

Sage Hill Preserve Vegetation Management Plan County of San Diego

Prepared for

**County of San Diego
Department of Parks and Recreation
9150 Chesapeake Drive, Suite 200
San Diego, California 92123**

Contact: Ms. Jennifer Haines

Prepared by



**Ecological
Conservation
& Management, Inc.**

6755 Mira Mesa Blvd, Suite 123413
San Diego, California 92121
858.842.7345

AECOM

9675 Businesspark Avenue
San Diego, California 92131
858.536.5610

Contact: Tito Marchant

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1.0 Introduction

The County acquired the Sage Hill Preserve (Preserve) for preservation in early 2009 in partnership with SANDAG and The Conservation Fund. The Preserve is included in the proposed North County Multiple Species Conservation Program (North County MSCP) preserve system and consists of valuable native habitats containing sensitive species, as well as areas that have been marginally impacted by human activities, such as unofficial trail systems, foundations of former buildings, former agricultural fields, and recreational use (Figure 1). It should be noted that the North County MSCP has not been approved by the resource agencies (California Department of Fish and Game and U.S. Fish and Wildlife Service) and is currently in draft form. A key feature of the North County MSCP is the focus of proposed conservation areas that are identified in the plan as pre-approved mitigation areas (PAMA). As proposed 80% of the natural habitats within the North County MSCP planning area are proposed for conservation.

As part of the North County MSCP planning framework, the County is required to prepare a Resource Management Plan that is consistent with Area Specific Management Directives (ASMDs) for use of the property as a biological reserve. ASMDs are management actions that meet species- and habitat-specific needs in a phased manner that take into account the particular circumstances of a given logical and discrete area, and are meant to ensure adequate management of reserved lands consistent with the draft North County MSCP. The ASMDs direct appropriate levels of vegetation management activities including invasive weed control, habitat restoration, and fire and fuel management activities. This Vegetation Management Plan provides the basis for the ASMDs by characterizing current site conditions and providing recommendations for invasive species control, habitat restoration, and fire management.

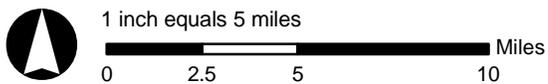
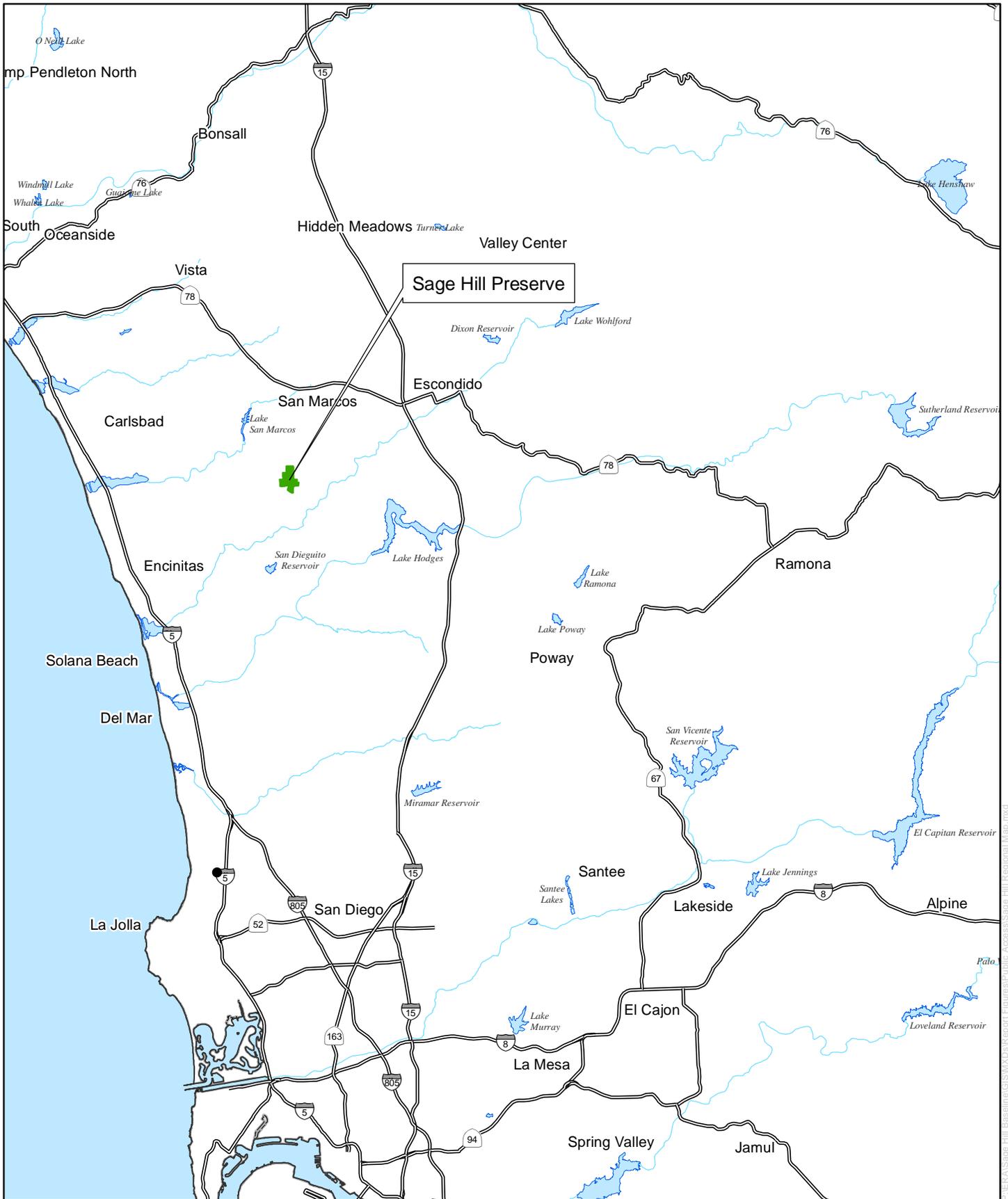
1.1 Purpose and Need

The purpose of this Plan is to outline the planned removal of exotic species and the restoration of disturbed areas to manage and enhance the existing biological and cultural resources within the Preserve. The plan also includes a discussion of fire prevention, suppression, and post-suppression fire control activities within and adjacent to the Preserve. The intent of the plan is to provide DPR and fire response personnel with critical site information for emergency fire response within and immediately adjacent to the Preserve boundaries and identify targeted fuel management actions that can be implemented as preventative measures.

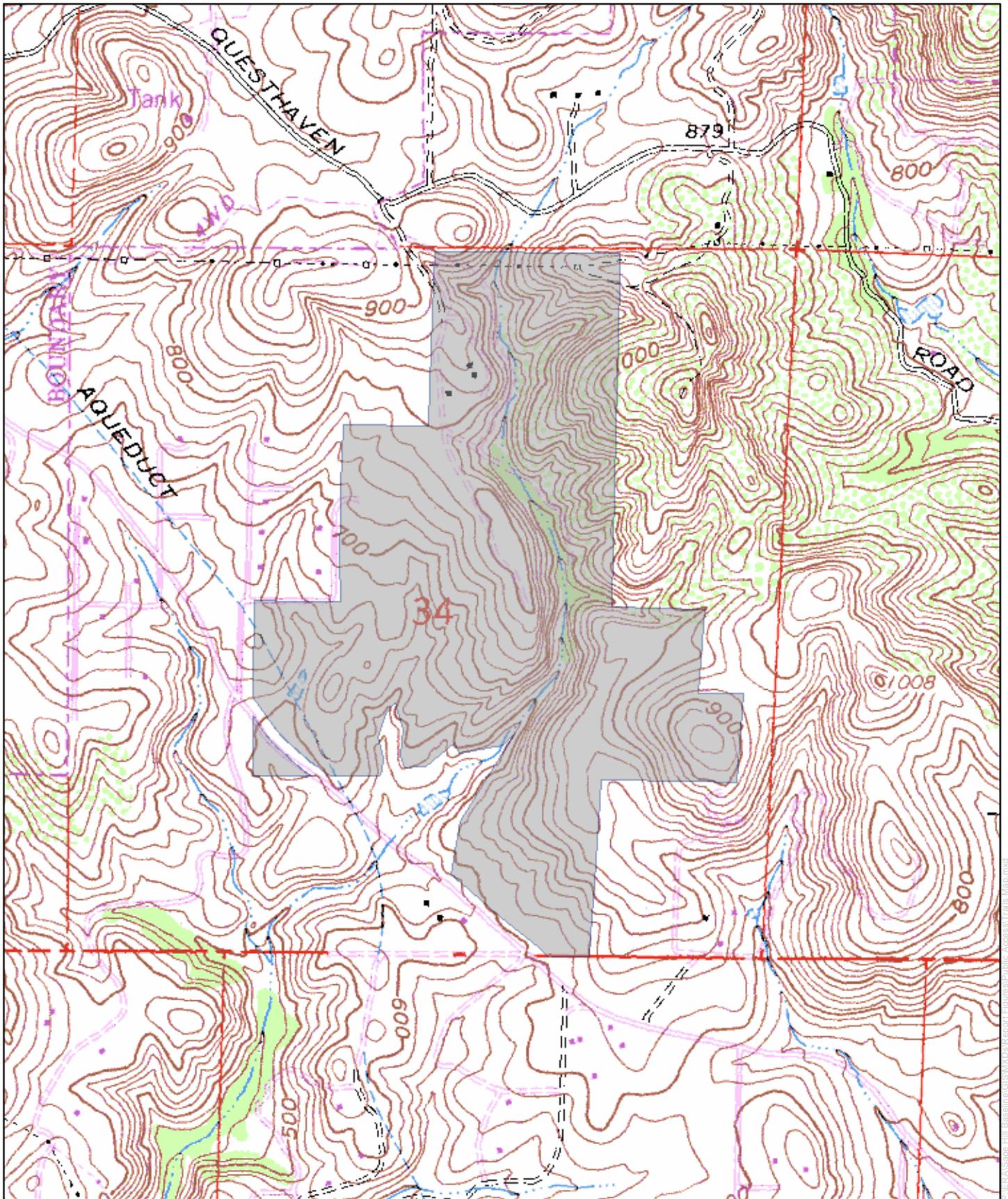
1.2 Site Location and Description

The 231.5 acre Preserve consists of mostly prime coastal sage scrub and riparian drainages. Bisected by a south flowing tributary of the Escondido Creek system, the Preserve sits north of Elfin Forest Road and southwest of Questhaven Road within the North County MSCP subarea. The Preserve is located in the community of Harmony Grove in unincorporated San Diego County, California, between Fortuna del Norte and Carib Drive on the west, Questhaven Road on the north, Aguilera Lane on the east and Elfin Forest Road on the south (Figures 1, 2).

The Preserve is mapped in the Rancho Santa Fe USGS 7.5 minute quadrangle map at Township 12 South, Range 3 West, Section 34. The Preserve consists of assessor's parcel numbers 679-060-04, 679-060-06, 679-060-07, 679-080-10, 679-080-11, 679-100-01, 679-100-02, 679-100-03, 679-100-04, and 679-100-06. It is bordered by private property on all sides, and these parcels include single-family residences, agricultural land, and undeveloped parcels.



Sage Hill Regional Map



Source: USGS (Rancho Santa Fe Quad), County of San Diego



Sage Hill USGS Vicinity Map

Primary and vehicular access to the Preserve is through a parking lot on Elfin Forest Road on the southern edge of the Preserve. Secondary access is through a gate on Elfin Forest Road east of the parking lot, and through a gate on Questhaven Road on the northern side of the Preserve.

