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Ecological Consultants

Guadalupe Oak Grove Park Management Plan

Project # 3823-01

Prepared for:

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and
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June 2016

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Section 1.0 Introduction

1.1 Management Plan Area Location

Guadalupe Oak Grove Park is an approximately 49.62-acre (ac) parcel of land in the southern portion of the City of San José (City) in Santa Clara County, California (Figure 1), and is located within the Los Gatos U.S. Geological Survey (USGS) 7.5-minute quadrangle (Figure 2). The park is embedded within a residential area to the southwest of the intersection of Coleman Road and Almaden Expressway. It occurs immediately north of Jeffrey Fontana West City Park, but is otherwise isolated from nearby, expansive open space areas such as Santa Teresa County Park, Alamaden-Quicksilver County Park, and Sierra Azul Open Space Preserve. It harbors one of the last remaining large tracts of deciduous oak savanna and woodland on the floor of the Santa Clara Valley, and as such, represents an invaluable natural resource to the City and to oak woodland conservation in the San Francisco Bay region.

1.2 Goals of the Management Plan

Herein we provide a vegetation management-based supplement plan to the Guadalupe Oak Grove Park Management Plan Report (Management Plan) (Hardesty Associates, 1987). This Management Plan has been prepared to outline additional management actions that would preserve and enhance the natural resources of while integrating and balancing the current, passive recreational use for the citizens of the City. The Supplement specifically focuses on several regional land management issues (see *Section 1.3* below) such as the removal/control of invasive plant species, reducing the negative impacts of fire suppression, encouraging natural regeneration of oak woodlands and savannas, preserving and enhancing the quality of grassland habitat, and reducing unplanned fires in natural settings. The broad, overarching goals of the Supplement remain unchanged from those presented in the Management Plan, and are as follows:

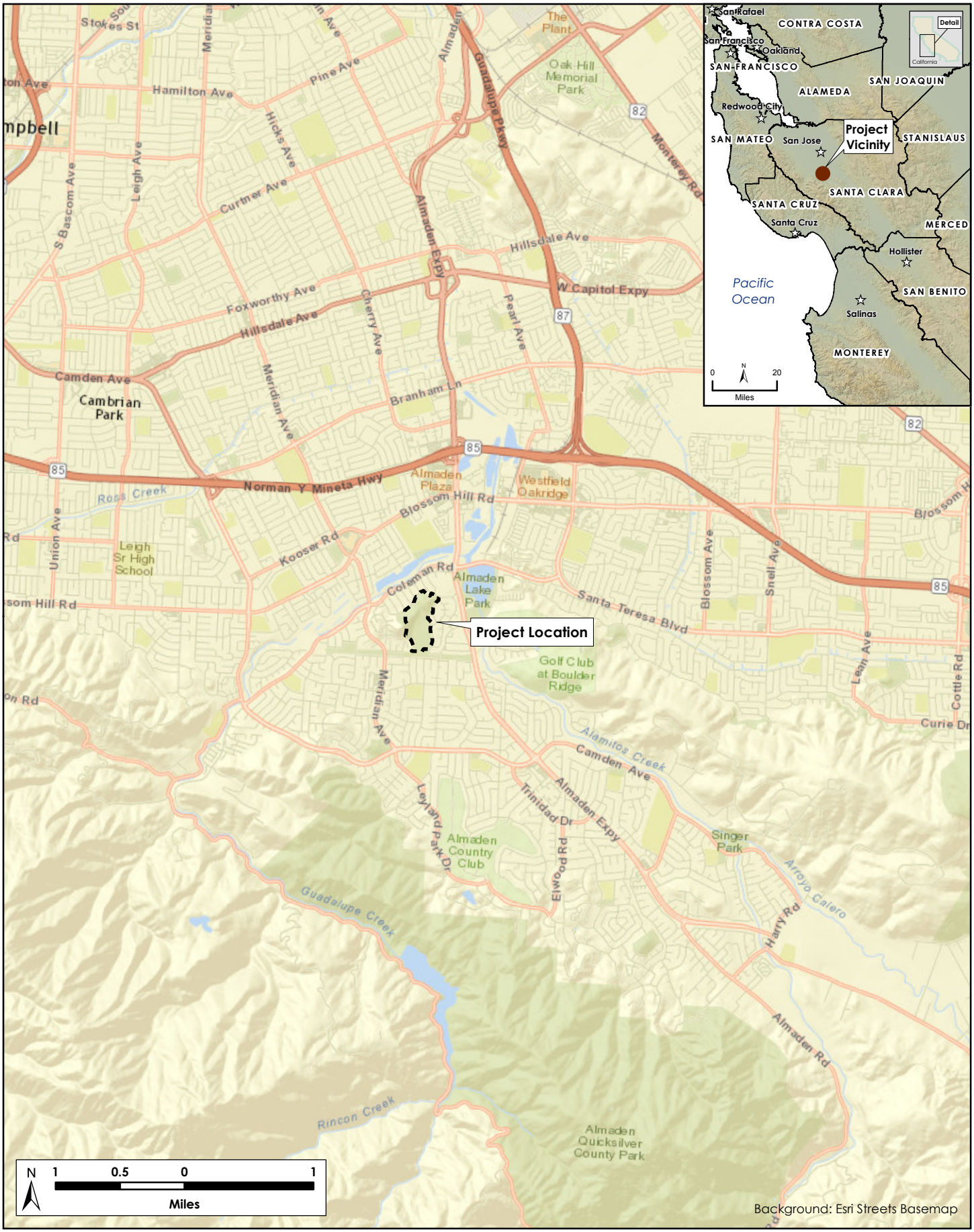
1. The protection of natural resources will remain as a dominant theme to the design of management actions.

2. Maintain and encourage natural recruitment of native oaks in woodland, savanna, and grassland habitat types.

3. Preserve and/or enhance wildlife habitats.

4. Maintain the compatibility of recreational uses of the park and management actions that preserve and enhance its natural resources.

5. Encourage participation from the public, conservation groups, and resource agencies in the implementation of the Management Plan.



N:\Projects3800\3823-01\Reports\Biotic Resources\Fig 1 Vicinity Map.mxd cfu

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Figure 1. Vicinity Map
Guadalupe Oak Grove Park Master Plan (3823-01)
June 2016

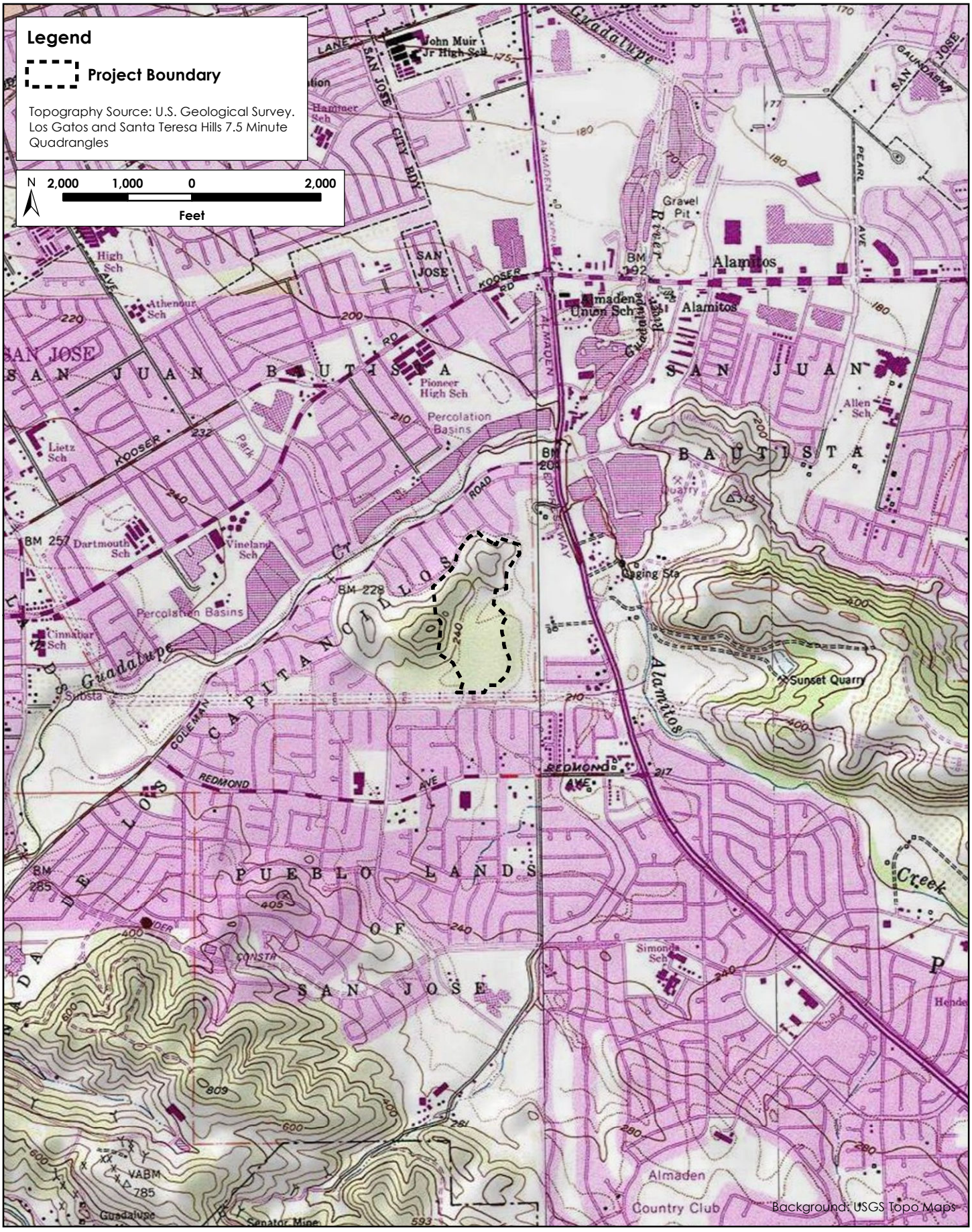

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Figure 2. USGS Topographic Map
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1.3 Regional Land Management Issues

1.3.1 Invasive Species

The California Invasive Plant Council (Cal-IPC 2016) rates the degree of ecological impact of weedy, non-native plant species. Invasive plant species rated as High or Moderate in the Cal-IPC Inventory can have substantial to severe impacts on ecological processes such as reducing wildlife habitat and forage, displacing native plants, and altering fire regimes by increasing fuel loads. Several problematic, non-native forbs and grasses that were introduced to the California from Mediterranean areas of Eurasia are now dominant herbaceous species in mixed oak savanna and ruderal grassland habitats in the park. In addition, one small patch of Himalayan blackberry (*Rubus armeniacus*), rated as High in the Cal-IPC inventory, occurs in ruderal grassland habitat in the park. Below are expanded descriptions of these species, as basic biological information pertaining to the life history and phenology of each is critical for developing timely and effective control strategies.

Integrated Pest Management Programs employ a combination of biological, mechanical, and chemical methods to ensure the most effective control method for invasive plants is utilized while providing the greatest amount of protection to the existing natural resources within the park. Invasive species removal/control may not be effective if only a single treatment method is implemented, such as mowing, herbicide application, grazing, fire, or hand removal. Instead, the best results and greatest chance for long-term control of invasive weeds in an area are often achieved with a combination of these methods. The overarching goals of invasives control are to simultaneously reduce the size, number, and/or density of existing invasive populations through the reduction of individual plants and suppression of seed production, prevent new infestation from occurring or spreading, and also encouraging desirable vegetation to colonize the infested areas.

