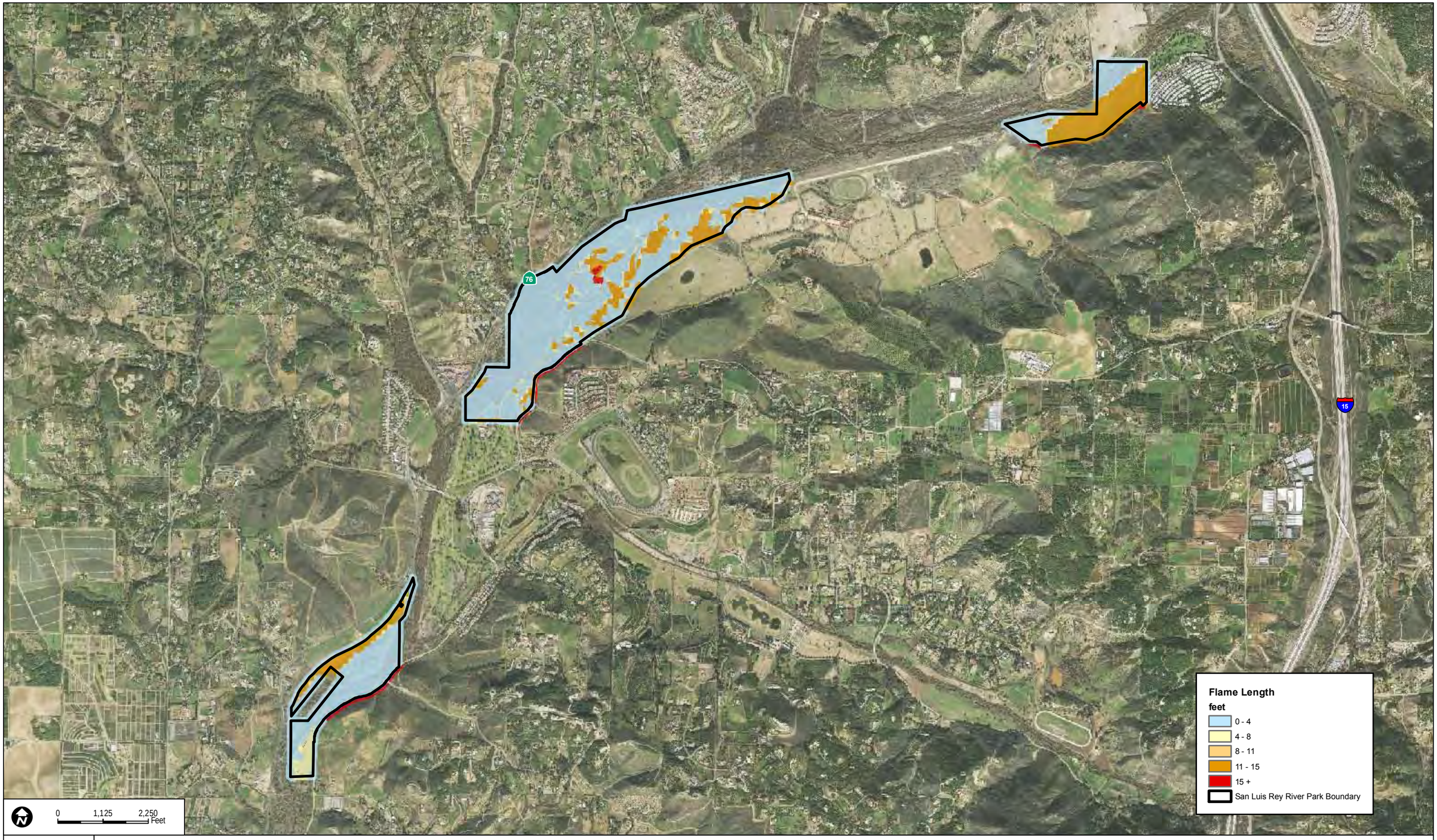

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SOURCE: Digital Globe 2008

APPENDIX C-3

Flame Length, Fall Fire

San Luis Rey Riverpark - Vegetation Management Plan

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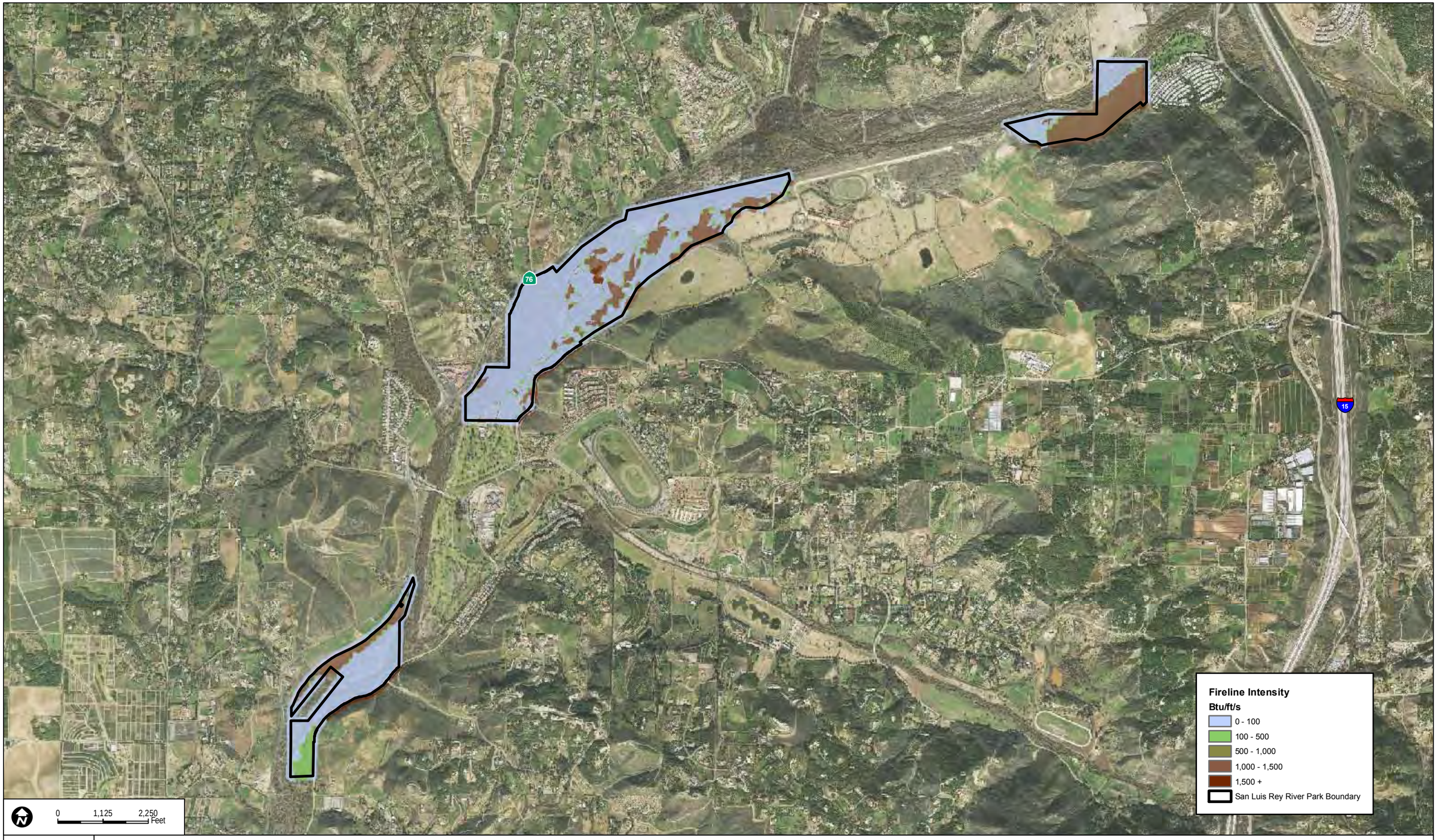

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SOURCE: Digital Globe 2008

APPENDIX C-4

Fireline Intensity, Fall Fire

San Luis Rey Riverpark - Vegetation Management Plan

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