Elevations on the Preserve range from 600ft above mean sea level in the southwest section to as high as 920ft on the eastern slopes. Development fronts the north, south, and west boundaries of the preserve but the eastern boundary is bordered by undeveloped land. A historic nursery location is located in the northern portion of the Preserve near the Questhaven Road access point.

1.3 Vegetation Management Goals

The Preserve is located within the Draft North County Multiple Species Conservation Program (North County MSCP) Plan area. The County of San Diego's MSCP Subarea Plan is a regional plan that ensures the long-term survival of sensitive plant and animal species and protects the native vegetation. Within the North County MSCP, the County identifies the following objectives for its open space areas.

- To ensure the long-term viability and sustainability of native ecosystem function and natural processes throughout the MSCP Preserve.
- To enhance and restore, where feasible, the full range of native plant associations in strategic locations and functional wildlife connections to adjoining habitat in order to provide viable wildlife and sensitive species habitat.

The purpose of this plan to prescribe vegetation management practices with the intent of accomplishing specific resource goals and objectives. Per the vegetation specific guidelines within the North County MSCP Framework Resource Management Plan, the following goals have been developed for the Preserve:

- Wildlife habitat enhancement and protection.
- Protect watersheds and waterways by controlling soil surface erosion.
- Control invasive and noxious weeds that replace more desirable plant species.
- Reduce the risk and damage to life and property from wildfires.

2.0 Environmental Resources

This section summarizes the biological and cultural resource inventory conducted for the Preserve. This information provides the baseline conditions from which management recommendations were derived. It also outlines the biological and cultural constraints that will need to be considered in the implementation of these recommendations.

2.1 Biological Resources

2.1.1 Vegetation Communities

The Preserve is dominated by two vegetation communities: Diegan coastal sage scrub, and southern maritime chaparral (Table 1, Figure 3). The remainder is composed of six other

vegetation types, including freshwater marsh, coastal sage-chaparral scrub, and southern coast live oak riparian forest. Non-native species dominate non-native grassland, which occurs primarily as fire fuel modification zones along the outer edges of the Preserve, disturbed habitat, which includes the existing roads and trails and an old agricultural area, and a tamarisk thicket (“tamarisk scrub”) (Table 1).

Table 1
Vegetation Communities and Overall Acreage

Vegetation Communities	Holland Code	Acres
Diegan Coastal Sage Scrub	32500	138.5
Southern Maritime Chaparral	37C30	53.6
Coastal sage-Chaparral Scrub	37G00	4.6
Coastal and Valley Freshwater Marsh	52410	1.2
Southern Coast Live Oak Riparian Forest	61310	5.5
Non-Native grassland	42200	14.7
Disturbed Habitat	11300	12.6
Tamarisk Scrub	63810	0.9
Total		231.5

2.1.2 Sensitive Plant Species

Three sensitive species were found at the Preserve: summer holly (*Comarostaphylis diversifolia* ssp. *diversifolia*), wart-stemmed ceanothus (*Ceanothus verrucosus*), and Palmer’s sagewort (*Artemisia palmeri*) (Figure 4). Wart-stemmed ceanothus is a North County MSCP covered species and is widespread in the southern maritime chaparral vegetation onsite. In some cases, these plants occupy the same general area as invasive species and so care must be taken to protect these plants during the restoration and invasive plant species removal. Summer holly also considered a North County MSCP covered species may potentially mix with onionweed on the northeastern slopes of the Preserve and the Palmer’s Sagewort grows along the stream channel found in similar habitat as invasive pampas grass. It is also located along a trail in the vicinity of fountain grass and tree-of-heaven.

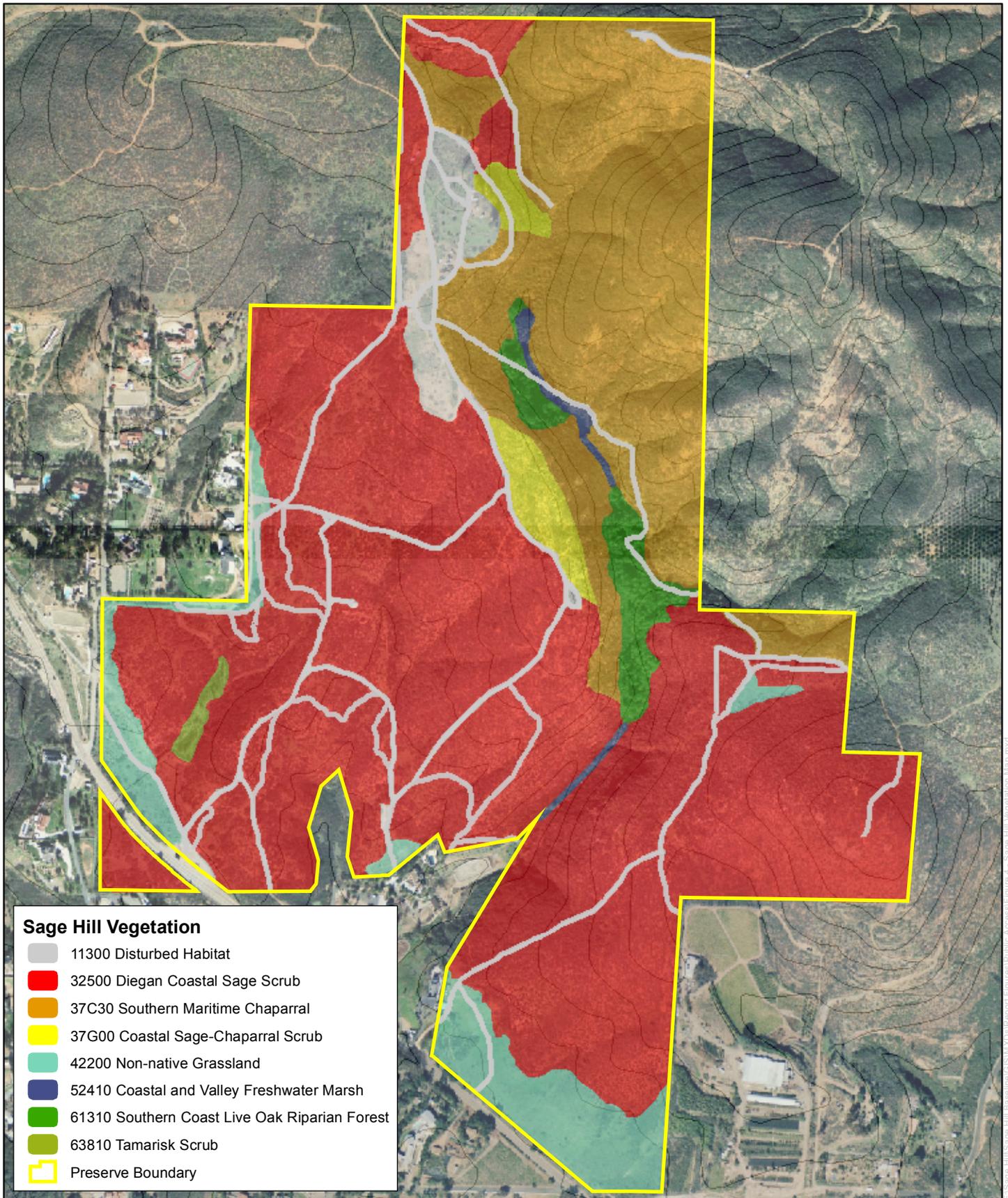
2.1.3 Sensitive Animal Species

Ten (10) sensitive animal species were detected on the Preserve (Table 2). The coastal California gnatcatcher (*Polioptila californica californica*), a federally threatened species and State species of special concern, was present throughout the coastal sage scrub with up to six potential territories observed (Figure 5). In addition, several federal and state species of concern were recorded including western spadefoot (*Spea hammondi*), coast horned lizard (*Phrynosoma coronatum*), Dulzura pocket mouse (*Chaetodipus californicus femoralis*), northwestern San Diego pocket mouse (*Chaetodipus fallax fallax*), San Diego desert woodrat (*Neotoma lepida intermedia*), Yuma Myotis (*Myotis yumanensis*), and rufous-crowned sparrow (*Aimophila ruficeps canescens*) (Figure 5). White tailed kite (*Elanus leucurus*), a California fully protected species, and Coopers Hawk (*Accipiter cooperi*), a State species of special concern, were also detected flying or foraging over the site.

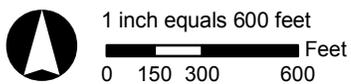
Table 2
Sensitive Animal Species

Common Name	Scientific Name	Status (Fed/State/County/ MSCP)
Western Spadefoot	<i>Spea hammondi</i>	FSC/CSC/2/NCMSCP
Coast Horned Lizard	<i>Phrynosoma coronatum</i>	FSC/CSC/2/NCMSCP
Coastal California Gnatcatcher	<i>Polioptila californica californica</i>	FT/CSC/1/NCMSCP
Rufous-crowned Sparrow	<i>Aimophila ruficeps canescens</i>	FSC/CSC/1/NCMSCP
White-tailed Kite	<i>Elanus leucurus</i>	-/CFP/1/-
Cooper's Hawk	<i>Accipiter cooperi</i>	-/CSC/1/-
Dulzura California Pocket Mouse	<i>Chaetodipus californicus femoralis</i>	FSC/CSC/2/-
Northwestern San Diego Pocket Mouse	<i>Chaetodipus fallax fallax</i>	FSC/CSC/2/-
San Diego Desert Woodrat	<i>Neotoma lepida intermedia</i>	FSC/CSC/2/-
Yuma Myotis	<i>Myotis yumanensis</i>	FSC/CSC/2/-
State and Federal Listing Status		
FT Federally Threatened	CFP California Fully Protected Species	
FSC Federal Species of Concern	CSC California Species of Special Concern	
Sensitive Animals (County)		
1 Animals of high sensitivity (listed or specific natural history requirements)		
2 Animals declining, but not in immediate threat of extinction or extirpation		
NCMSCP North County MSCP Covered Species		