Yellow Star Thistle

The Management Plan indicated that much of the hillside oak savanna was infested with yellow star thistle (*Centaurea solstitialis*) at the time, a highly invasive forb with a High ecological impact rating (Cal-IPC 2016). Although it is now less widespread across the park, several patches of yellow star thistle still exist there (Photo 1, Appendix A). Yellow star thistle is usually found in dry, light-intensive areas; and has invaded over 15 million acres in California in a variety of habitat types, including woodlands, grasslands, and disturbed lands (DiTomasio 2003, Otto 2011). It propagates rapidly, with one plant producing up to 75,000 seeds, and forms dense stands that rapidly deplete soil moisture. It is a long-lived winter annual in the Asteraceae family, germinating during the wet season, and subsequently allocating the majority of its resources to a small basal rosette and root growth. By late spring, the roots of yellow star thistle plants can extend 3 feet below the soil surface, which allows the species to compete for soil moisture, survive late into the summer, and re-sprout following mowing or grazing. Yellow star thistle produces solitary, spiny-heads of disk flowers that emerge from stems up to 4 feet in height. Flowering generally occurs between the months of April and September.

Black Mustard, Field Mustard, and Mediterranean Hoary Mustard

Significant portions of the herbaceous plant community in the park are infested with dense stands of weedy mustards, such as field mustard (*Brassica rapa*), black mustard (*Brassica nigra*), and/or Mediterranean hoary mustard (*Hirschfeldia incana*) (Photo 2, Appendix A). Black mustard and Mediterranean hoary mustard are rated as having Moderate ecological impact by the Cal-IPC, whereas field mustard is rated as having only a Limited impact (Cal-IPC 2016). These species have colonized a variety of woodland, grassland, and riparian habitats across the state of California. Disturbance promotes their spread, and they are early successional species that often decline in dominance when native vegetation re-establishes. These weedy mustards are in the Brassicaceae family, and are also winter annuals that germinate during the wet season, and then distribute their resources to a basal rosette and root growth thereafter. Black mustard, in particular, is allelopathic and can alter the chemistry of the soil to prevent germination and growth of other neighboring plant species (Turk and Tawaha 2003). Black mustard and field mustard produce four-petaled, yellow flowers that emerge from stems up to 6 feet in height. Flowering can occur year-round for Mediterranean hoary mustard, but generally occurs between the months of April and July for black mustard and field mustard. Seed production is profuse, and the seedbank of mustard populations is generally thought to be quite long-lived (up to 50 years) (Brooks 2004).

Italian Thistle

Dense stands of Italian thistle (*Carduus pycnocephalus*) were observed growing alongside the weedy mustards across large portions of the park (Photo 3, Appendix A). This species has similar timing of phenological events, such as germination, flowering, and seed production, as yellow star thistle and the weedy mustard species. It is rated as having Moderate ecological impact by Cal-IPC (2016), and like many plants in the Asteraceae family, produces a basal rosette upon germination and before bolting to flower. Spiny heads with pink to purple ray and disk flowers will emerge from stems up to 4 feet in height from February through July. Italian thistle infests areas below 3,000 feet elevation over much of the state of California, with the exception of the Great Basin and northern Mojave Desert. It is common in chaparral, savanna, woodland, and grassland habitats, and prefers warm, dry environmental conditions and basalt soils with high fertility and high pH (greater than 6.5). Italian thistle propagates rapidly, with one plant producing up to 20,000 seeds (Wheatley and Collett 1981). In addition, the species is known to have a very high germination rate, and the seedbank may persist for up to 10 years (Bossard & Lichti 2016).

Stinkwort

Stinkwort (*Dittrichia graveolens*) has infested the northeastern corner of the park, and is also present alongside trails (Pauser 2016, pers. comm). It is rated as having Moderate ecological impact by Cal-IPC (2016), and is a late summer annual in the Asteraceae family that begins its growth in June, and quickly produces foliage with resinous, glandular hairs up to several feet in height. To this end, stinkwort can rapidly form dense populations with few competing plant species. It was first discovered in the San Francisco Bay region in the 1980s, and has since expanded into substantial portions of disturbed riparian and grassland habitats, and is also commonly observed along the margins of wetlands and vernal pools. It grows best on well-drained, gravelly, soils; and thrives in hot, dry climates. Small yellow flowers are produced between the months of August and October. Stinkwort propagates rapidly, with one plant producing up to 30,000 seeds. It is important to note that this

plant species may be toxic to livestock, as the barbed seedlings can become lodged in the intestine of animals, causing enteritis (Philbey and Morton 2000). In addition, stinkwort produces terpenes that may cause allergic reactions and dermatitis (Thong et al. 2008).

Non-Native Annual Grasses

Across the entire park, a suite of non-native annual grasses that are considered invasive with Moderate or High ecological impact ratings (Cal-IPC 2016), such as various species of wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), and Spanish brome (*Bromus madritensis ssp. rubens*), represent the greatest coverage of any plant functional group in the herbaceous plant community (Photo 4, Appendix A). Wild oats appeared to be the dominant understory species during the December 2015 reconnaissance survey. It is a cool season, annual grass that has a broad geographic range across the entire United States, and has infested much of California's savanna, grasslands, rangelands, and agricultural fields that have been previously subjected to livestock grazing. It germinates immediately following the first several precipitation events of the wet season, and produces wind-pollinated and self-compatible flowers from March through June on erect culms. Individual plants have dense, fibrous root systems, and produce allelopathic compounds that inhibit the growth of neighboring plant species. Non-native annual grasses are thought contribute to the displacement of native species either from being superior competitors for light, soil moisture, and/or nutrients, or as a result of an exceptional tolerance of disturbance. It is not recommended, nor would it possible, to monitor and/or control this suite of non-native grasses in the same manner that infestations of the other invasive species in the park are treated. Non-native grasses have already colonized the park, and indeed, the wider region, to such a degree that native wildlife depend on the structure and forage provided by these species. That being said, if completely uncontrolled, it is likely that these non-native annual grasses will create an undesirably thick thatch layer and tall grass canopy, and will out-compete native forbs at the park and increase fire fuel loads.

Himalayan Blackberry

One small patch of Himalayan blackberry, a shrub rated as having a High ecological impact rating (Cal-IPC 2016), occurs along the fence line on the eastern edge of the park in ruderal grassland habitat. Infestations of Himalayan blackberry occur throughout California, where the species forms dense thickets of long, prickly canes (branches) that can reach heights of over ten-feet. It is in the Rosaceae family; flowers are white, and are produced from April through August. Plants produce berries that are initially red in color, changing to shiny black when ripe. Himalayan blackberry can seed heavily; thickets can produce 7,000 to 13,000 seeds per square meter (Amor 1974), and are readily dispersed by wildlife. Moreover, this species can reproduce asexually by rooting cane tips. Infestations of Himalayan blackberry can cause ecological damage by shading out forbs and grasses and the herbaceous layer, and competing for soil moisture. Moreover, solid thickets climbing up fences can cause structures to fall, and may pose a significant fire hazard.

1.3.2 Fire Suppression in Oak Savanna and Woodland Habitats

Native Americans had lived amongst oak savannas and woodlands for almost 10,000 years prior to European settlement; and because oak trees provided a myriad of resources used for food, medicine, structures, tools,

and weapons, they were accomplished land managers of these habitats. Native Americans used a variety of techniques including pruning, reduction of fuels in the understory, and fire to promote stands of widely spaced trees with large canopies and long lifespans (NRCS 2007). Setting frequent, low temperature fires across the ground surface was an ancient practice of Native American tribes in California, Oregon, and Washington; and was a necessary human-intervention to optimize the structure and diversity of oak stands, facilitate acorn production, induce growth of seedlings, reduce understory brush, and control insects and pathogens that predate on and infect oaks (Thysell and Carey 2001; Tveton and Fonda 1999; Anderson n.d.). Furthermore, the fire regime promoted the germination and growth of herbaceous species in the understories of oaks and in patches of grassland that provided resources to the Native Americans, especially geophytes with edible roots, tubers, corms, or rhizomes (Anderson 1997). In the absence of fire, stands of oak trees face a variety of challenges, including poor natural regeneration, reduced age-class diversity of stands, disease, reduced plant species diversity, and build-up of understory fuels that could contribute to unplanned high intensity fires. In areas where prescribed fire is no longer possible, additional land management techniques that mimic the previous fire disturbance regime may be considered to promote healthy, self-sustaining oak savannas and woodlands.

1.3.3 Natural Regeneration of Blue Oaks

For over a century, there has been particular concern that blue oak, a species that is endemic to California, has not been naturally regenerating adequately to sustain and eventually replace existing stands of mature blue oak trees (Jepson 1910). While this may be indirectly affected by fire suppression, there are several theories regarding direct mechanisms that inhibit blue oak regeneration, and these provide important implications for management of savannas and woodlands in the state of California. Blue oak is relatively long lived and the recruitment of only a few seedlings and saplings are needed in any one year to replace mature trees that die. Research indicates that in portions of its geographic range this natural regeneration is not occurring (Swiecki et al. 1997). One theory suggests that the apparent shortage of blue oak seedlings and saplings may be a result of a lull in natural recruitment, which occurs in "pulses" during a rare combination of events, such as the production of a good acorn crop followed by wet conditions that extend into the warmer months of spring. In addition, pulses are likely correlated with low populations of herbivores and seed predators, such as voles, gophers, ground squirrels, rabbits, and deer (McCreary et al. 2011). When these pulses do occur and a sufficient number of acorns germinate, the survival of small seedlings is further inhibited by competition for light, soil moisture, and nutrients from dense non-native annual grasses, browsing by domestic livestock, and herbivory. As a result of these challenges to natural regeneration, many blue oak stands present a bimodal size distribution with considerable numbers of seedlings and mature trees, but few saplings (McCreary et al. 2011). As such, natural regeneration of blue oaks may be encouraged by augmenting the understories of blue oak stands with acorns, controlling/removing non-native plant species surrounding seedlings, and protecting seedlings and saplings from herbivory.

1.3.4 Oak Pathogens

In the early 1980's, increasingly severe dieback of large oak branches up to 6 inches in diameter was noted across the state of California (University of California 2016a). This oak branch die-back, or "twig blight" has continued to be present and has by now affected large numbers of oaks; it is caused by several pathogens, including the diplodia fungus (*Diplodia quercina*), which has been documented in the park. The fruiting bodies of the diplodia fungus are produced on dead tissues, and it attacks individual trees mainly through wounds, eventually killing the cambium, sapwood, and phloem of branches. The result is branch flagging and eventual stag-heading in tree crowns, sometimes sufficiently severe as to result in the death of individual trees. Infection generally occurs in the early spring during warm and wet conditions; and symptoms, such as wilted leaves and dark colored inner-bark, cambium, or sapwood, become most pronounced during the driest months of the year. This disease has been observed in coast live oak, valley oak, blue oak, and black oak in at least 20 counties of California and throughout most of the geographic range of coast live oak. Infected trees can be managed by pruning out diseased and dead branches during the coldest months of the year (November through January), as new infections are least likely to occur during that time (University of California 2016a).

An additional pathogenic threat to oaks in the Santa Clara Valley is Sudden Oak Death (SOD), caused by a water mold called *Phytophthora ramorum*. This same organism also causes Ramorum blight. Tanoak (*Notholithocarpus densiflorus*), coast live oak (*Quercus agrifolia*), Shreve oak (*Q. parvula*), California black oak (Q. *kelloggii*), and canyon live oak (*Q. chrysolepis*) are native California trees that are typically killed by SOD. Blue oaks (*Q. douglasii*) and Valley oak (*Q. lobata*) are not susceptible to SOD (Swiecki and Bernhardt 2013), meaning that areas of Guadalupe Oak Grove Park with higher densities of coast live oak are more at risk for infection. Poor drainage or excessive water (for example, in clayey soils in low landscape positions, or shady drainages or north facing slopes) can be associated with both increased susceptibility for infection and increased severity of infection. *Phytophthora* infection (there are multiple species of this pathogen) can cause root rot, lethal trunk cankers, or in the case of Ramorum blight, presents as a disease of the leaves and twigs of a plant. Nursery stock of native plants can be infected and may serve as a source of pathogen spread. Some measures to prevent the introduction or reduce spread of SOD include targeted removal of high spore-producing hosts interspersed with susceptible oaks such as California bay (*Umbellularia californica*) and poison oak (*Toxicodendron diversilobum*), avoiding pruning or wounding prior to the rainy season, and individual treatment of high value, large trees with fungicide (Swiecki and Bernhardt 2013).

1.4 Management Objectives

This Supplement introduces specific management objectives to address the regional land management issues described above under *Section 1.3*, and to accomplish the goals of the Management Plan. Detailed management prescriptions and associated activities for each of the following objectives will be addressed under *Section 3.0*.

Objective 1- Maintain a competitive advantage of native forbs and grasses over invasive species. This should be accomplished through revegetation activities and a variety of invasive species removal/control methods.

Objective 2- Directly promote regeneration of blue oak (in the savanna habitat through revegetation efforts. Natural regeneration will be indirectly encouraged through the implementation of invasive species control/removal.

Objective 3- Prevent or discourage habitat transition of the current mixed oak savanna to closed canopy mixed oak woodland dominated by coast live oak, or savanna or grassland areas to coyote brush scrub, by careful control of coast live oak and coyote brush recruitment.

Objective 4- Encourage volunteers from local conservation groups, such as the California Native Plant Society or the Sierra Club, to assist with conducting an assessment of a subset of individual trees in the park every 5 years.

Objective 5- Establish a wildflower meadow in existing grassland habitat to enhance native plant species diversity, improve wildlife habitat, and engage the public through the addition of a visually attractive focal point for visitors in the park.

Objective 6- Actively manage the park to reduce the risk of high intensity fire by removing fuel sources in the herbaceous layer of vegetation in woodland, savanna, and grassland habitats. Methods employed as part of Integrated Pest Management Programs, such as mowing, herbicide application, grazing, and/or fire, will concomitantly reduce fuels and invasive species infestations in the park. In addition, trails/ roads within the park will be maintained free of obstructions for emergency fire access. Fire breaks may also be installed within buffer strips that run parallel to the trails/access roads, and around the perimeter of the park.

Objective 7 - Manage herbaceous canopy height and residual dry matter allowed to remain as standing dead biomass in the dry season by a combination of grazing using goats and/or mowing and removing the cut grass. This will reduce competition for light and soil resources that may be preventing native grasses, forbs, and blue oak saplings from establishing, and will favor the development of a more diverse herbaceous understory with a higher proportion of spring annual forbs.

Objective 8- Prevent the spread of oak pathogens within the park by removing branches and dead trees on which there is evidence of disease (e.g. diplodia fungus).

Section 2.0 Methodology

2.1 Survey of Existing Habitats

Prior to conducting field work, H. T. Harvey & Associates ecologists reviewed the Management Plan, aerial images (Google Inc. 2016), and various maps including those from the USGS, National Resource Conservation Service's (NRCS) soil survey (see Figure 3), and National Wetlands Inventory (NWI). H. T. Harvey & Associates' plant ecologist, Maya Goklany, M.S., visited the park on December 23, 2015 to conduct a reconnaissance survey. Specifically, the goals of the survey were to assess the plant communities of each habitat in the park, roughly map the distribution of invasive species across the park, and to compare the existing conditions of the park to those described in the Management Plan in order to facilitate development of management actions to preserve and enhance natural resources. A Geographic Positioning System (GPS) unit was used to record habitat boundaries in the field, and habitat mapping was finalized using aerial vegetation signatures in Google Earth (Google Inc. 2016). Due to the mosaic of open, grassy areas and stands of trees at the park, we designated a minimum mapping unit (MMU) size of approximately 1.00 ac to aid in the reconnaissance survey effort, and to serve as a guideline for any future habitat mapping that might take place at the park.

2.2 General Habitats/Plant Communities

Six general habitat types were identified within the 49.62-ac park: mixed oak woodland, mixed oak savanna, California buckeye savanna, California sagebrush scrub, ruderal grassland, and developed/trails. Table 1 provides a summary of the habitat acreages on the site and Figure 4 shows the distribution and extent of the biotic habitats and invasive species populations on the park.

Table 1. Habitat Acreages

Habitat	Area (acres)
Mixed oak woodland	20.21
Mixed oak savanna	15.75
California buckeye woodland	2.02
California sagebrush scrub	0.96
Ruderal grassland	7.94
Developed/trails	2.75
Total	49.62*

* Values are subject to rounding errors.

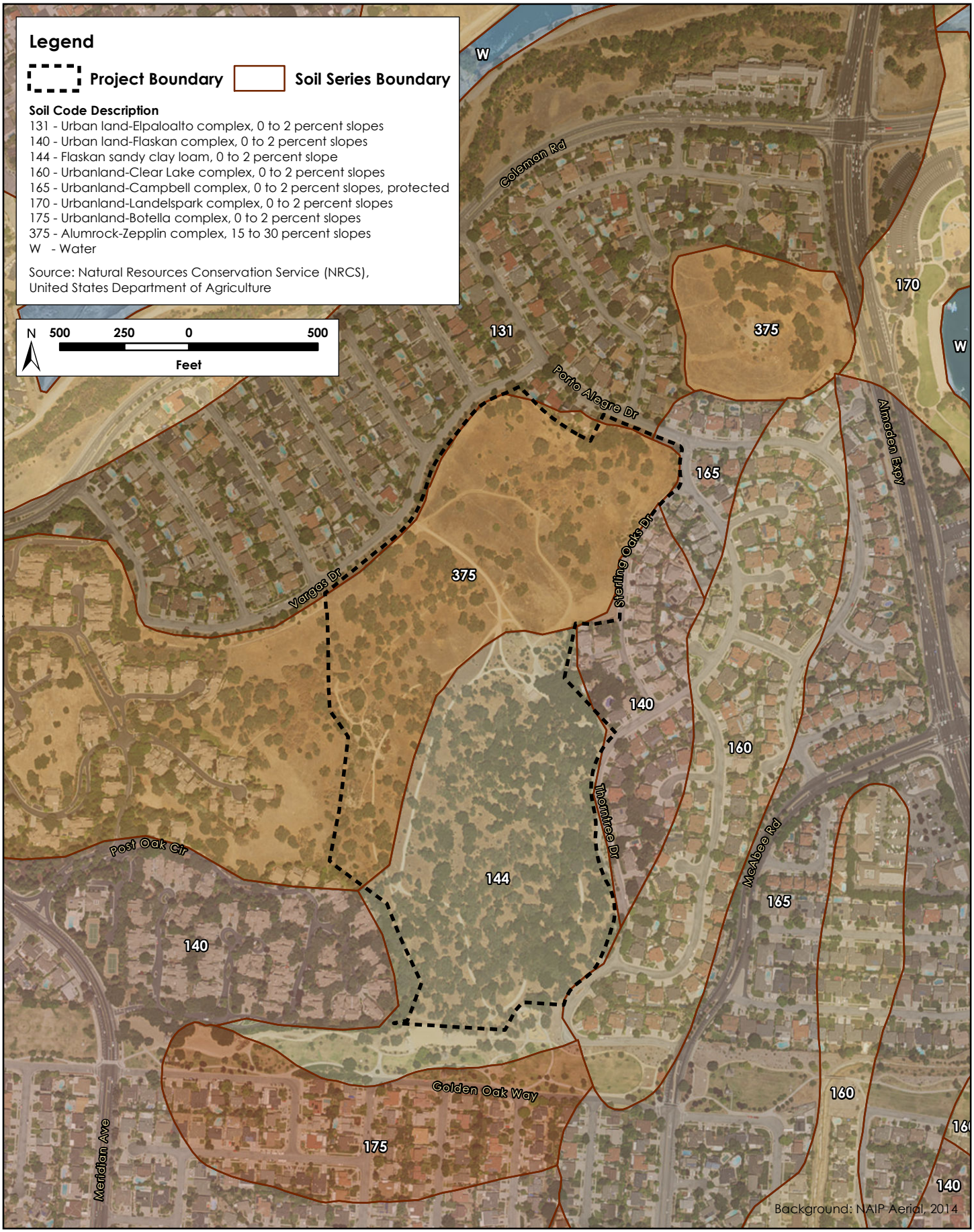

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Figure 3. NRCS Soils Map
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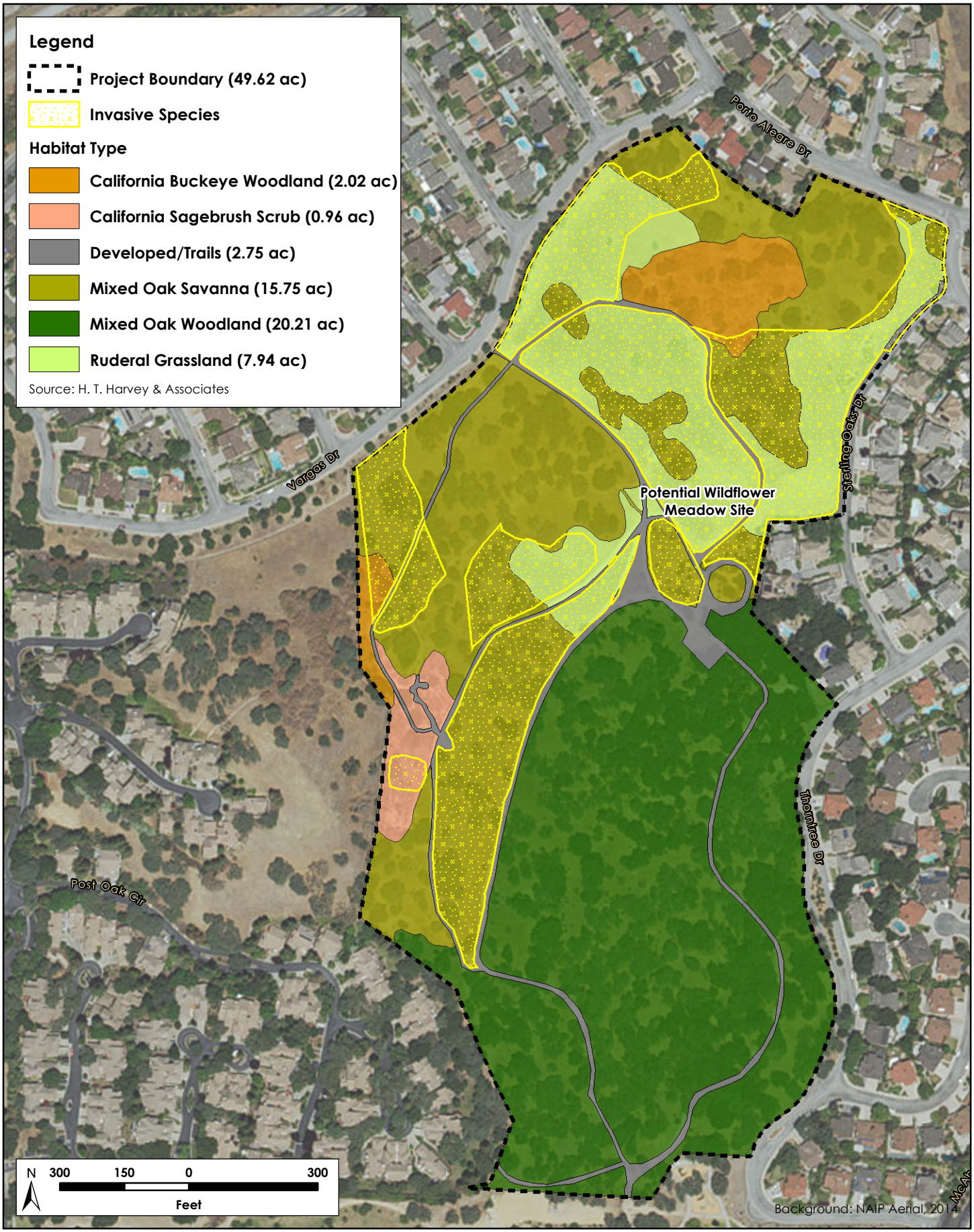
Mixed Oak Woodland

The mixed oak woodland was previously mapped as "closed canopy oak forest" in the Management Plan (Photo 5, Appendix A). This habitat occurs at the lowest elevation in the park (220 to 240 feet NVGD29) in an area with little topographic variation that is underlain by Flaskan sandy clay loam, 0 to 2 percent slopes (Figures 2 and 3). This soil type is derived from metamorphic and sedimentary rock. It is typically found on terraces of streams and in alluvial fans, and the profile may reach of depth greater than 7 feet before a feature that restricts the movement of water, such as bedrock, is reached. This rich, deep, loamy soil is well-drained, fertile, and ideal for farmland. Furthermore, it is ideal for growth of Valley oaks, which often occur in riparian corridors and floodplains, yet they require a delicate moisture balance as they do not tolerate waterlogged soils, but are also negatively impacted by a reduction in the groundwater table.