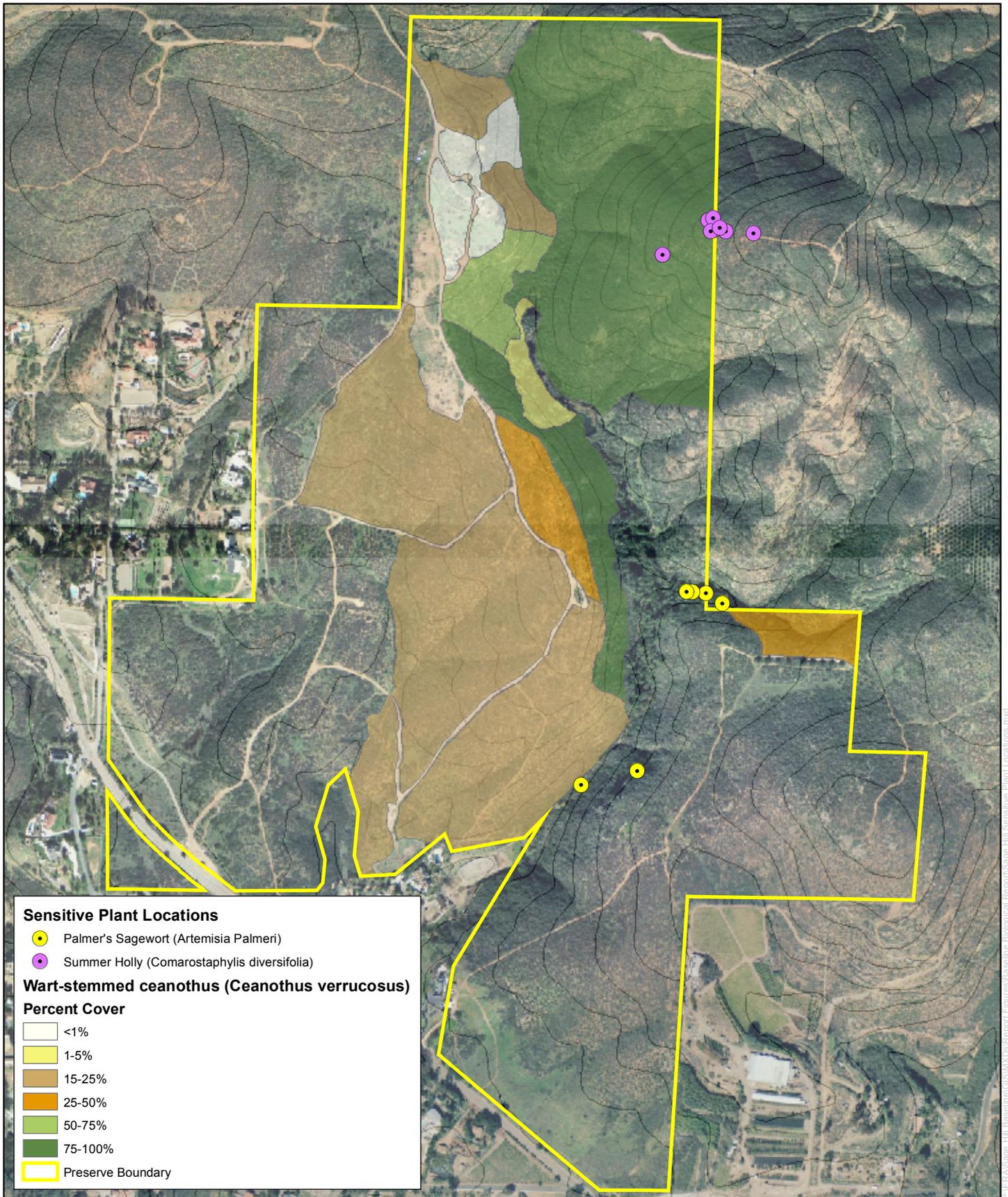
The coastal rosy boa (*Charina trivirgata roseofusca*) and orange-throated whiptail (*Cnemidophorus hyperythrus*), both State species of special concern, were historically observed on or near the Preserve and thus have a high probability of occurring in the Preserve. The habitat within the Preserve also has the potential to support the coast patch-nosed snake (*Salvadora hexalepis virgultea*) and the California legless lizard (*Anniella pulchra*), both State species of special concern. The patch-nosed snake, though rare in San Diego County, has historically occurred in Del Mar and feeds primarily on the whiptail lizards which are very common at the Preserve.



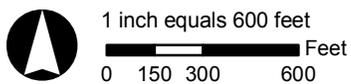
Source: AECOM (2009), County of San Diego (2008)



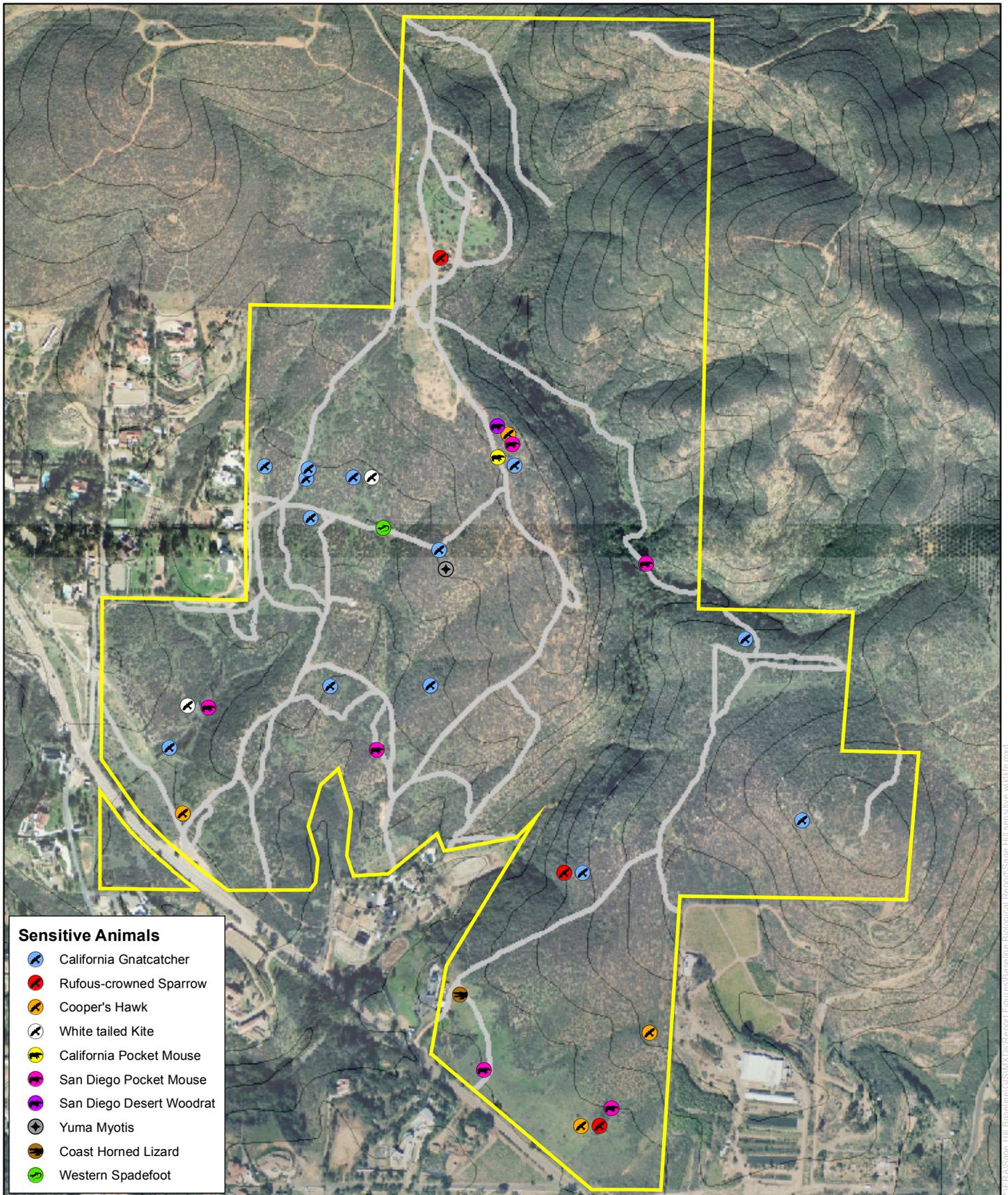
Sage Hill Vegetation Map



Source: AECOM (2009), County of San Diego (2008)



Sensitive Plant Locations



PIEVA Sage Hill Baseline GIS MXD Report Figures Baseline Biological Report Sage Hill sensitive wildlife.mxd

Sensitive Wildlife

2.2 Cultural Resources

Twelve archaeological resources were identified within the Preserve during current survey efforts including 5 prehistoric sites and 6 historic sites (Table 3). Five of the twelve sites were identified through this survey effort; however one was not relocated.

Table 3
Sage Hill Preserve Cultural Resources Sites

Trinomial or Primary or Temp Site#	Description	Subsurface Potential	Evaluation Recommendation
CA-SDI-4496	Prehistoric site – lithic scatter/quarry/campsite	None	Not relocated
CA-SDI-4932	Prehistoric camp site – one milling feature, historic scatter	High	CEQA Significant; Avoidance and Preservation, or Treatment Plan
CA-SDI-15,353	Prehistoric camp site and milling site – four milling features	High	CEQA Significant; Avoidance and Preservation, or Treatment Plan
CA-SDI-15,354/H	Former historic farmstead residence location, trash scatter/trees; and prehistoric campsite location	High	CEQA Significant; Avoidance and Preservation, or Treatment Plan
CA-SDI-15,355	Prehistoric site – sparse lithic scatter	Low	Not Significant
CA-SDI-15,356	Prehistoric site – sparse lithic scatter	Low	Not Significant
SH-H-4	Mid 20 th -century nursery	Low	Avoidance and Preservation
SH-H-5	Second San Diego Aqueduct	Low	Avoidance and Preservation
SH-H-6	Water conveyance feature	Low	Avoidance and Preservation
SH-H-7	Historic road alignment	Low	Avoidance and Preservation
SH-H-8	Historic road alignment	Low	Avoidance and Preservation

3.0 Invasive Species Management

3.1 Target Invasive Species

Forty non-native species were found at the Preserve (Appendix 1 - Invasive Plant Summary). Eleven of these species were identified as target species for removal because of their invasive status as well as their current cover and distribution on the Preserve (Table 4, Figure 6). Four of the target species (onionweed, cardoon, Italian thistle, and fountain grass) are defined as noxious weeds by either the United States or California and are ranked as moderate by the California Invasive Plant Council (CAL-IPC). Another four species (tamarisk, pampas grass, and hottentot fig) are rated as high by CAL-IPC (Appendix 1). The other species shown below are rated as moderate and do not substantially impact the Preserve, although these populations should be monitored. The eleven target species are listed in Table 4 below.

Table 4
Target Invasive Species Identified for Treatment

Common Name	Scientific Name	US/CA Weed List	Cal-IPC Rating
Onionweed	<i>Asphodelus fistulosus</i>	NW, Q	M*
Cardoon	<i>Cynara cardunculus</i>	B	M
Italian thistle	<i>Carduus pycnocephalus</i>	C	M
Fountain grass	<i>Pennisetum setaceum</i>	C, Q	M
Salt cedar	<i>Tamarix ramosissima</i>		H
Pampas grass	<i>Cortaderia selloana</i>		H
Hottentot-fig	<i>Carpobrotus edulis</i>		H
Mexican fan palm	<i>Washingtoniarobusta</i>		M
Tree-of-Heaven	<i>Ailanthus altissima</i>		M
Crown daisy	<i>Chrysanthemum coronarium</i>		M
Tasmanian blue gum	<i>Eucalyptus globulus</i>		M

US/CA weed list codes :
NW: Federal Noxious Weed (USDA 2006); **Q:** California quarantine list (CDFA 2003);
A: California list A noxious weed (CDFA 2003); **B:** California list B noxious weed (CDFA 2003); **C:** California list C noxious weed (CDFA 2003)
CAL-IPC Rating (CAL-IPC 2006)
 * = Species has "Alert" status with CAL-IPC
H = High. Species causes major biotic and physical impacts, they can spread rapidly, and they are generally widely distributed.
M = Moderate. Species has substantial and apparent biotic and physical impacts, have moderate to high rates of dispersal, and their range varies from limited to widespread.
L = Limited. These species are invasive but either have limited impacts or are insufficiently known to justify a higher rating. They have low to moderate rates of dispersal, and a limited range, but may be locally persistent and problematic.

Appendix 1 lists the non-native species, plus their distribution in the vegetation polygons. The polygons are listed by vegetation type, as described in the legend at the bottom of the table. Species were ranked by decreasing ratings, with unrated non-native species listed at the end. The location information was sorted into three categories (throughout, openings, and trail edge). Based on the baseline biological assessment, two figures were generated to illustrate the distribution of the invasive species on the Preserve. The biology and invasive status of each target invasive plant species is described below along with their general location within the Preserve (Figure 6).

Onionweed (*Asphodelus fistulosus*) is a noxious weed on the California quarantine list. It occurs in several patches in the disturbed area of former agriculture and on the edge of the adjacent chaparral (Figure 6). It also occurs as scattered individuals along trails in polygons (Figure 6). Finally, a few plants were discovered in small openings high on the mountain (Figure 6). These plants were uprooted, but more may be present. All patches are small and could be readily controlled through a herbicide application, as described below.

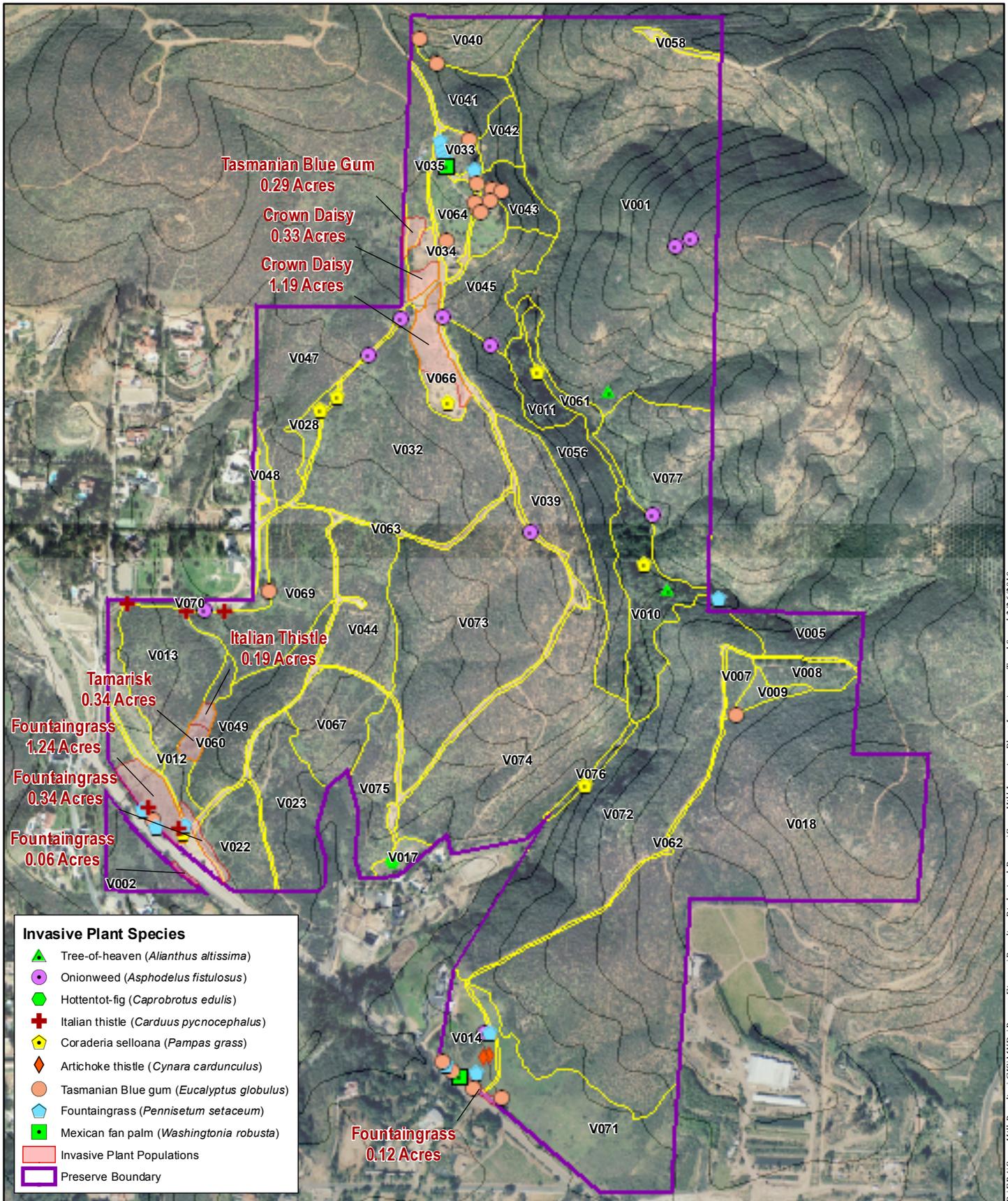
Artichoke thistle or cardoon (*Cynara cardunculus*) is a California list B noxious weed. It occurs along the trails in non-native grassland on the south side of the Preserve. These individuals can be readily controlled through an herbicide application, as described below. Individuals should be sprayed in early spring, prior to flowering. If a flower head is present, herbicide application will encourage seed set and should be avoided. In such cases, the flower head should be cut before herbicide treatment.

Italian thistle (*Carduus pycnocephalus*) is a California list C noxious weed. It occurs on the margin of the west side of the preserve, primarily in the tamarisk patch and the grassland upslope (Figure 6). These individuals can be readily controlled through an herbicide application, as described below. Individuals should be sprayed in early spring, prior to flowering. If a flower head is present, herbicide application will encourage seed set and should be avoided. In such cases, the flower heads should be cut before herbicide treatment. There is likely a large seed bank onsite and multiple seasons of treatment will be required to eradicate this species.

Fountain grass (*Pennisetum setaceum*) is a California quarantine and list C noxious weed. It occurs in patches along the road, in grasslands adjacent to the road, and on the edge of the disturbed areas (Figure 6). This species can also be readily controlled through herbicide application.

Tamarisk (*Tamarix ramosissima*) is a high rated, highly invasive non-native (CAL-IPC 2006). It occurs in the southern half of polygon 60, which it dominates (Figure 6). However, the tamarisk scrub patch does have a native arroyo willow stand on the north end, so removal of the tamarisk and other invasive non-natives would allow the arroyo willows to dominate the area. The larger tamarisk trees should be cut and the stump treated with imazapyr. Smaller individuals can be foliar sprayed with imazapyr as well as any resprouts.

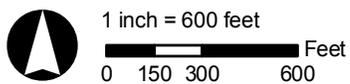
Pampas grass (*Cortaderia selloana*) is a high rated, highly invasive non-native (CAL-IPC 2006). Several individuals occur around the oak trees and along the stream, in a wet area in coastal sage scrub in the northwest preserve, and in the disturbed areas (Figure 6). These individuals can be controlled through herbicide application, mostly likely glyphosate. The infestation along the creek should be treated with a herbicide approved for aquatic environments, such as Aquamaster.



P:\ERA\Sage Hill Baseline\GIS\MAXDs\Report Figures\Baseline Biological Report\Sage Hill Invasive Plant Locations - Top 10.mxd 2/26/2010

Source: AECOM (2009), County of San Diego (2008)

Sage Hill Preserve Target Invasive Non-native Plant Species Locations



Hottentot fig (*Carpobrotus edulis*) is a high rated invasive non-native (CAL-IPC 2006). Currently, there is one small patch on the site near the house in the southern preserve (Figure 6). This patch can be treated with a foliar application of herbicide. Several treatments are usually required to completely eradicate this species.

Mexican fan palm (*Washingtonia robusta*) is a medium rated invasive non-native that is the subject of an alert by CAL-IPC (2006). There are two small individuals on the site: one a seedling by the roadside, the other a two meter tall sapling in the disturbed area (Figure 6). Both should be eliminated to prevent it from establishing in the preserve. This species should be treated using the cut-stump methods described below.

Tree-of-Heaven (*Ailanthus altissima*) is a moderately rated invasive non-native (CAL-IPC 2006). Three individuals have been detected at the Sage Hill Preserve in the stream watershed (Figure 6). Their elimination would prevent a more problematic infestation from occurring. This species should be treated using the cut-stump methods described below.

Crown daisy (*Chrysanthemum coronarium*, no *Glebionis coronarium*) is a moderately rated invasive non-native (CAL-IPC 2006) that dominated patches of Sage Hill and other areas of San Diego County. At Sage Hill, it occurs in the tamarisk patch and dominates parts of the disturbed area (Figure 6). Both infestations should be controlled by a foliar herbicide application.

Tasmanian blue gum (*Eucalyptus globulus*) is a moderately rated invasive non-native (CAL-IPC 2006) that occurs in polygons around the disturbed area, in the grasslands, and in coastal sage scrub near both areas (Figure 6). Blue gum is not a dominant species in any of these areas, but it is reproducing, as evidenced by the finding of seedlings and saplings around mature (apparently planted) trees. Removing and chipping large trees can be expensive. It is recommended to girdle the existing trees and leave them in place so that they can continue to provide raptor perching and nesting habitat.

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 native plants and wildlife, the degree of intermixing of invasive species with sensitive native habitats, the presence of sensitive native wildlife species, access, and proximity to surface water. California Department of Fish and Game and U.S. Army Corps of Engineers should be consulted regarding potential permitting requirements if invasive removal will occur in waterways under their jurisdiction. General recommendations for the Preserve are included below.

3.2.1 Herbicide

Foliar Herbicide Application

The primary technique proposed for controlling invasive plant species on the Preserve is foliar herbicide treatment with glyphosate. Because glyphosate is a broad-spectrum herbicide and care should be taken to avoid application or drift onto native vegetation. Application rates vary by situation and species and should be consistent with the label of the glyphosate product selected. Any proposed changes to the listed percentages on the label should be in consultation with a Pest Control Advisor (PCA). Foliar uptake and eradication may be achieved by spray application during active growth periods, primarily in spring. It may take up to four

months for herbicide to translocate throughout the entire system. An herbicide colorant, such as Blaz-on®, shall be applied to the mixture to distinguish treated versus non-treated areas; label or PCA recommendations will be used for mixing percentage.

The herbicides commonly utilized for eradication for target invasive non-native species within California are glyphosate (Round-up®, Aquamaster®) and imazapyr (Habitat®). Formulations of glyphosate and imazapyr for use near aquatic habitats are available under various brand names. However, care should be taken to lean the vegetation away from open water to avoid overspray or direct spray on to the water.

Glyphosate is a broad-spectrum, non-selective systemic herbicide. Glyphosate can be used to treat all the target species, but the effectiveness on tamarisk is lower than with the other selected herbicides. The USEPA and USFWS have approved Aquamaster® for use in aquatic environments. Roundup® is only approved for use in areas where water is not present.

Glyphosate is generally the preferred herbicide because of its low toxicity. There is a very low potential for glyphosate to build up in the tissues of aquatic invertebrates or other aquatic organisms. Glyphosate has very little chance of being leached into the groundwater table due to its strong absorption to soil particles, including soil structure with low organic material and low clay content. The half-life of glyphosate ranges from 1 to 174 days.

Imazapyr is a broad-spectrum imidazolinone herbicide used to control grasses, broadleaves, vines, brambles, brush and trees. Imazapyr, as Habitat®, can also be used to treat tamarisk and tree species. Imazapyr is the active ingredient in Habitat®, an aquatic habitat formulation that allows for use within areas with surface water.

Imazapyr is characterized as non toxic to slightly toxic to fish, with a low potential for leaching into groundwater. Unlike glyphosate, there is the potential to damage adjacent non target plants by transfer between root networks. Cut and daub is preferred over foliar application in areas surrounded by native vegetation.