The tree canopy in the mixed oak woodland is co-dominated by mature Valley oaks, blue oaks, coast live oaks, and hybrids. As a result of a large swath of deciduous trees (i.e. valley oak and blue oak) in this area, the canopy during the colder months of the year is relatively open, allowing light to reach shrubs and herbaceous plant species. Mature trees appeared to be healthy, although some fallen oaks were noted. While branch die-off was not evident in during the reconnaissance survey, the Management Plan noted some individual oak trees were infested with the diplodia fungus at that time. In addition, blue oaks were previously in decline, and exhibited poor health. It is possible that due to the reconnaissance survey taking place at the start of the wet season and coldest part of the year, evidence of poor health in deciduous trees went unnoticed as a result of the lack of leaves. At the time of the reconnaissance survey, there was a substantial amount of coast live oak regeneration; seedlings and saplings were common throughout the understory (Photo 6, Appendix A), although mortality of this age class appeared to be substantial in a few patches. However, little- to no regeneration of deciduous oaks was observed throughout the mixed oak woodland. Shrubs are generally lacking from this habitat type, with the exception of some scattered snowberry (*Symphoricarpos albus*). Non-native annual grasses, such as wild oats dominate the herbaceous layer (Photo 4, Appendix A).

Mixed Oak Savanna

The mixed oak woodland was previously mapped as "hillside oak savanna" in the Management Plan (Photo 7, Appendix A). It occurs on the northern and western portions of the park on steep slopes ranging from 240 to 315 feet NVGD29. These slopes are underlain by soils in the Alumrock-Zepplin complex, 15 to 30 percent slopes, which are shallow, highly erodible, and derived from sandstone parent material. This soil type is ideal for the growth of blue oaks, which are tolerant of drought and rocky soils. Mixed oak savanna is characterized by scattered clumps of primarily blue oaks, although some coast live oak and hybrids also occur here. Blue oak trees (and possible deciduous hybrids) appeared to be healthy, although little- to no regeneration was observed in the understory. On the other hand, there were some patches with substantial vegetative cover of coast live oak seedlings and saplings. The understory generally lacks a shrub layer, although two small patches of coyotebrush were noted during the reconnaissance survey; and the herbaceous layer is dominated by non-native annual grasses. In addition, there are large infestations of mustard, Italian thistle, and stinkwort that have encroached upon more open areas of the savanna.



N:\Projects3800\3823-01\Reports\Biotic Resources\Fig 4 Biotic Habitats and Invasive Species.mxd dfu

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Figure 4. Biotic Habitats and Invasive Species
Guadalupe Oak Grove Park Master Plan (3823-01)
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The Management Plan noted that this area was slowly eroding and infested with yellow star thistle as a result of overgrazing. Disturbance from cattle or other livestock was not evident at the time of the December 2015 reconnaissance survey, and further, only one patch of yellow star thistle was recorded in the park along a trail in the center of the property. Habitat descriptions in the Management Plan also noted a "transition slope area" between closed-canopy oak forest (now mapped as mixed oak woodland, as described above) and the savanna habitat type. At the time, blue oaks, the majority of which were dead, dominated this area. A review of historical aerial images from 1948 through 2015 (NETR 2015) indicate that substantial die-off of trees occurred in this area between 1980 and 1990. The blue oaks remaining in the area as of December 2015 did, however, appear to be healthy.

Ruderal Grassland

Ruderal grassland was not previously mapped within the boundaries of the park in the Management Plan, and instead, was included as part of the "hillside oak savanna" habitat type. Ruderal grassland occurs in the central and northern portions of the park (Photo 8, Appendix A) and is underlain by soils in the Alumrock-Zepplin complex, 15 to 30 percent slopes. It is heavily infested with mustard, Italian thistle, and stinkwort. A small patch of Himalayan blackberry (*Rubus armeniacus*), a highly invasive species (Cal-IPC 2016), was also identified along the chain link fence that surrounds the perimeter of the park during the reconnaissance survey, in addition to some small patches of coyotebrush. Recent efforts to control coyotebrush and invasive species on the park were evident from dead-headed shrubs and mowed areas where mustard, thistle, and filaree (*Erodium* sp.) germinants had since re-sprouted. In addition, a substantial amount of burrows were noted in the ruderal grassland habitat.

California Buckeye Woodland

California buckeye woodland was not previously mapped within the boundaries of the park in the Management Plan, and instead, was included as part of the "hillside oak savanna" and "buckeye-oak closed canopy" habitat types. Stands comprised exclusively of mature California buckeye (*Aesculus californica*) occur at higher elevations in the northern and western portions of the park (Photo 9, Appendix A), ranging from 250 to 350 feet (ft) NVGD29, that are underlain by soils in the Alumrock-Zepplin complex, 15 to 30 percent slopes. As a result of the overstory being dominated by deciduous trees, the canopy during the colder months of the year is relatively open, allowing light to reach shrubs and herbaceous plant species. The understory is generally devoid of woody plant species, and is dominated by non-native annual grasses. Tree seedlings and saplings were not evident in these areas. In contrast to the mixed oak savanna and ruderal grassland habitat types, populations of invasive species were not as prevalent in the California buckeye woodlands in the park.

California Sagebrush Scrub

Coastal sagebrush scrub was not previously mapped within the boundaries of the park in the Management Plan, and instead, was included as part of the "hillside oak savanna" habitat type. Since the size of patches dominated by woody shrubs, such as California sagebrush (*Artemisia californica*) and poison oak (*Toxicodendron diversilobum*), is approximately the size of our established MMU of 1.00 ac, we included this additional habitat type in our mapping effort. Coastal sagebrush scrub occurs on steep, east facing slopes along the western border of the

park (Photos 10-11, Appendix A), and is underlain by sandy soils in the Alumrock-Zepplin complex, 15 to 30 percent slopes. Rock outcroppings and an abandoned sandstone quarry are also present here. This area appears to harbor the greatest diversity of native forbs in comparison to the other habitat types in park, and lacks a thick herbaceous layer of non-native annual grasses. However, some open areas are infested with yellow star thistle and mustard.

Developed/Trails

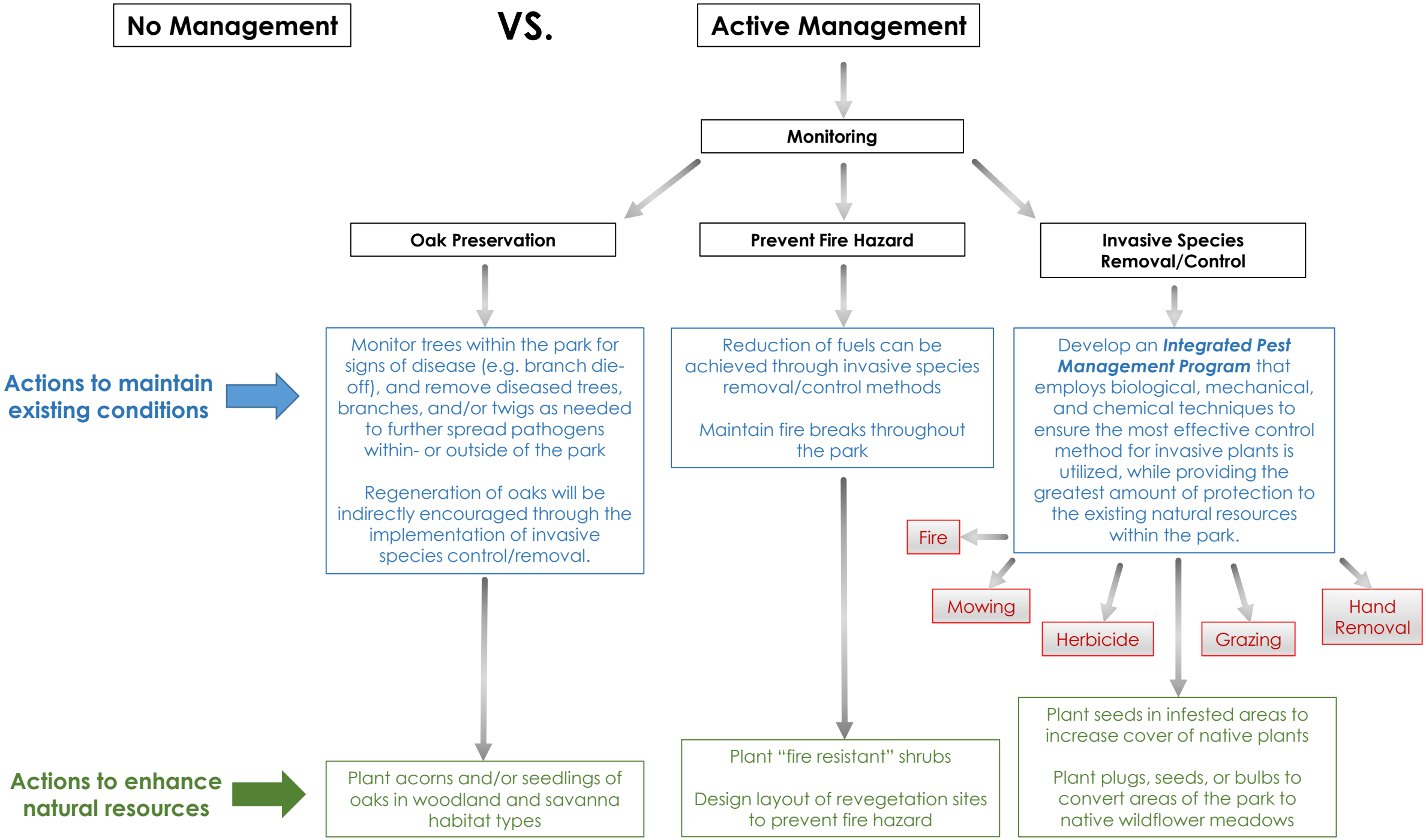
There is a well-developed system of trails in the park that intersect all the habitat types listed above that are open to hiking, bicycling, dog-walking, and equestrian uses. Several of the trails can also function as maintenance and emergency access roads. Developed areas also include restroom facilities, parking lots, and picnic areas.

Section 3.0 Management and Monitoring Guidelines, and Baseline Activities

3.1 Management and Monitoring – Overview

A major goal of this Management Plan is to allow the City flexibility with regards to the level of effort employed at the park to achieve the goals and objectives outlined above in *Sections 1.2* and *1.4*, respectively. This document is best viewed as a long term plan to optimize management and habitat functions and values within the park for the foreseeable future, and as such the level of management activities, or even the type of management activities for differing objectives of the Management Plan may need to be adjusted based on by annual or longer-term variations in environmental conditions or funding, among other unforeseen circumstances. These alternatives can be customized for each objective in a given year tom and will include the following general categories: 1) no management, with monitoring to assess the effects of cessation of management; 2) maintenance of existing conditions; and 3) enhancement of natural resources. Alternative 2 for any objective includes activities that collectively represent the minimal amount of management effort that would be necessary to avoid and minimize potential adverse impacts on the park's natural resources from invasive species, disease, fire, and lack of blue oak recruitment. Alternative 3 for any objective represents the maximum effort that may be employed, and includes additional monitoring and revegetation activities intended to improve existing conditions. It should be noted that these efforts may be futile unless they are implemented in parallel with the activities outlined under Alternative 2 (e.g., invasive species removal/control). Given the current state of the park, Alternative 3 is a favorable starting point, and as certain objectives are being met and conditions within the park are improved, or other constraints occur in a given year, implementing only Alternatives 2 or even Alternative 1 may be most appropriate.

Four management prescriptions are listed under the active management alternatives: a) monitoring; b) oak preservation; c) prevent fire hazard; and d) remove/control invasive species. The Management Plan included the majority of the activities associated with each prescription; and this Management Plan provides a framework for implementation that would assist the parties involved with the Management Plan with monitoring to determine whether management activities are triggered, and optimization of annual timing of the activities (e.g. mowing and/or grazing). In addition, pertinent sections this Management Plan can be directly disseminated amongst volunteers conducting monitoring and maintenance efforts and may aid in educating volunteers on the existing conditions and future management of the park. The overall approach to developing the management actions recommended for the park in the Supplement is depicted in Figure 5.


No Management
VS.
Active Management
Monitoring
Oak Preservation
Prevent Fire Hazard
Invasive Species Removal/Control
Actions to maintain existing conditions
Monitor trees within the park for signs of disease (e.g. branch die-off), and remove diseased trees, branches, and/or twigs as needed to further spread pathogens within- or outside of the park
Regeneration of oaks will be indirectly encouraged through the implementation of invasive species control/removal.
Reduction of fuels can be achieved through invasive species removal/control methods
Maintain fire breaks throughout the park
Develop an Integrated Pest Management Program that employs biological, mechanical, and chemical techniques to ensure the most effective control method for invasive plants is utilized, while providing the greatest amount of protection to the existing natural resources within the park.
Fire
Mowing
Herbicide
Grazing
Hand Removal
Actions to enhance natural resources
Plant acorns and/or seedlings of oaks in woodland and savanna habitat types
Plant "fire resistant" shrubs
Design layout of revegetation sites to prevent fire hazard
Plant seeds in infested areas to increase cover of native plants
Plant plugs, seeds, or bulbs to convert areas of the park to native wildflower meadows

3.2 Guadalupe Oak Grove Park Vegetative Management Work Approval Process

No work shall be performed in the Guadalupe Oak Grove Park including but not limited to mowing, trimming, plant removal, trail repair, grading, seeding, mulching, or planting, without a written and approved work plan that is consistent with the management plan. Prior to any work being performed in the Guadalupe Oak Grove Park, a written work plan shall be prepared, submitted, and approved in writing by City of San José Parks Recreation and Neighborhood Services (PRNS) department and/or the current governing agency. The proposed plan must be in compliance with the Guadalupe Oak Grove Park Vegetative Management plan.

Whether being performed by consultants, contractors, staff, or volunteers, the following information must be submitted as part of the work plan:

1. Proposed start and completion dates, including hours of the day work is anticipated.
2. Detailed description of proposed work (invasive species removal, trimming, mowing, grazing, seeding, planting, trail repair, etc.).
3. A map of the park showing the location where the work is going to be performed. The map can be an aerial photograph of the park or City provided map. The map is to clearly identify the limits of the work.
4. A reference to the section of the GOGP management plan that identifies the proposed work and recommended methods for how it could be performed.
5. List of equipment, chemicals, methods, tools, materials, and/or animals that will be used to perform the work.
6. Names of qualified individuals that will be organizing and supervising the work and their contact information, including phone numbers and email addresses.
7. Total number of people who will be involved in the work project.
8. Assistance needed from the City if any. This might include things like the pickup and removal of debris, use of tools, mowing needed prior to the start of the work, planting materials, mulch, etc.

A brief summary of the work accomplished during the work project is to be submitted to the City PRNS department within two weeks after the completion of the work project so that the effectiveness of the work projects over time can be determined. Any follow-up activities required after the completion date will require the preparation of an additional work plan and the reasons why the additional work is necessary.

3.3 Baseline Activities

Prior to the commencement of the active management alternatives described herein, the Partners would be responsible for ensuring the following baseline activities are implemented at the park, in the manner set forth below. The baseline activities include those related to general maintenance, biotic surveys and reporting, including:

1. Conduct comprehensive invasive species surveys using GPS to document the location and extent of plant populations in the park ranked as moderately and highly invasive by the Cal-IPC (2016) (see http://www.cal-ipc.org/paf/ for the statewide inventory of invasive species).
2. Conduct comprehensive tree assessments using the line-transect method to document the distribution of tree species, woodland density and vegetative cover, age class of tree stands, and health of trees in the park.
3. Install signage (as part of general maintenance)
4. Implement measures to reduce the potential for the introduction of invasive species to the park during baseline surveys, general maintenance, and any additional activities within the park boundaries that are carried out as part of the management alternatives outlined in *Section 3.3*.
5. Produce a Baseline Report that includes the results of initial invasive species surveys and tree assessments conducted in 2016 (or first year of Management Plan implementation).

Each of these activities is described in greater detail below.

3.3.1 Invasive Plant Species Survey

Properly trained volunteers from the general public, conservation groups, and/or resource agencies could assist with conducting observational surveys to monitor existing populations of moderate to high ranking invasive plants (Cal-IPC 2016), and to document new occurrences, or new invasive species in the park. In addition, coyotebrush and dense patches of coast live oak seedlings and saplings should be recorded during the survey. Those conducting the survey should traverse the entire park on-foot, paying special attention to areas where invasive plant populations have been previously recorded. The boundaries of invasive plant populations and patches of problematic woody species should be demarcated using GPS. The approximate area of coverage (square feet) of each contiguous population should then be calculated via visual estimate of the patch size or using ArcGIS to record actual match size, and the absolute percent cover1 of invasive plants associated with each population should be estimated to the nearest cover class (<1%, 1-5%, <5-25%, <25-50%, <50-75%, and <75-100%). Invasive plant populations visible and identifiable in winter have been mapped as part of this report, but additional species or infestations may be apparent during the early summer growing season.

The results of the survey would include an invasive species occurrence ArcGIS map to aid in the development of Integrated Pest Management Programs to remove/control invasive species. Surveys would focus on those areas known to account for the majority of invasive plant introductions and infestations at the park. The baseline survey would be conducted once, in late June or early July, timed to occur when all of the target winter annuals are flowering, and while the late summer annuals are in vegetative state, making for easy identification and mapping. Incidental observations of invasive plants can also be made in conjunction with routine quarterly

[1] An ocular estimate of absolute vegetation cover disregards overlap of the various tree, shrub, and/or herbaceous layers and species. As such, it takes the porosity, holes of the vegetation.

patrols and other monitoring efforts being conducted in the park. Ideally, the invasive plant species would be repeated every 5 years thereafter (see *Section 3.3.2*).

3.3.2 Tree Assessment/Vegetation Monitoring

Properly trained volunteers could assist with conducting a tree assessment along a baseline transect that was established in the park as part of the Management Plan activities. As part of this Management Plan, the transect was overlain on an aerial photograph and is shown on Figure 6. This transect was installed along a north-south gradient through the center of the park, and points were set and labeled (from the south to north, G, F, E, D, C, B, A, BB, CC, DD, and EE) in 200-foot intervals. Perpendicular lines running east to west were set from each of these labeled points on the baseline transect, so that 11 east-west transects are also created, where all trees within 30 ft of either side of the transect are recorded. Location of each tree is recorded as feet from the baseline transect, with negative numbers on the west side of the baseline transect and positive numbers on the east side of the baseline transect (e.g., EE, -66 ft would be a tree located on transect EE 66 ft to the west of the baseline transect). In the original Management Plan, trees along these lines within 30 feet of the baseline transect were surveyed, but only every other transect was surveyed for a total of 6 transects surveyed in a given year. Data collection for each tree includes associated landscape characteristics, habitat type, age class, size measurements, and health. Survey methods and a sample data form are included under *Section 2.0* of this Management Plan, and in Figures 3 and 4 of the Management Plan.

This Plan retains the basics of this tree assessment protocol because these were the methods proposed in the 1987 Management Plan, and prior data was collected via these methods. Future data will be most accurately comparable to prior years, and trends more accurately assessed, if similar methods are used going forward. However, there are a number of ways that this monitoring could be adjusted, modernized, or added to, thus enhancing the ability of the monitoring data to inform future management decisions. These include the following recommended options:

1. **Use of GPS-based mapping.** The transect system described above is relatively easy to lay out, and includes a method for providing location data on trees without actual coordinate-based mapping. The Management Plan was developed in a time when geographic information systems such as GPS were not in widespread use. These systems have become relatively cheap and ubiquitous in recent decades, and can enhance data by providing actual location data in a very efficient way. This allows data to not only be analyzed via spreadsheet, but via maps that can visually illustrate spatial patterns of tree occurrence, health (so that infections that may be spreading can be tracked), and similar spatial data. Plus, taking a GPS point for a tree can be quicker and easier in some instances than the location system used in field for the Management Plan's transect-based method. GPS units can also be programmed to show the permanent transects, saving time and effort from laying these out in the field with physical equipment such as measuring tapes.

N:\Projects3800\3823-01\Reports\Biotic Resources\Fig 6 Aerial Photo and Transect Map.mxd mlagarde

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 6. Aerial Photo and Transect Map
Guadalupe Oak Grove Park Master Plan (3823-01)
June 2016

2. **Tree definition and individual tree tracking.** The method outlined in the Management Plan does not provide instructions on what size of plant constitutes a tree and should therefore be included in the study. For clarity, we recommend a size of 4 inches at diameter breast height (DBH) for a plant to be considered a tree and not a seedling, sapling, or shrub. Secondly, because these transects are permanent and oaks are long-lived species, much of the data collected will be on the same mature trees each time. This has the potential of creating a database that looks similar during each monitoring period, which could potentially mask more subtle changes occurring in younger age classes. Also, because we expect that the same mature trees will be measured over and over again, there is no need to collect data that is not expected to change, or would change only very slowly in mature trees, for example landscape position, size, or age class. We recommend that trees within the permanent transects be tagged for future efforts, which will allow monitoring to better track changes in health and other attributes of individual trees, and reduce some effort in monitoring as it will be possible to simply note that conditions for a certain tree have remained consistent since the last monitoring effort.
3. **Coast Live Oak Seedling and Sapling Recruitment monitoring.** Objective 3 for this Plan is to discourage habitat type transition from the more open oak savannah to closed mixed oak woodland canopy dominated by coast live oak. Because saplings under 4 inches DBH and especially seedlings are much more ephemeral and subject to change over a 5-year period than mature trees, we suggest a plot-based monitoring system for coast live oak seedlings and saplings. A plot can be used that is 60 ft (the width of the permanent transect) by 100 ft (Figure 6). Within this plot, seedlings and saplings can be counted quickly to determine density, and general assessments of health of all seedlings and saplings in this plot can also be made quickly. Changes in density of coast live oak seedlings and saplings in a given area will be a more important indicator for potential habitat type conversion or undesirable coast live oak encroachment than collecting data on each seedling or sapling and/or attempting to follow the fate of any particular seedling or sampling. Similarly, coyotebrush could be monitored the same way. The results of this monitoring effort will help guide decisions to remove woody plant species from certain areas of the park.
4. **Blue and Valley Oak (and Deciduous Hybrid) Seedling and Sapling Recruitment monitoring.** In contrast, there is not as much natural recruitment of deciduous oaks on the site, and this recruitment is much more favorable than coast live oak recruitment, particularly within the mixed oak savannah habitat type. Deciduous oaks may also be planted as part of management. In either case, immature individuals of these species may be desirable to track as individuals similar to mature trees, to determine survivorship, possible threats restricting deciduous oak recruitment such as disease and herbivory, and to know where these individuals are located so that they may be protected by cages during grazing activities.
5. **Introduction of Grassland/Herbaceous Canopy and Residual Dry Matter (RDM) monitoring.** Objective 1 (control invasives), Objective 5 (establish a wildflower meadow), Objective 6 (reduce fuel loads) and Objective 7 (manage herbaceous canopy height and RDM to enhance grassland health) all focus on the herbaceous vegetation within the park. This vegetation layer is currently affected by a high density of invasive species and, due to a completely closed, choked canopy, exhibits a low diversity of grassland species (including few native forbs that form typical Californian wildflower meadows).