Cut and Daub

In addition to foliar herbicide application, direct treatment to cut stems can reduce herbicide costs and avoid drift onto desirable plants, with fair results year-round. Herbicide is applied directly to stems cut within two to four inches (5 to 10 cm) of the substrate by painting with a cloth-covered wand or a sponge. A colorant, such as Blaz-on® must be added to solution to identify treated material. Solution must be applied immediately following cutting because translocation ceases within minutes of cutting; a three-minute maximum interval is suggested. When using this approach adjacent to the creek precautionary measures must be taken to dispose of the live, green material in an appropriate disposal area outside of the creek channel. The cut and daub technique can be used with glyphosate and imazapyr. Imazapyr is a preferred for treatment of tamarisk and other tree species because of it increased effectiveness. The aquatic form of imazapyr, Habitat®, should be used near open water.

3.2.2 Manual and Mechanical Removal

Manual or mechanical removal includes hand pulling, hoeing, weed whacking, mowing, or using a chainsaw to remove all or a portion of an individual plants biomass. These methods can be effective if the entire plant can be removed, such as small herbaceous annuals. Removal of plant material on large size plants removes resources but rarely leads to effective control when

not implemented in conjunction with a herbicide treatment as described above, particularly for species that can crown sprout or resprout from roots or rhizomes. This method can be effective for removing seed heads to that the plant does not spread more seed. However, care should be taken with mustard and grass species that can set new flowers and seed heads from individuals reduced to several inches tall from mowing.

4.0 Habitat Restoration

Habitat restoration is proposed to enhance areas that are degraded in order to improve their value to sensitive species onsite, reduce recolonization by invasive species, and rehabilitate existing trails. Riparian scrub and Diegan coastal sage scrub habitat is proposed for restoration.

4.1 Proposed Restoration Areas

Four main areas are proposed for habitat restoration within the Preserve: the patch of tamarisk scrub located in the western area of the Preserve, the proposed trail closures, nonnative grassland outside of the fuel modification zone and the historic nursery location in the northern area of the Preserve.

Non-native grassland within the Preserve is a product of required annual fuel modification activities. Focused weed eradication efforts could be used to prevent the fuel modification zones from becoming a source of invasive non-natives for the rest of the Preserve. Control of invasive non-natives will also allow the coastal sage scrub and native grassland species to passively recolonize areas of non-native grassland outside the fuel modification zones.

4.2 Restoration Approach

The restoration approach for the four restoration areas are presented below. The goal is to restore these areas to the adjacent habitat. The tamarisk scrub will be restored to riparian scrub and the proposed trail closures, non-native grassland and nursery location will be restored to Diegan coastal sage scrub.

4.2.1 Riparian Scrub

Approximately 0.88 acre of riparian scrub is proposed to be restored in the area currently occupied by tamarisk (Figure 7). The presence of tamarisk as well as arroyo willow (*Salix laesiolepis*) and mulefat (*Baccharis salificalia*) suggest that there is appropriate hydrology in this area to create riparian scrub habitat. The patch is located in a low lying area which receives seasonal rainfall from the surrounding small, watershed. The existing patch also appears to be accessing groundwater or a small seep. Restoration of the tamarisk patch will occur after the tamarisk trees have been treated, following the recommendations in 4.2 above, and the biomass removed from the site. No other site preparation is anticipated to be required prior to planting. Table 5 below includes the proposed plant palette and planting densities. The container plant material will require supplemental watering in order to become established. It is recommended that the site be watered by a water truck rather than a temporary irrigation system, because temporary and permanent irrigation systems provide ideal habitat for the Argentine ant. The Argentine ant is known to displace native ants which are the primary food source of the sensitive coast horned lizard (observed within the Preserve).

Table 5
Riparian Scrub Plant Palette

Scientific Name	Common Name	Plant Material	Minimum Spacing	Total Planting
<i>Sambucus mexicana</i>	blue elderberry	5-gallon	10-feet o/c	5
<i>Baccharis salicifolia</i>	mule fat	Cuttings or 1-gallon	6-feet o/c	200
<i>Salix lasiolepis</i>	arroyo willow	Cuttings or 1-gallon	8-feet o/c	150
<i>Baccharis sarothroides</i>	broom baccharis	1-gallon	5-feet o/c	150
Total				505

4.2.2 Diegan coastal sage scrub

Approximately 15 acres of Diegan coastal sage scrub is proposed for restoration along the trails proposed for closure, in existing nonnative grassland along Elfin Forest Road, and in the historic nursery location (Figure 3, 7). Historically, Diegan coastal sage vegetation likely occurred in all these locations and it now occurs adjacent. At both the trail and nursery locations the ground is heavily impacted and will require ripping to a depth of 18 inches prior to planting. In the nursery location, the ripping is likely to encourage non-native weed growth that should be treated several times before planting through a number of grow-kill cycles. Table 6 below includes the proposed plant palette for the two restoration areas. The container plant material will require supplemental watering in order to become established. As mentioned above, it is recommended that the site be watered by a water truck rather than a temporary irrigation system, because temporary and permanent irrigation systems provide ideal habitat for the Argentine ant, which is known to displace native ants.

Table 6
Diegan Coastal Sage Scrub Container Plant Palette

Scientific Name	Common Name	Plant Material	Minimum Spacing	Plantings/Acre
<i>Artemisia californica</i>	California sagebrush	1-gallon	6-feet o/c	250
<i>Lotus scoparius</i>	deer weed	1-gallon	6-feet o/c	150
<i>Eriogonum fasciculatum</i>	buckwheat	1-gallon	6-feet o/c	250
<i>Salvia apiana</i>	white sage	1-gallon	6-feet o/c	150
<i>Salvia mellifera</i>	black sage	1-gallon	6-feet o/c	500
<i>Hesperoyucca whipplei</i>	our Lord's candle	1-gallon	6-feet o/c	50
Total				1,250



Non-native Plants in Disturbed Garden Area



Disturbed Garden Area

Source: AECOM; 2009

P:\ER\A\Sage Hill Baseline\GIS\PDFs_Graphics\Report Figures\Vegetation Report\Figure 6 - Photographs of the Proposed Habitat Restoration Areas.dh11



Disturbed Garden Area



Disturbed Garden Area

Source: AECOM; 2009

P:\ER\ASage Hill Baseline\GIS\PDFs_Graphics\Report Figures\Vegetation Report\Figure 8a - Photographs of Proposed Habitat Restoration Areas.in11



Disturbed Garden Area



Disturbed Garden Area

Source: AECOM; 2009

P:\ER\A\Sage Hill Baseline\GIS\PDFs_Graphics\Report Figures\Vegetation Report\Figure 8b - Photographs of Proposed Habitat Restoration Areas.In11

No Scale

Photographs of Proposed Habitat Restoration Areas

AECOM

Figure 7b



Eucalyptus Trees in Disturbed Garden Area



Tamarisk Scrub Area

Source: AECOM; 2009

P:\ER\A\Sage Hill Baseline\GIS\PDFs_Graphics\Report Figures\Vegetation Report\Figure 8c - Photographs of Proposed Habitat Restoration Areas.fh11



Trail Closure on the Western Edge of the Preserve Near Carib Drive



Trail Closure on the Western Edge of the Preserve Near Carib Drive

Source: AECOM; 2009

P:\ERA\Sage Hill Baseline\GIS\PDFs_Graphics\Report Figures\Vegetation Report\Figure 8d - Photographs of Proposed Habitat Restoration Areas.In11

5.0 Fire Management

This section describes the current fire management practices, fire history, vegetation and fuels on the Preserve. It also includes a fire response plan for the Preserve.

5.1 Current Fire Management Practices

Based on County guidelines, the vegetation 100 feet from any structure and 30 feet from any roadway should be modified to reduce the fuel load. Fuel modification zones are located where the Preserve borders private residences (within 100 feet) and along the southern boundary where the Preserve meets Elfin Forest Road (30 feet) (Figure 9). These fuel modification zones consist mostly of non-native grassland and bare ground. The intent of the fuel modification zones is to protect residential uses adjacent to the Preserve from wildfires. They may further protect the resources within the Preserve by absorbing some of the “edge effects” that might otherwise occur within the Preserve.

The recommended 100 foot fuel modification zone is appropriate for the residences adjacent to the Preserve to the north and south of the Preserve, which are also buffered by Elfin Forest Road, Carib Drive, Questhaven Road or Fortuna del Norte. The County currently maintains approved fuel modifications zones adjacent to Elfin Forest Road and adjacent to the residences off Carib Drive. The Elfin Forest Road fuel modification zone extends along the entire southern border of Elfin Forest Road and the Preserve and is 30 feet wide. The Carib Drive residences are protected by a County maintained fuel modification zone that extends into the Preserve by a width of 50 feet to the north and 30 feet to the south, based on the actual distance from the structures within the residential community.

There are two residences that occur immediately adjacent to the Preserve along the south boundary and north of Elfin Forest Road that currently do not have a approved County maintain fuel modification zone. Both residents require that a portion of the 100 foot fuel modification occur within the Preserve. The residence that occurs adjacent to the drainage includes a structure within 45 feet of the Preserve boundary. The additional 55 feet of protection has come from unapproved fuel modification within the Preserve boundary. Similarly, the residence on the slope on the east side drainage, requires that nearly 100 percent of the fuel modification zone necessary to protect the structures on the north and east sides occur within the Preserve boundary. It is recommended that the County coordinate with the property owners to assure that the fuel modification zones are approved and properly maintained.

5.2 Fire Environment

5.2.1 Climate

San Diego County has a Mediterranean climate, with cool wet winters and warm, dry summers. To provide more detail, temperature and precipitation data were taken from the California Irrigation Management Irrigation System (CIMIS 2009) weather station in Escondido, approximately 12 miles east of the Preserve (33.08°N, 116.98°W, 390' elevation). The data were averaged by month across 10 years (July 1999-July 2009) to determine the monthly mean temperature, the mean minimum temperature, and the mean maximum temperature, as well as mean monthly precipitation (Table 7). Overall, December is the coldest month and August is the hottest, while June is the driest and February is the wettest month, on average (Table 7).

Table 7
Mean Monthly Temperatures and Precipitation, July 1999-July 2009

Month	Mean Monthly Temperatures Mean (Min to Max)(°F)	Mean Monthly Total Precipitation (in)
January	51.8° (36.4° to 68.9°)	1.18"
February	52.4° (39.0° to 66.7°)	2.52"
March	55.1° (41.7° to 69.8°)	1.08"
April	57.7° (44.2° to 71.8°)	0.82"
May	62.8° (50.1° to 76.9°)	0.19"
June	66.5° (53.5° to 81.4°)	0.01"
July	70.9° (57.2° to 86.7°)	0.03"
August	71.2° (57.2° to 87.7°)	0.10"
September	68.0° (53.4° to 85.7°)	0.03"
October	62.7° (48.0° to 79.8°)	0.71"
November	56.5° (41.1° to 73.9°)	0.65"
December	51.2° (36.1° to 68.4°)	0.86"

Temperature, relative humidity, and wind, among other factors, influence fire behavior (Potter 1997). In southern California, the hot dry summers are highly conducive to wildland fires. While average relative humidity decreases from April through August, mean maximum temperatures are reaching their annual highest levels. Prevailing onshore winds at this time of year will tend to drive a fire from west to east; however Santa Ana conditions can drive a fire in the reverse direction.

5.2.2 Topography

The Preserve is located in the Peninsular Geomorphic Range, in the coastal foothills of western San Diego County, approximately 7.4 miles east of the Pacific Ocean. The Preserve's terrain contains primarily moderate to steep slopes with some flat terrain along the top of the ridgelines. The elevation change is approximately 400 feet, ranging from 590 feet above mean sea level (MSL) near the southern edge of the Preserve to 990 feet above MSL on the eastern edge (Figure 2). A canyon with a small, unnamed perennial stream bisects the Preserve from north to south (Figure 2).