Therefore, there is ample reason to directly monitor this aspect of the park's vegetation to track progress on invasives control and increased diversity and density of native species, as well as collecting data on canopy height and residual dry matter (RDM) to help inform grassland management activities such as grazing. It is recommended that 10 ft x 10 ft plots be established within the center of each coast live oak seedling/sapling plot within the permanent transects (Figure 6). The following data would be collected in each of these plots, ideally in April when most grassland plants are identifiable to species:

- Visual estimate of cover by species, as well as an estimate of cover of bare ground and areas of thatch without living plants
- Canopy height
- General observations on herbivory, erosion, or other factors, as apparent

Additionally, with the introduction of managed grazing, it is recommended that four permanent RDM tracking stations be established within the park (Figure 6). RDM will be measured at up to four monitoring locations in the park (preliminary locations identified on Figure 6), and exact locations should be chosen according to slope and aspect prior to the first significant rain and will be established during the baseline activities. RDM is most commonly measured through a combination of clipping plots and estimation, although an experienced Ranch Manager or shepherd may be able to accurately estimate RDM visually. The initial target range for RDM is between 800-1,500 pounds per acre (lbs/ac), depending on slope (discussed in further detail below). During each monitoring event, and at each location, photo monitoring will occur and will include a panoramic view for inclusion in the report.

3.3.3 Reduce the Potential for the Spread of Invasive Plant Species and Harmful Pathogens

Park managers, staff, hired contractors, and volunteers must be educated on measures that will avoid and minimize the spread of invasive species and harmful pathogens (e.g., diplodia fungus, SOD) within the park through the expansion of existing populations, and/or via the introduction of new invasive species brought into the park from elsewhere. Livestock, equipment, vehicles, clothing, and footwear are often needed at multiple locations within- and outside of the park, and as such, their movement across a large landscape allows these materials to become potential vectors for invasive species. In addition, ground-disturbing activities can create ideal conditions for the establishment of invasive plants. The Cal-IPC (2012) has compiled a list of Best Management Practices (BMPs) that are practical, and have been found to be effective in avoiding and/or minimizing degradation of native habitats as a result of the spread of invasive, terrestrial plants. These BMPs may also function to reduce the potential for the spread of harmful pathogens.

- Include a risk evaluation for the potential spread of invasive plant species and harmful pathogens during decisions to implement the activities outlined under the management alternatives in *Section 3.3*. Use data from the invasive plant species survey to aid in the risk evaluation.

- Provide pre-work training on invasive plants and prevention BMPs to staff, contractors and volunteers. Training should include field identification of invasive plants in the work area and methods for safely removing and disposing of plant materials.

- Use a "weed-free" source for materials used on the park (e.g., soil and aggregate and erosion control materials)

- Only procure specimens for planting at the park from nurseries that use Best Management Practices to control and limit the incidence of *Phytophthora* infection.

- Design access routes throughout the park to avoid the existing invasive plant species populations and known outbreaks of harmful pathogens.

- Designate "cleaning areas" on hardscape to remove soil, plant materials, and other debris from equipment, vehicles, clothing, and footwear before entering/leaving the park.

    - Remove soil, seeds and plant parts from tools, the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment. Wash tires and under carriage if the travel route is muddy.

    - Bristle brushes, brooms, scrapers, vacuum cleaners, and hand removal may assist with cleaning without the use of water.

    - When water is required for cleaning, wash on hardscape, and contain waste water and splash from spreading through runoff. If washing is conducted within the park, install berms or silt fences around the perimeters of the cleaning areas to avoid and minimize the spread of contaminated materials.

- Should grazing areas of the park using goats and/or sheep be chosen as a management technique (see *Section 3.3.2*), the Partners should work closely with the professional shepherd to ensure that livestock do not contribute to the spread of invasive plant species. For instance, animals should be brushed at regular intervals to remove soil and plant materials from their legs and hooves.

3.3.4 Signage

A good park signage system can perform multiple functions; it can assist park visitors in navigating the park, encourage learning experiences with regards to the existing natural resources of the park and on-going land management activities, and communicate the park rules. An informal survey of the existing signage conditions, and an evaluation of perceived decision points along trails throughout the park would help inform needs for additional signage. Drawing attention to the unique natural resources and historical aspects of the park would stimulate learning and pride about the area. For instance, the Management Plan recommended educational

signage pertaining to acorn growth, geologic history of rock outcroppings, distribution of plant species based on slope aspect, and wildlife habitat. As described in the Management Plan, the signage system may be designed as an "edu-course" for both self-guided individuals and organized groups led by park staff or docents. In addition, signage

must be installed prior to implementing the management activities outlined in Alternatives 2 and 3 to both inform the public of the actions being taken, and to prevent human disturbance in locations where invasive species removal/control and revegetation efforts are planned. Obvious signage indicating areas where herbicide application, grazing, and/or fire are planned are especially crucial to ensure public safety, and should be posted prior to the implementation of these activities.

3.3.5 Baseline Report

Following the baseline invasive species survey and tree assessment, a Baseline Report would be compiled to summarize the results. This report would detail the methods used to collect and analyze the data, and would be used as a reference in future years to understand how the natural resources of the park change over time. Moreover, the Baseline Report is a necessary tool for understanding the effectiveness of the management activities that are implemented at the park and what the most appropriate management alternative is to use in a given year.

3.4 Management Alternatives

Once the Baseline Activities described above under *Section 3.2* are completed, the Partners would be responsible for selecting management alternatives to be applied in each habitat type on the park. The reconnaissance survey indicates that mixed oak savanna and ruderal grassland habitats would require the greatest management efforts to either maintain or enhance the existing natural resources of the park. Each management alternative and the potential activities that may be implemented as part of each prescription for a) monitoring, b) preserving stands of oak trees, c) controlling excessive fuel loads to prevent fire hazard, and d) removing/controlling invasive species are described in detail below.

3.4.1 Alternative 1: No Management

This "no action" alternative may be selected for years of low growth, when a particular Management Plan Objective is being met, or in habitat types that are least impacted by the regional management issues described above under *Section 1.3*. Currently, natural resources associated with California buckeye savanna and California sagebrush scrub are less imperiled in comparison to the other habitat types that occur on the park. The Partners may also opt for Alternative 1 in additional habitats (mixed oak woodland, mixed oak savanna, and ruderal grassland) during years during which environmental conditions, funding, or other unforeseen circumstances present significant difficulties in carrying out management activities. For example, in a drought year, the park monitors may find that grass canopy height and cover, and corresponding fuel load are low, and therefore it could be decided that grassland grazing is not needed in that year.

Any Objective or habitat that is not being actively managed should be re-assessed at least every 5 years to ensure that the lack of management is not leading to undesirable conditions or an inability to meet Objectives. For example, triggers for other management options include:

- An increasing density of coast live oak seedlings and saplings or coyote brush within the mixed oak savannah
- A high RDM score in the fall of 1500 lbs/acre or more
- New weed infestations, or substantial growth in size or increase in density of an existing infestation
- Signs of disease affecting an increasing number of trees

3.4.2 Alternatives 2 and 3: Maintain Existing Conditions/Enhance Existing Conditions

These management alternatives include activities that collectively represent efforts that would be necessary to avoid and minimize potential adverse impacts on the park's natural resources from invasive species, disease, fire, and lack of blue oak recruitment. In particular, the application of these alternatives should be considered in mixed oak woodland, mixed oak savanna, and ruderal grassland habitat types each year as indicated by monitoring and visual observation by park staff. Alternative 3 selections represent more intense levels of effort, and are highly recommended as a starting point for grassland management in the park to decrease current levels of invasives, reduce average canopy height, open up areas for native forb germination and recovery, and reduce current fuel loads. Alternative 2 or 3 selections are currently recommended for mixed oak woodland and savannah, to maintain current conditions, or potentially improve them through activities such as acorn planting or removal of coast live oak and coyotebrush seedlings and saplings. Once a desirable state meeting Management Plan Objectives is reached in any given habitat (or for any given Objective), more active, intense Alternative 3 management selections are best downgraded to Alternative 2 levels of effort to maintain the positive conditions.

a) Monitoring

Properly trained volunteers could assist with replicating the baseline invasive species survey and tree/vegetation assessment annually, or every 5 years, depending on feasibility and the desires of the Partners. RDM should be tracked each year that grazing has occurred, to allow for an assessment of appropriate grazing intensity. A short summary report would detail any changes made to the methods used to collect and analyze the data from the Baseline Report. Summaries would be used by the Partners to assess changes in vegetation of the park's existing habitats, and to identify new threats to the natural resources of the park. Moreover, these summaries would be essential to evaluating the success of management activities that are implemented at the park as part of Alternatives 2 and 3, and determining whether use of these management alternatives or Alternative 1 (no management) for any Objective is leading to undesirable changes in park ecology.

If active planting occurs, monitoring data should also focus on tracking the conditions of oak or shrub plantings using photo-documentation, and may include limiting mortality/survival counts to the transect plots described above, or also establishing plots in other areas where planting has occurred. As described above, both natural recruits and planted deciduous oaks should be monitored to determine competition from undesirable or invasive plant species; and evidence of herbivory, drought stress, and disease. Natural recruits of coast live oak and coyotebrush should be monitored for changes in density indicating potential habitat type conversion or encroachment of vegetation unsuitable for the savannah and grassland habitats. Results would inform the Partners if adaptive management is needed to ensure the long-term success of plantings, or if control efforts are needed for native woody species. Monitoring could also inform whether plantings are succeeding, as for instance, invasive species may need to be carefully removed from areas around the plantings, wire mesh cages surrounding the plantings may need to be replaced to protect them from natural or grazing-related herbivory, and temporary irrigation may be needed in unexpectedly dry years. Methods of reporting to the Partners can be relatively simple, involving marking findings on an aerial image that depicts boundaries invasive species populations or tree maps, summaries of grassland and tree monitoring data including species lists and indices such as species diversity or species richness[2], or average density of coast live oak seedlings and saplings in areas of interest, and/or by providing photos that detail the life history stages encountered at each population, along with the associated GPS points.

b) Oak Preservation

Signs of disease would be identified by the monitoring activities described above. As described above under *Section 1.3*, the diplodia fungus is of particular concern because it is known to occur on trees in the park. Once forms of disease (e.g. branch flagging and stag-heading of tree crowns) are identified, a certified arborist would determine the appropriate treatment, if any, for the infected tree(s). The removal of individual trees, branches, and/or twigs may be needed to prevent further spread pathogens within- or outside of the park.