5.2.3 Watershed Description

The Preserve lies within the Carlsbad Hydrologic Unit 904.00 within the Escondido Creek (904.60) and San Elijo (904.61) Hydrologic SubAreas. An unnamed tributary of Escondido Creek bisects the Preserve north to south. The tributary is mapped as an intermittent blue-line stream.

5.2.4 Fire History

Although it is common to speak of fire cycles, the evidence suggests that historically, chaparral and coastal sage scrub (common on the Preserve) faced rare, massive fires that happened once per century or less frequently (Keeley and Davis 2007, Rundel 2007). Many native plant species are adapted to particular fire regimes, and these adaptations are based on the minimum fire return intervals that species can tolerate and still complete their life cycles (Keeley and Davis 2007, Rundel 2007). Research suggests that too-frequent fires (<30 year return interval)

will eliminate many chaparral species from a landscape, and fire return intervals of <10 years can cause type conversion of chaparral and coastal sage scrub into non-native grasslands, as only a few native species can tolerate being burned that frequently (Keeley and Davis 2007, Rundel 2007). Unfortunately, a majority (99 percent) of recent fires in San Diego County were caused by humans, and exacerbated by drought and invasions of non-native annual plants. In many areas of San Diego County, fires have recurred frequently enough to cause type conversion.

The Preserve burned entirely in 1943 and 1996 (SanGIS 2009) (Figure 8). The Preserve was completely burned in October of 1996 by the Harmony Fire which consumed 8,600 acres from Harmony Grove west of Escondido to La Costa. While fires occurred nearby in 1988 and 1994, they did not enter the Preserve. Based on the continued dominance of chaparral and coastal sage scrub in the Preserve's vegetation, the Preserve's native species can tolerate fires that return approximately every 50 years.

5.2.5 Vegetation Dynamics

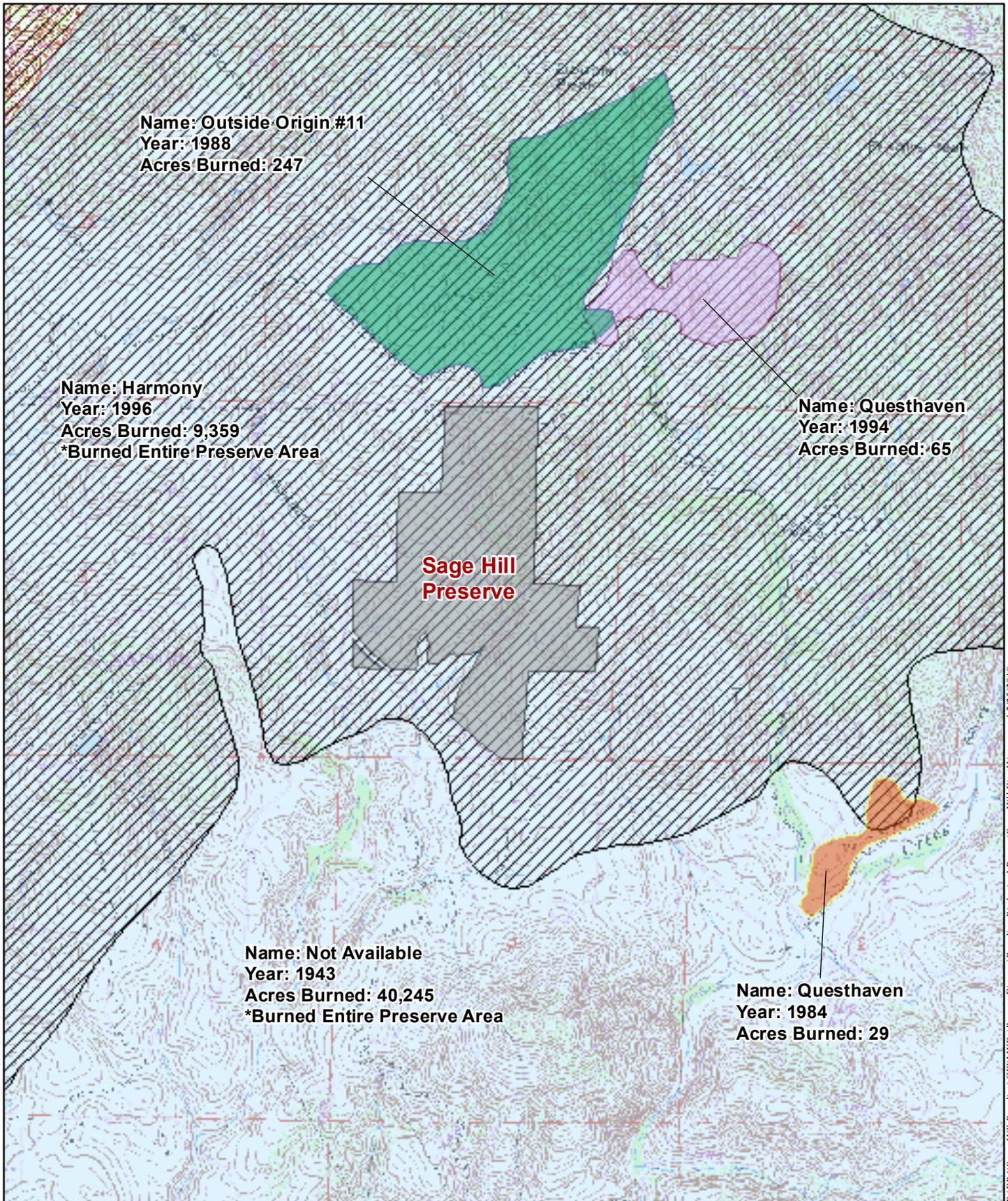
Wildfire is a natural phenomenon in southern California and several vegetation communities are adapted to fire. This section describes how the plant community have evolved or adapted to fire as well as the implications of altering the natural fire regime. Detailed plant community descriptions may be found in the Sage Hill Preserve Biological Baseline Report (AECOM 2010).

Southern Mixed Chaparral

The chaparral vegetation community can produce intense fires because of the tall, dense canopy, a tendency to accumulate dead debris, and the presence of highly volatile compounds in the leaves of chaparral plant species. This vegetation community has evolved with fire. As a result, a number of the plant species within this community have specific traits for dealing with fire including: obligate resprouters; obligate seeders, that require a fire cue for the seeds to germinate; or facultative seeders, which crown sprout and whose seeds may also germinate after a fire (Chaparral Institute 2010). Historically, the fire return interval for chaparral was on the order of 30 to 150 years. However, over the last 100 years the fire return interval has increased dramatically because of human activity, in excess of what the chaparral can tolerate; resulting in a conversion to coastal sage scrub and in some cases non-native grassland (Chaparral Institute 2010).

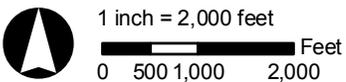
Diegan Coastal Sage Scrub

In contrast to chaparral, the fuel load and depth of coastal sage scrub is generally less due to a number of factors. Depending on the age class, mature coastal sage scrub generally has a canopy height that is half that of chaparral, although height will vary depending on the species composition. Coastal sage scrub is also generally more patchy than chaparral and rarely provides large stands of overlapping canopies. The percent shrub cover will ultimately determine whether the fire behaves as a surface-fire or a crown-fire. Like chaparral, coastal sage scrub has also evolved with fire although the historic fire return interval is generally shorter, in the range of approximately 20 to 40 years. Most coastal sage scrub species have evolved to tolerate fires through resprouting but do not require fire to initiate germination. In fact, intense fires can kill seeds. Interestingly, the proportion of strong or weak resprouting species within a particular coastal sage scrub community will determine how resilient the community is to fire (Westman 1986).

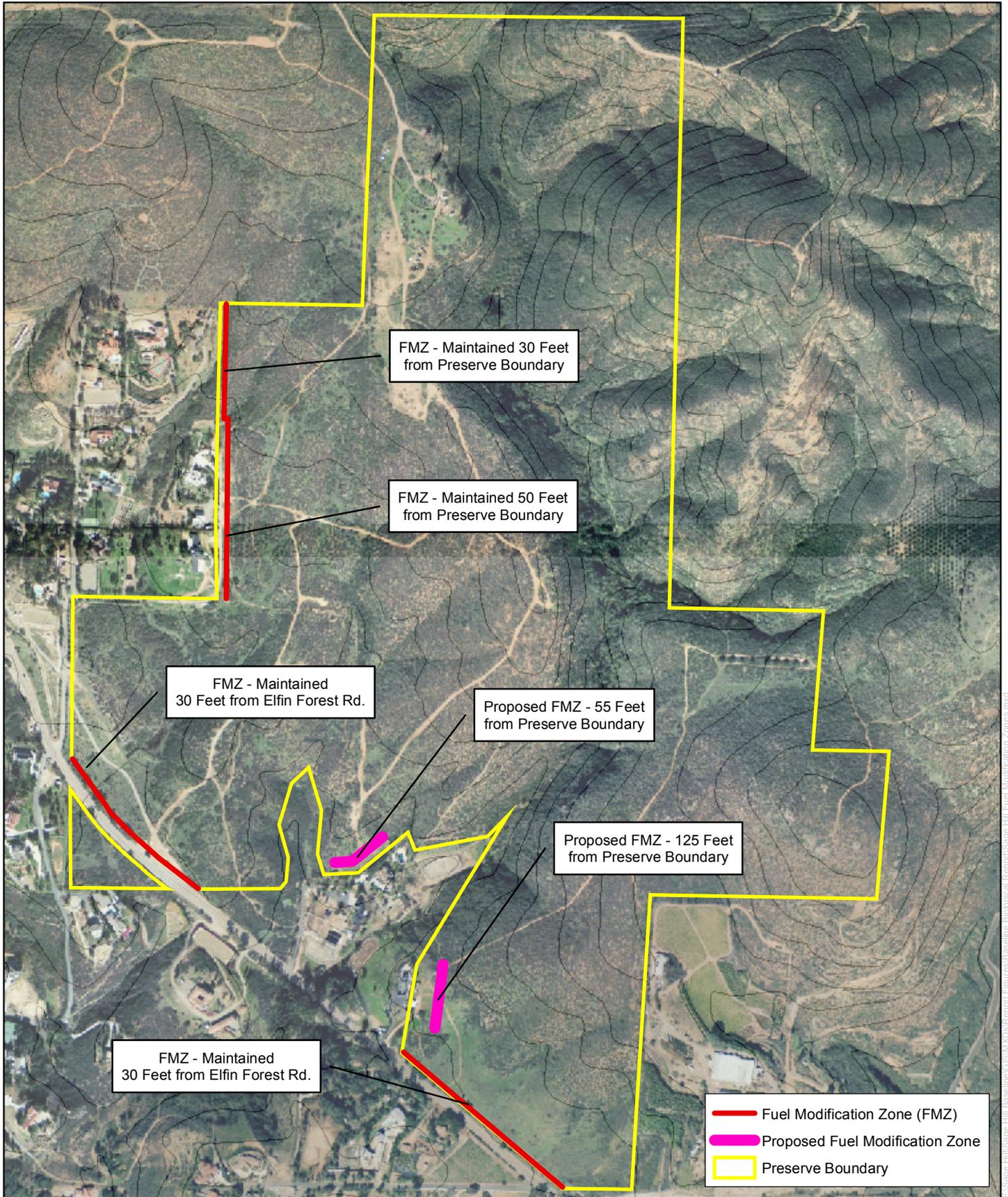


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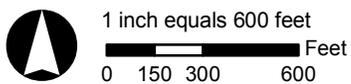
Source: USGS (Rancho Santa Fe Quad), SanGIS (2009)



Sage Hill Preserve Fire History



Source: AECOM (2009), County of San Diego (2008)



Sage Hill Fuel Modification Zones

Riparian Communities

Riparian scrub and southern coast live oak riparian forest occur on the Preserve. The ecological consequences of fire in riparian zones is not well understood (Pettit 2007). Riparian communities are somewhat resistant to fires, because of their proximity to water and the high water content of the vegetation, and can be a refuge for fire sensitive species (Pettit 2007). When fires do occur, riparian species often resprout if the fire is of low intensity, although oak species generally have a higher rate of resprouting due to their thick, protective bark. More importantly depending on the size of the creek system, fires can remove canopy cover, increase evapotranspiration and create dry patches that promote shorter fire return intervals, thus potential altering the composition of the vegetation community. In particular, invasive species, such as giant reed tend to flourish in riparian areas following high intensity fires. Secondary effects of fire in riparian habitat are equally important include altering nutrient fluxes and cycling, increasing sediment loads, and increasing erosion (Pettit 2007).

Grasslands

The grasslands of the Preserve are mostly composed of non-native annual species, as is typical of grasslands throughout California. These annual species are highly competitive and have maximized the available niches in terms of nutrient resources, space and sunlight at the expense of native perennials. Because the annual growth dies each year, nonnative grassland can accumulate a tremendous amount of thatch, or dead biomass that can increase the intensity of the grassland surface-fires. Although grasslands are generally adapted to fire, high intensity fires can cause mortality of native perennials. However, late spring to summer fires can reduce the accumulated thatch, and kill the current year's annual seed set and promote native perennial recruitment (Menke 1992).

5.3 Fire Response Plan

This section discusses the responsible agencies and resources available to respond to a fire on the Preserve.

5.3.1 Fire Hazard Evaluation

The California Department of Forestry and Fire (CalFire) have classified the entire Elfin Forest/Harmony Grove area as a very, high fire hazard. The qualitative evaluation of fire hazard described below was conducted to identify specific, potential fire hazards within the Preserve. The vegetation communities, fuel models and topography within the Preserve were evaluated relative to existing structures or infrastructure to highlight potential areas of concern. The vegetation communities within the Preserve and described above were categorized into three fuel models: short grass (Fuel Model 1), intermediate shrub (Fuel Model 6) and tall riparian shrub/hardwoods (Fuel Model 9) (Appendix B).

The entire Preserve last burned 14 years ago in 1996. The vegetation communities' onsite have recovered and many have developed closed canopies or multiple vegetative layers (i.e. chaparral, riparian oak woodland) which define the appropriate fuel model and affect fire behavior. Each fuel model is described below in terms of the seasonal variation in fuel load and fuel moisture, as these factors ultimately relate to fire intensity.

Fuel Model 1 corresponds to the nonnative grassland that are primarily the result of fuel modification activities and are generally located adjacent to Elfin Forest Road, Fortuna del Norte, and adjacent to residential developments surrounding the Preserve. These areas are kept short due to maintenance activities, with minimum thatch or cured vegetation observed at the time of this assessment. Relatively low intensity surface-fires are anticipated for this fuel model. However, fuel loads can vary on a yearly basis depending on annual rainfall. The majority of the species in this fuel model are annuals that germinate in the spring, set seed and are dormant by early summer. Due to the short height and low fuel loads characteristic of fuel modification zones these areas are considered a low fire hazard.

Shrub Fuel Model 6 corresponds to the Diegan coastal sage scrub and southern maritime chaparral onsite. The spatial arrangement within this fuel model includes low growing; patchily distributed shrubs as well as closed canopies up to 5 or 6 feet tall. This fuel model includes most of the area within the Preserve. Fires carry through the shrub layer, largely due to the highly flammable foliage. The largest fuel loads occur on steep, north facing slopes with a dominance of chaparral species. Fire intensity is expected to be high in these areas, particularly within the steep sided drainage that bisects the Preserve. High winds will contribute to the rate of spread. In particular, the drainage serves to funnel onshore winds up to the northern portion of the Preserve, and conversely off shore winds are funneled down the Preserve under Santa Ana conditions. The drainage is considered a high fire hazard. The residence at the bottom of the drainage and north of Elfin Forest Road is considered a moderate to high fire hazard, as the fuel load becomes more patchy in the immediate vicinity (within 200 feet) of structures. The same is true of the residence immediately upslope and to the east. Fuel moisture in Shrub Fuel Model 6 varies seasonally but remains higher overall in chaparral compared to coastal sage scrub, which can occur in a dormant or senescent stage from approximately July to December, depending on the species. There is minimal dead woody material in the stands and the litter layer is shallow, likely due to the relative short time frame since the last fire. Power lines occur within this fuel model; however most poles have a 10 foot wide clearing at the base.

Fuel Model 9 includes tall riparian shrubs and hardwoods and corresponds to the southern coast live oak Riparian forest and tamarisk scrub within the Preserve. This fuel model differs from the others because it has multiple layers and vertical structure that serves as fire ladder fuels. However, the habitat and vegetation have high moisture content throughout the year that can help to inhibit the spread of fire in these habitats, although there is seasonal variation with reduced moisture in the fall and early winter. Similar to the shrub fuels described above, only a moderate amount of dead plant material was observed in the crown and understory compared to older, undisturbed oak woodlands. Because of the steep topography and high fuel loads, the riparian drainage is considered a moderate to high fire hazard.

Overall, the largest fuel loads and highest fire hazard occurs in the middle of the Preserve. Lower fuel loads and fuels characteristic of surface-fire occur in the vicinity of residential developments.

5.3.2 Short-term Tactical Fire Suppression Plan

The short-term tactical fire suppression plan includes the local and regional resources designated for combating the fire. These resources will vary depending on the fire condition. However, typical first alarm fire resources are outlined below by agency. The Elfin Forest/Harmony Grove Fire Department is the local agency and will be the first responder.

Elfin Forest/Harmony Grove Service Area 107:

- 2-Type I Engines (standard fire truck)
- 2-Type 3 Engines (wildland fire truck/brush truck)
- 2,000 gallon water tender

CalFire State Responsibility Area:

- 5-Type 3 Engines
- 2-Hand crews
- 1- Bulldozer
- 2-Air tankers
- 2-Helicopters

5.3.3 Primary Actions and Contacts for Wildfire Emergency

All reports of a fire within the Preserve should be directed to 911. The 911 dispatcher will contact the appropriate fire department and supporting fire departments in adjacent jurisdictions, if necessary.

Depending on the length and duration of the fire, an Incident Command Team will be called together to develop an Incident Action Plan. Participating agencies for the Preserve are listed below including the contact person.

Elfin Forest/Harmony Grove Fire Department
Chief Frank Twohy
(760) 744-2186

California Department of Forestry and Fire (CalFire)
Unit Ranger Chief Howard Windsor
(619) 590-3100

County of San Diego Parks and Recreation
District Park Manager
Jake Enriquez
(858) 966-1365

5.3.4 Roads and Access

The primary roads and points of access include the two access points off Elfin Forest Road along the southern portion of the Preserve and the access point off of Questhaven Road at the northern portion of the Preserve. These existing access roads are wide enough to support fire fighting vehicles. Secondary access points include residential roads off of Fortuna del Norte and Carib Drive. Also the agricultural lands to the southeast of the Preserve could serve as an access point and position from which the fire could be controlled.

5.3.5 Fuel Breaks

The local fire department and CalFire 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 will then serve as a defensive position for fighting the fire. The existing trails and roads within the Preserve generally meet the anticipated fuel break requirements for the Preserve. However, the need for fuel breaks is dependent on the specific conditions of the fire. If new fire breaks are required the location will be coordinated with the Incident Command Team where possible. The Incident Command Team includes the District Park Manager and Agency staff with access to location information on sensitive biological and cultural resources that should be avoided, if possible. Given the number and coverage of existing roads and trails within the Preserve, no new fuel breaks are proposed at this time.

5.3.6 Staging Areas

There is currently a wide road buffer near the western access point off of Elfin Forest Road that could serve as a temporary staging area. There are accessible fire hydrants to the west and east of this location. Secondary staging areas could also be located at the secondary access points described above including: Fortuna del Norte, Carib Drive, and the agricultural land to the southeast of the Preserve.

5.3.7 Fire Hydrants

There are approximately 6 fire hydrants in the immediate vicinity of the Preserve. Fire hydrants are located at approximately 1,000 foot intervals along Elfin Forest Road and the residential side streets that bisect Elfin Forest Road. Fire hydrants are also available in the residential development to the north of the Preserve along Questhaven Road.

5.3.8 Other Water Sources

In addition to the 2,000 gallon water tender that is part of the local resources provided by the Elfin Forest/Harmony Grove Fire Department, Olivenhain Reservoir is an available water resource for air resources.



Fuel modification Zone Adjacent to a House Along the East Elfin Forest Trail



Fuel Modification Zone Adjacent to Elfin Forest Road at the East Elfin Forest Trail Access

Source: AECOM; 2009

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Fuel Modification Area Adjacent to Elfin Forest Road Near the West Elfin Forest Trail Access Point



Fuel Modification Zone East of Carib Drive

Source: AECOM; 2009

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Fuel Modification Zone South of Carib Drive



Community Trail and Fuel Modification Area Along Fortuna Del Norte

Source: AECOM; 2009

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6.0 Management Directives

Invasive Weed Species

- Maintain an up-to-date vegetation community map and invasive species map to be used as a tool for adaptive management within the Preserve
- Treat and control high to moderate ranked invasive weed species
- Continue to monitor non-invasive weed species so that their populations do not impact adjacent native habitat, thereby requiring treatment
- Restore treated sites to minimize the recolonization by invasive weed species.

Habitat Restoration

- Restore native habitat to reduce the colonization of sites by invasive weed species
- Rehabilitate trails where access is proposed to be prohibited
- Rehabilitate redundant trails to reduce the sediment load into the water features and drainages onsite

Fire Management

- Maintain all roads within the Preserve for access by emergency personnel
- Maintain a 100-foot fuel modification zone adjacent to structures and 30-foot fuel modification zone adjacent to roads
- Establish fuel modification zones for residences immediately adjacent to the Preserve that are currently not maintained by the County.
- Mile-markers are recommended for the trail system to allow emergency response personnel to more readily locate injured individuals onsite and to better locate the specific location of reported fires.
- Agencies should maintain 10 feet of clearance around utility poles or consistent with the specifications of the utility easement
- Discuss with CalFire and other fire agencies the potential for future prescribed burns or other vegetation management activities within the Preserve as fuel loads build over the next 35 years.