It should be noted that impacts to trees may trigger the need for a Tree Removal Permit. The City Municipal Code (Chapter 13 Section 28.220) states that unlawful pruning or removal of street trees (located in public right-of-ways) and/or heritage trees is prohibited without obtaining a permit. Permits to impact ordinance-sized and heritage trees can be obtained from the Department of Planning, Building, and Code Enforcement, and would define protection measures that would be required during development and construction activities to limit adverse environmental effects. For instance, heritage tree work must be performed by a certified arborist and must remain in compliance with the trimming, cutting, or pruning standards adopted by the American National Standards Institute.

[2] A species diversity index takes into account how many species are present, using their relative proportions (or rarity) to put a measure on how many rare species are encountered and how even the species' proportions are (a very even community would have 33% cover of species 1, 33% cover of species 2, and 33% cover of species 3). Species richness is simply how many species were encountered, with no weight on relative proportion or commonality vs. rarity of a given species on the list. Currently, both native grassland species richness and diversity are quite low in the park, so summarizing either measure could aid in tracking improving conditions and increases in native species within the park.

Natural regeneration of deciduous oaks (blue oak and valley oak) would be indirectly promoted through efforts to remove/control invasive species. These efforts would strive to shift the physiognomy of the herbaceous layer of vegetation, and are intended to result in a lower stature mosaic of native grasses and forbs. In addition to a reduction in height, the density of herbaceous vegetation may also decrease, allowing for less competition for light, nutrients, and moisture between deciduous oak seedlings, invasive species, and problematic woody species, such as coyotebrush and coast live oak.

c) Prevent Fire Hazard

Reduction of fuels would be indirectly achieved through efforts to remove/control invasive species. As previously mentioned, these efforts would strive to shift the physiognomy of the herbaceous layer of vegetation by reducing its' height and density. In turn, this would reduce the amount of thatch accumulation in the understory. Large accumulations of woody debris should be manually cleared from the base of live tree trunks to prevent an avenue for flames to climb into the tree canopy in the event of an unintentional fire. Fallen trees or large branches may be left on the ground surface to provide wildlife habitat, and should be individually assessed with regards to their fire hazard depending on their location in the park, size, and branching structure. In some cases, it may be ideal to prune branches of fallen trees and leave larger woody debris on the ground surface. Trails within the park should also be maintained free of obstructions for emergency fire access. Fire breaks may be installed by mowing buffer strips that run parallel to the trails, and around the perimeter of the park. Additional signage posted along fire breaks may prevent fire breaks from becoming "secondary trails" used by park visitors.

d) Invasive Species Removal/Control

An Integrated Pest Management Program that utilizes biological, mechanical, and chemical methods (mowing, herbicide application, fire, grazing, and/or hand removal) should be employed at the park. Using a combination of removal/control methods is necessary to ensure the most successful outcome, while simultaneously providing the greatest amount of protection to the existing natural resources within the park. Primary target invasive species should include black and Mediterranean hoary mustard, Italian thistle, yellow star thistle, and stinkwort, and any newly discovered population of a Cal-IPC non-native invasive species rated as Moderate or High ecological impact, so that the development of new infestations can be avoided while these are still small. These four primary target species are broadly distributed across the park, but the largest and densest infestations were identified in the mixed oak savanna and ruderal grassland habitats (see Figure 4). Secondary target species should include Himalayan blackberry and non-native grasses. Complete eradication of these grasses is not possible; however, controlling them would reduce competition for light and soil moisture that may now inhibit germination and survival of native species, including the deciduous oaks. As such, one of the goals is to "tip the balance" of non-native versus native plants in the park. Coyotebrush and coast live oak seedlings should be considered tertiary target species in open areas that are threatened by encroachment of these native woody species.

This Management Plan provides detailed methods for the Partners to consider during further development of Integrated Pest Management Programs. In many cases, it would take several years of intensive management to

significantly reduce invasive species populations, and use of Alternative 1 (no management) on primary target infestation should be carefully weighed against the probability that past gains in invasives reduction and infestation eradication may be undone by relatively short periods of reducing or stopping treatment and control efforts. On an annual basis, the Partners should weigh the advantages and risks of each approach, and should consider how each method continues to fit into the Management Plan and provides progress towards meeting the Objectives of this Management Plan. It is possible that several different strategies are successful within the park, and thus, it is imperative that invasive species removal/control efforts are persistent, flexible, prevent new seed recruitment, and remain compatible with the public and recreational uses of the park. It should be noted that collected invasive plant material from hand removal efforts that may contain viable seed, or propagules capable of resprouting, should be solarized to kill seeds, or completely removed from the park to be deposited in a regulated landfill or waste management company capable of "hot composting".

Mowing

Mowing is a popular method of invasive species removal/control because it has less of an impact on the land in comparison to fire and herbicides, and it is cost-effective. Depending on the topography of the land, various field or brush mowers may be used across large areas. For smaller populations of invasive species, a handheld weed whip (or string trimmer) may be used on populations that have not yet set mature seed for that season. Substantial thatch accumulation from mowing should be avoided, and ideally, in open areas this can be achieved with swathing and bailing straw, or using a silage harvester that cuts and deposits plant material into a trailer. If neither of these are options, a mulching mower can help to hasten the decay of thatch (Boyer 2013). Drawbacks to mowing include the production of fuel exhaust, and the risk of sparks from metal blades striking rocks and igniting the surrounding dried vegetation. Mowing can also harm native forbs with late season phenology, burrowing animals, and ground-nesting birds, or disturb other nesting birds. As such, mowing is best accomplished outside the effective nesting bird season from approximately February 1 to August 31. If mowing efforts are desired to occur within this nesting season period, surveys for active nests should be conducted and 50-ft no-mow buffers around active nests implemented to protect these nests from disturbance.

Proper timing of mowing is essential, and to some extent, species-specific. As mentioned above, mowing should occur before viable seeds are produced within the target invasive species population, and if possible, after the plant has just begun to bolt. At this time, individual plants have depleted the majority of their resources to seed production, and would not likely have reserves to initiate a second crop. The "viability" of a seed may be gauged by pressing it between one's fingers. If a mushy substance exudes from the seed, it is not yet viable and it is the appropriate time to initiate the first mowing of the growing season. Therefore, managers should perform phenology checks across the park when planning weed control efforts using mowing. Phenology checks are essential to successful invasive species removal/control efforts because viable seeds of yellow star thistle, for instance, only take 8 days to develop once flowering is initiated. Mowing or weed-whacking after viable seed has been set can actually worsen infestations by dispersing seed from cut plants A second treatment of mowing may be applied later in the season to eradicate invasive species that re-sprout and/or initiate a second round of flowering following the initial mowing effort. Timing should be gauged based on the presence of late season native species and potential fire hazard.

Herbicide Application

Herbicide application can be a useful, cost-effective tool for removing or controlling invasive species when used in combination with other methods; however, in many cases the impacts of these chemicals on the ecosystem, and their acute and chronic toxicities to humans and other wildlife are largely unknown. Glyphosate (generic Roundup®) is non-carcinogenic and is thought to be of little concern to human health, as safety evaluations have not resulted in adverse effects on development, endocrine systems, and reproduction of animals (Williams et al. 2000). Glyphosate a post-emergent, non-selective herbicide that is absorbed through a plant's foliage, and moves through the entire plant, including the roots. It interrupts the basic biochemical processes that are necessary to the plant's survival. Residual glyphosate may stay in the soil for several weeks following application, and does have limited movement to untreated plants. As such, any glyphosate application should be restricted to areas that are generally devoid of desirable native forbs and grasses. The seasonal timing of glyphosate application must also occur prior to viable seed production of the target invasive species population, during a window of dry weather lasting several days and low wind speed, and should not interfere with any livestock grazing that might occur on the park. Glyphosate should be considered for use only in targeted areas of high density infestations or persistent infestations that have been resistant to other methods of control. Herbicide is not an appropriate control method for widespread treatment of large areas, within driplines of mature oaks, or in proximity to desirable deciduous oak seedlings or saplings.

Herbicide application may be especially useful at the park as part of site preparation for Alternative 3 revegetation activities such as seeding, or planting plugs and oak seedlings. Once plants dieback several days after exposure to glyphosate, and after at least 3 weeks to avoid residual glyphosate within the soil, accumulated thatch can be removed from the area, and the majority of the ground surface would be devoid of vegetation. Bare ground facilitates seed-to-soil contact and reduces competition for plugs or seedlings, whereas mowing would leave some aboveground biomass and intact roots of invasive species. As described in greater detail below, any seeding should occur during the months of September and October. While the majority of the herbaceous plant community would be senesced at this time of year, stinkwort and yellow star thistle may not have completed their annual life cycles and herbicide may be used to prepare areas infested by these species for revegetation activities. Winter annuals should first be treated between the months of January and March, and stinkwort should be treated in July. In general, glyphosate should be applied twice annually, and second round of application can eradicate new plants that germinate later in the season. In select areas of the park, glyphosate application may also be a preferred treatment where there are small infestations, or where terrain makes the use of other methods either hazardous or ineffective. For example, in rocky areas whipping and mowing may damage resources and equipment, and hand pulling can be a safety risk due to uneven, steep ground. Moreover, it may be a practical method of removing/controlling stinkwort, which can be toxic to livestock (although goats will eat younger stinkwort plants and regrowth from topped plants). Glyphosate may be applied using a boom truck for large infestations, whereas small infestations can be spot treated with a backpack sprayer.

If the partners decide to include herbicide in the Integrated Pest Management Programs for the park, the following guidelines should be followed:

- Use occurs specifically for control of invasive, non-native plant species, particularly primary target species.
- Herbicide use should be guided by label restrictions and any advisories published by the California Department of Pesticide Regulation or the County Agricultural Commission.
- All non-target plant species should be avoided.
- Herbicide drift should be minimized by complying with all label restrictions.
- Application shall be avoided if significant rainfall is predicted in the subsequent 48-hour period.
- The lowest recommended and efficacious rate of herbicide should be used.
- Use would be in accordance with all guidelines and requirements from the Department of Pesticide Regulation.

Grazing

Grazing with goats and/or sheep has become an increasingly popular and effective tool for removing/controlling invasive species when used in combination with the other methods presented herein. In comparison with cattle, they do not require heavy duty or permanent fencing, and their potential negative impacts on the ecosystem from dung and soil compaction are not as great due to their smaller size. Both goats and sheep would readily feed on non-native annual grasses prior to flowering and younger forbs. Goats are generalist browsers, and also can consume tough woody or spiny plant material; in particular, they may be desirable for the removal of woody species in problematic areas with coyotebrush and coast live oak seedlings. In contrast, sheep demonstrate a preference for forbs. Goats and/or sheep may provide some important and unique benefits to the park that mowing and herbicide do not. For instance, if desirable, they can graze the vegetation to a lower height than can be achieved through mowing, and they are an option for invasive species removal/control in rocky, steep areas where mowing presents difficulties. Furthermore, disturbance from their hooves can churn the top soil and can create fine topographic variation on the ground surface that then provides microsites with variable environmental conditions (e.g. moisture) and thus, could allow for greater species diversity.

The goal of grazing is to control or minimize the defoliation of desirable plants while managing invasive species and controlling grassland canopy height. It is most beneficial in the early and late stages of an Integrated Pest Management Program, as it can be used both at high intensities to address invasives and improve habitat conditions within an overgrown ruderal grassland, and at moderate or low intensities to maintain existing desirable conditions once these have been reached. Based on the current conditions observed at the park, "flash" or short-duration intensive grazing for large infestations is recommended. This technique introduces livestock to a site for up to one week; they are concentrated in a specific location using temporary fencing for a short amount of time and allowed to graze with the oversight of a professional shepherd and/or guard dog(s).