7.0 References

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APPENDIX A INVASIVE PLANT SUMMARY

Species	US/CA Weed List	CAL IPC Rating	Imp	Inv Pot	Dis	Distribution (Veg Type: Polygon)		
						Throughout	Openings	Trail Edge
* <i>Asphodelus fistulosus</i> (Onionweed)	NW, Q	M*	B	A	C	Dist: 33, 70	Chap: 1	Chap: 45, 56, 77, CSS: 40, Dist: 63
* <i>Cynara cardunculus</i> (Artichoke thistle)	B	M	B	B	B	Grass: 14		
* <i>Carduus pycnocephalus</i> (Italian thistle)	C	M	B	B	A	Grass: 12, 70, Tamarisk: 60		CSS: 02
* <i>Pennisetum setaceum</i> (Fountain grass)	C, Q	M	B	B	B	CSS: 13, 22, Dist: 33, Grass: 12, 14, 71		CSS: 02, CSS-Chap: 43
* <i>Tamarix ramosissima</i> (Tamarisk)		H	A	A	A	Tamarisk: 60		
* <i>Cortaderia selloana</i> (Pampas grass)		H	A	A	B	Dist: 66, Grass: 12	CSS: 72, Marsh: 76	CSS: 28, Oak 10, 11
<i>Bromus madritensis</i> ssp. <i>rubens</i> (Red brome)		H	A	B	A	CSS: 07, 13, Dist: 34, 58, 66, Grass: 09, 12, 17, 48, 70, Tamarisk: 60	Chap: 01, CSS: 08, 18, 35, 44, 49, 67, 72	Chap: 05, 41, 45, 56, 77, CSS: 02, 23, 32, 40, 42, 47, 68, 69, 73, 74, 75, CSS-Chap: 39, 43, Oak: 11
* <i>Carpobrotus edulis</i> (Hottentot-fig)		H	A	B	A	Grass: 17		
<i>Foeniculum vulgare</i> (Fennel)		H	A	B	A	Dist: 34, 66, Grass: 09, 12, 48, 70, Tamarisk: 60	CSS: 08, Marsh: 76	CSS: 28, 40, Oak: 11
<i>Avena fatua</i> (Wild oats)		M	B	B	A	CSS: 07, 22, Dist: 58, Grass: 09, 12, 14, 71	Chap: 01, CSS: 08, 18, 35, 44, 67, 72	Chap: 56, 77, CSS: 02, 28,
<i>Brassica nigra</i> (Black mustard)		M	B	B	A	CSS: 07, 22, Dist: 34, 58, 66, Grass: 9, 12, 14, 48, 70, 71	Chap: 01, CSS: 08, 44, 49, 67	Chap: 45, 56, 77, CSS: 02, 40, 47, 68, 69
<i>Bromus diandrus</i> (Ripgut brome)		M	B	B	A	Grass: 14, 71		Chap: 05, 56, 77
<i>Hirschfeldia incana</i> (Mediterranean mustard)		M	B	B	A	Grass: 17		CSS: 32, 73, 74, 75
<i>Lolium multiflorum</i> (Italian ryegrass)		M	B	B	A	Grass: 14, 71		
<i>Vulpia myuros</i> (Rat-tail fescue)		M	B	B	A	CSS: 22, Grass: 12		Chap: 05, CSS: 02, 40, 42
* <i>Ailanthus altissima</i> (Tree-of-Heaven)		M	B	B	B		Chap: 1, CSS: 72	Oak: 10

APPENDIX A INVASIVE PLANT SUMMARY

Species	US/CA Weed List	CAL IPC Rating	Imp	Inv Pot	Dis	Distribution (Veg Type: Polygon)		
						Throughout	Openings	Trail Edge
<i>Centaurea melitensis</i> (Tocalote)		M	B	B	B	CSS: 13, 22, Dist 34, 66, Grass: 12, 48, 70	CSS: 08, 49	Chap: 05, 45, 56, 77, CSS: 02, 23, 28, 32, 47, 68, 69, 73, 74, 75, CSS- Chap: 43
* <i>Chrysanthemum coronarium</i> (Crown daisy, = <i>Glebionis coronarium</i>)		M	B	B	B	Dist: 33, 34, 64, 66, Tamarisk: 60		Chap: 45
<i>Eucalyptus globulus</i> (Tasmanian blue gum)		M	B	B	B	Dist: 33, 34, 64, Grass: 12, 14, 70, 71, Tamarisk: 60	CSS: 18	Chap: 41, CSS: 40, CSS-Chap: 43
<i>Nicotiana glauca</i> (Tree tobacco)		M	B	B	B	Dist: 33, 64	Marsh: 76	
<i>Vinca major</i> (Periwinkle)		M	B	B	B	Dist: 33, 64		
* <i>Washingtonia robusta</i> (Mexican fan palm)		M*	B	B	C	Dist: 33 Grass: 14		
<i>Bromus hordeaceus</i> (Soft chess)		L	B	C	A	CSS: 07, 22, Dist: 58, Grass: 14, 17, 48, 70, 71	Chap: 01, CSS: 08, 44, 67	CSS: 23, 47, 68, 69
<i>Hypochaeris glabra</i> (Smooth cat's ear)		L	C	B	B	CSS: 13, Grass: 17		
<i>Olea europaea</i> (Olive)		L	C	B	B			CSS: 08
<i>Picris echioides</i> (Bristly ox-tongue)		L	C	B	B	Dist: 34, 66, Marsh: 61	Marsh: 76	CSS: 28
<i>Piptatherum miliaceum</i> (Smilo grass)		L	C	B	B			Oak: 11
<i>Salsola tragus</i> (Russian thistle)		L	C	B	B	Grass: 17		
<i>Schinus molle</i> (Peruvian pepper tree)		L	C	B	B	Grass: 14		
<i>Erodium cicutarium</i> (Filaree)		L	C	C	A	CSS: 22, Grass: 14, 17, 48, 70, 71	CSS: 08	Chap: 56, 77, CSS: 02, 23
<i>Rumex crispus</i> (Curly dock)		L	C	C	A	Dist: 34, 66, Grass: 12, Marsh: 61	Marsh: 76	
<i>Polypogon monspeliensis</i> (Annual beard grass)		L	C	C	B	Marsh: 61		
<i>Erodium moschatum</i> (Filaree)			D	C	A	CSS: 13, Grass: 12		
<i>Acacia cyclops</i> (Cyclops acacia)								CSS: 02
<i>Agave americana</i> (Agave)						Dist: 33, 64		
<i>Anagallis arvensis</i> (Scarlet pimpernel)						Tamarisk: 60		
<i>Eucalyptus sideroxylyon</i> (Red iron-bark)						Dist: 33		
<i>Galium aparine</i> (Common bedstraw)						Tamarisk: 60		

APPENDIX A INVASIVE PLANT SUMMARY

Species	US/CA Weed List	CAL IPC Rating	Imp	Inv Pot	Dis	Distribution (Veg Type: Polygon)		
						Throughout	Openings	Trail Edge
<i>Hordeum murinum</i> (Glaucus barley)						Grass: 48, 70		
<i>Melilotus indica</i> (Sour clover)							Marsh: 76	CSS: 28
<i>Mentha spicata</i> (Spear mint)							Marsh: 76	
<i>Opuntia ficus-indica</i> (Indian fig)								Chap: 45
<i>Parkinsonia aculeata</i> (Mexican palo verde)						Dist: 33		
<i>Periserianthes lophantha</i> (plume albizia)						Dist: 66		
<i>Pinus canariensis</i> (canary Island Pine)						Dist: 64		

Species: * before the species means that the species is discussed further and mapped in Figure X.

US/CA weed list codes : **NW:** Federal Noxious Weed (USDA 2006): **Q:** California quarantine list (CDFA 2003): **A:** California list A noxious weed (CDFA 2003): **B:** California list B noxious weed (CDFA 2003): **C:** California list C noxious weed (CDFA 2003)

CAL-IPC Rating (CAL-IPC 2006)

* = Species has "Alert" status with CAL-IPC

H = High. Species causes major biotic and physical impacts, they can spread rapidly, and they are generally widely distributed.

M = Moderate. Species has substantial and apparent biotic and physical impacts, have moderate to high rates of dispersal, and their range varies from limited to widespread.

L = Limited. These species are invasive but either have limited impacts or are insufficiently known to justify a higher rating. They have low to moderate rates of dispersal, and a limited range, but may be locally persistent and problematic.

Imp = Ecological impact (CAL-IPC 2006)

Inv Pot = Invasiveness potential (CAL-IPC 2006)

Dis = Distribution within California (CAL-IPC 2006)

These categories are coded as A=high/widespread, B=moderate, C=limited, D=none.

Vegetation Type Codes: **Chap** = Southern Maritime Chaparral: **CSS** = Diegan Coastal Sage Scrub: **CSS-Chap** = Coastal sage-Chaparral Scrub: **Dist** = Disturbed Habitat: **Grass** = Non-Native grassland: **Marsh** = Coastal and Valley Freshwater Marsh: **Oak** = Southern Coast Live Oak Riparian Forest: **Tamarisk** = Tamarisk Scrub

Numbers: The numbers 1-71 refer to the polygons in Figure 1. For example "1" is polygon V001.

APPENDIX B FUEL MODELS

Fuel models within the Preserve have been classified into groups and described based on the National Forest Fire Laboratory System (NFFL) (Anderson 1982). The NFFL system is based on 13 models categorized into groups by the general structure of the vegetation including grass, shrub, timber, and logging slash. Model types within these groups are distinguished by the fuel load and depth in terms of the amount of live and dead biomass, including canopy height, and in some cases general descriptors of the flammability. Fuel load and depth are the most significant fuel properties for predicting whether a fire will be ignited, how quickly it will spread, and the fire intensity (Anderson 1982). These fuel models can be used to predict fire behavior under varying weather, fuel moisture, and topographical conditions. The following fuel models are based on the vegetation communities present on the Preserve. However, no fire modeling was conducted for this Plan.

Grass Group : Fire Behavior Fuel Model 1 (Short Grass (<2 feet tall))

Fuel Model 1 corresponds to the non-native grassland vegetation community within the Preserve. The fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured govern fire spread (Anderson 1982). Fires are surface fires that move rapidly through the cured grass and associated material (Table 8). Very little shrub is present, generally less than one-third of the area.

Table B.1. Fuel Model Values for Estimating Fuel Model 1 Fire Behavior

Total Fuel Load of ,3-inch in diameter dead and live fuel	0.74 tons/acre
Dead fuel load, ¼ inch and less	0.74 tons/acre
Live fuel load, foliage	0.00 tons/acre
Fuel bed depth	1.0 ft

Shrub Group: Fire Behavior Fuel Model 6 - Intermediate, Dense, mature Shrubs

Fuel Model 6 corresponds to the Diegan coastal sage scrub and southern maritime chaparral onsite. Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mph at mid-flame height (Table 9) (Anderson 1982). Fire will drop to the ground at low wind speed or at openings in the stand. The shrubs are older, but not as tall as shrub types of fuel model 4. This fuel model covers a broad range of shrub conditions. Fuel situations to be considered include intermediate chamise, chaparral, oak brush and mature California sagebrush scrub.

Table B.2. Fuel Model Values for Estimating Fuel Model 6 Fire Behavior

Total Fuel Load of ,3-inch in diameter dead and live fuel	6.0 tons/acre
Dead fuel load, ¼ inch and less	1.5 tons/acre
Live fuel load, foliage	0.0 tons/acre
Fuel bed depth	2.5 ft

Timber Group: Fire Behavior Fuel Model 9 - Tall Riparian Shrub/Hardwoods

Fuel Model 9 corresponds to the southern coast live oak Riparian forest and tamarisk scrub within the Preserve. Fires run through the surface litter faster than other shrub/hardwood tree group fuel models and have longer flame height (Table 10) (Anderson 1982). Hardwood trees and hardwood shrub stands, especially the dense oak-willow scrub are typical Fuel Model 9 species. Fall fires are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves.

Table B.3. Fuel Model Values for Estimating Fuel Model 9 Fire Behavior

Total Fuel Load of ,3-inch in diameter dead and live fuel	3.5 tons/acre
Dead fuel load, ¼ inch and less	2.9 tons/acre
Live fuel load, foliage	0.0 tons/acre
Fuel bed depth	0.2 ft