After the weed control has been achieved, the land is left to recuperate before the process is repeated. The park would likely require grazing by approximately 100-200 goats and/or sheep. It must be timed when vegetation at- or below the height of the mouths of the livestock being deployed on the park (approximately 2 feet). Grazing of intense infestations of primary target species should occur before any of the target species have set viable seed. Once again, the phenology checks conducted by park managers would aid in the determination of annual timing for grazing. Grazing management shows promising results in control of Italian thistle in Australia, for example, when infested areas are grazed once plants reach a height of 4 to 6 inches.

Although dependent on environmental conditions, March and April would likely be the ideal months to initiate grazing in the park, potentially followed by a second round in June. The desired height of vegetation after grazing may vary, and the professional shepherd would determine when this is achieved and would then move the livestock off that area. Should grazing be used as a tool to prepare a site for revegetation efforts (e.g. seeding, which is described below) a lower height of the herbaceous layer may be desired to allow for good seed-to-soil contact which would enhance the germination of the desirable species being augmented on the site. RDM monitoring can be used to determine grazing targets, and appropriate levels of RDM for the park grasslands are as follows: 800-1500 lbs/acre on slopes of 0–10 percent, 1000–1500 lbs/acre on slopes of 10–20 percent, and 1200–1500 lbs/acre on slopes over 20 percent. RDM measures targeted closer to the bottom ends of these ranges may be desirable when first initiating grazing management, to remediate the currently overgrown and infested state of the park grasslands and encourage growth of native forbs. During drought years, much less grazing (both lower intensity and lower duration for a given area) will be needed to reach RDM targets.

Despite the potential success in the removal/control of invasive species on the park using grazing, cost may be one issue that could render this method unfeasible. Interactions with guard dog(s) and other dogs on-leash in the park must also be prevented, as the guard dog(s) are trained to protect their livestock herd from predators, including coyotes. Many professional shepherds are; however, experienced in grazing in urban settings, and it is also possible to prohibit public access in the short-term in specific areas of the park where the grazing operation is visible. Additionally, the professional shepherd will often times request to sleep on-site near their herd in case of emergency, and thus, a temporary trailer may need to be placed in some location within the park.

Fire

Grassland and savanna habitats in California are well adapted to periodic fires as a result of intentional burning by the Native Americans prior to European settlement of the state (see *Section 1.3.2* above) and also from lightning strikes. Today, fire is an effective land management tool that can control invasive species, promote the growth of native grasses and forbs, and reduce dangerous fuel accumulation. However, it is scarcely implemented due to the fear of a burn spreading to unwanted areas or harmful impacts from smoke on the respiratory health of the general public. One other, less intensive use of fire in an Integrated Pest Management Program, is the use of seedling flaming techniques. This is a much more targeted burn technique where the goal is not to produce an actual burn on the ground. Instead, this tool is best employed in an invasive plant infestation that has been controlled in some other way, and now is experiencing a thick growth of young

seedlings in the area where more mature plants have been removed. This method involves using a propane blowtorch to "cook" seedlings before they can mature by waving the blowtorch from side to side a few inches above the seedlings. For safety and effectiveness, this method should only be employed in the winter or early spring months when the ground and seedlings are damp with precipitation or morning dew. The goal is not to light the seedlings on fire, but to kill them with a moist heat. This can help exhaust large latent seedbanks that have developed within dense infestations in the park.

Hand Removal

Hand removal of target invasive species and undesirable woody plants, such as coyote brush and coast live oak seedlings would be most effective toward the later stages of the Integrated Pest Management Program, once populations are reduced in size and density using a combination of the techniques described above. It is also a good choice in treating discrete infestations of limited size. This technique should be implemented prior to the production of viable seed by the target species. The results of the reoccurring invasive species surveys can provide information regarding locations of patches of invasive species that are appropriate for hand removal. This method of invasive species removal/control is currently carried out at the park by volunteers using basic landscaping tools such as spades, shovels, and/or weed wrenches, which are designed to uproot woody and deep-rooted plants. Future hand removal efforts should ensure that volunteers are properly trained, and should provide them with maps of target locations, written instructions for removal and appropriate tools for digging out roots such as a weed wrench, and photos of target species.

3.4.3 Restoration and Active Enhancement

This section describes a collective of Alternative 3 activities that represent a higher level of effort in enhancing, or restoring the park's natural resources. The majority of these activities were detailed in the Management Plan and still remain as feasible options for the park; however, they would not be successful unless they are implemented concurrently- or following management to improve and/or maintain current conditions in the park habitats as described above. In particular, the activities described below should be considered for mixed oak woodland, mixed oak savanna, and ruderal grassland habitat types.

a) Oak Planting and Replacement

The Management Plan recommended replacing dead blue oaks on the in the mixed oak woodland with Valley oak trees, in addition to planting blue oaks in the mixed oak savanna. Due to the relatively closed canopy of the mixed oak woodland, it is possible that valley oak germinants and seedlings would be light inhibited in this habitat. As such, we recommend in this Management Plan that efforts to revegetate the park with deciduous oaks be focused in the more open, savanna habitat type. Just as described in the Management Plan, planting clumps of blue oak acorns and/or seedlings would likely be a more effective strategy due to the expected high mortality rates of plantings. During a site assessment of the park, Dave Muffly observed crossbreeding between Valley and blue oaks in the mixed oak woodland (Pizzo 2016, pers. comm.). Due to potential hybridization issues of these species at the park, and the rarity of blue oaks now found on the Santa Clara Valley, it is possible that the blue oaks at the park are genetically unique. This may be due to their isolation from other blue oak

populations in the Diablo Mountains and their foothills, which are in closer proximity to one another, thus, allowing for gene flow. For this reason, acorns for plantings of blue oak should be collected directly from the existing park trees to the extent feasible.

Acorn collection could provide an enjoyable and educational experience for volunteers and/or school groups, and should occur in the early fall season when their color is beginning to turn from green to brown. To determine the proper timing of collection, park managers conducting phenology checks at the park should include blue oaks in their patrols. The healthiest acorns are collected directly from trees, which may be picked by hand or knocked onto a tarp laid on the ground surface. Should acorns be collected directly from the ground surface, the "float" test should be performed, where acorns are placed in water and only those that sink are considered viable for planting. The caps of acorns must be removed prior to storage, and once this is done, acorns should be placed in the refrigerator for 1 month to slow metabolic activity and to prevent excessive drying. During this time, blue oaks are especially prone to premature germination, and if this is observed the collection should be planted out as soon as possible (University of California 2016b). Acorn collection from the park itself would be depending on the annual crops of the existing blue oaks. If collection is not possible, or in the event that the Partners elect to plant blue oak seedlings, it is essential that plant materials are obtained from a local source in the Santa Clara Valley, or at least similar ecotype from the foothills of the Diablo Mountains. Again, genetic material local to the park itself is strongly preferred and planting efforts may be postponed until a good acorn crop occurs.

Planting a combination of acorns and seedlings should occur at intervals of 5 to 10 years to produce an uneven age class of blue oaks. Acorns can be planted from November, after the first rains of the wet season have soaked the soil, until early March. A critical factor affecting young oak germinants and seedlings is competing vegetation, and therefore, it is recommended that a 2 to 3 foot radius surrounding the blue oak clumps be cleared of vegetation prior to planting. This could be accomplished through the implementation of any of the appropriate techniques incorporated into the Integrated Pest Management Program outlined above, or may be achieved in smaller, targeted areas by hand-removing vegetation. Mulching around plantings may help to prevent encroachment following the initial clearing, and would also help the soil retain moisture. Acorns should be placed 0.5 to 1 inch below the ground surface. Holes should be dug to a slightly greater depth, and the bottom loosely backfilled with native soil before planting to facilitate root growth. Seedlings should be planted from December to February in holes that are augered 1 to 2 feet below the ground surface, and once again, the bottom should be loosely backfilled with native soil before depositing seedlings in the ground.

Acorns are an important food source for wildlife at the park, such as ground squirrels, and there is always a risk some of them would be dug up and consumed. Further, tender young shoots sprouting from acorns or new growth on seedlings may be browsed on by wildlife and insects. To protect the blue oak clumps, a wire mesh cage can be constructed around them, above- and below ground if possible. Cages could consist of aluminum screening that is formed into a cylinder, folded closed at the top, and stapled to a wooden stake. Cages should be monitored at regular intervals and maintained to prevent herbivory. Protection may also be provided by surrounding the blue oak clumps with additional plantings of native shrubs. These "islands of vegetation" are

discussed in the Management Plan under the Tree Summary section and depicted in Figure 9 of the Management Plan, and are described in greater detail below. Finally, supplemental irrigation may be needed in particularly dry years so that large numbers of the young planted oaks do not die. In this scenario, a water truck could be brought to the park to irrigate the planted areas of concern in a targeted manner so as to not compromise the overall success of the Integrated Pest Management Program.

b) Shrub Canopy Enhancement

Planting native understory vegetation in the mixed oak woodland and/or mixed oak savanna habitats would build a shrub layer (which is now generally absent from the park), and in turn, would provide wildlife habitat and increase the diversity of plant species. As mentioned above, shrubs can also be placed around the perimeter of "islands of vegetation" to protect clumps of blue oaks in their center. The Management Plan recommended planting several species of native shrubs that still remain as feasible options for the park. The original recommendation was partially based on slope aspect (see Figures 11 and 12 of the Management Plan), and included buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), California coffeeberry (*Frangula californica*), common snowberry (*Symphoricarpos albus*), spreading gooseberry (*Ribes divaricatum*), and mountain mahogany (*Cercocarpus betuloides*). However, the Management Plan did include coyotebrush as a possible species to plant, which is no longer desirable due to its potential aggressive encroachment on grassy areas the park. Should the Partners decide to revegetate the park with native shrubs, fire resistant plant species should be selected to the extent possible. Although fire resistant plant lists are notoriously fallible, buckbrush species are notoriously resistant to burning (Schettler 2010). Although these traits may be regionally, or site-specific, plants that are less likely to ignite and burn quickly have a high moisture content in their foliage, open branching habits (as opposed to dense, upright growth), and non-resinous stems and leaves.

The layout for revegetating the understory must be designed to prevent fire hazard, and further, must avoid the conversion of the open, grassy areas of mixed oak savanna to woody species. If shrub planting in undertaken, extra vertical space should be allowed between shrubs and trees to prevent flames from reaching tree crowns, and extra horizontal space should be afforded between all woody species to slow the spread of potential surface fires. These gaps in the mixed oak woodland and savanna habitat types would also need to be maintained as understory plantings grow and natural recruitment occurs. It may be advantageous to plant seedlings of shrubs to facilitate faster growth which may provide better protection of clumps of blue oaks at the center of "islands of vegetation". Shrub seedlings should be planted during the wet season from October to January.

c) Seeding to Increase Cover of Native Grassland Plants

Augmenting native seed that can serve as a strong competitor with target invasive species might be necessary to "tip the balance" between native and invasive species; and thus, preventing infestations in treated areas of the park from returning. Mowing, herbicide, grazing, fire, or hand removal can help prepare the site for seeding, and in some cases may be utilized for general maintenance thereafter. To the extent feasible, native seeds should originate from local ecotypes; the seed source should be from populations in the vicinity of the park that occupy the same habitat types, and in addition, elevation, slope, and aspect of the land from which the seeds were obtained may also be taken into account. Native seeds may be collected and processed by properly trained

volunteers; or seeds with genetic material local to central coastal California may be sourced and purchased from a reliable nursery experienced with restoration of California native species and habitats.

Depending on availability of appropriate native seeds, a seed mix should be designed with competitive native species in ratios appropriate for the size of the area slated for revegetation. The most basic seed mix should contain a high ratio of native perennial grasses, such as purple needlegrass (*Stipa pulchra*), and a lower ratio of common, native forbs such as California poppy (*Eschscholzia californica*) or yarrow (*Achillea millefolium*). More complex seed mixtures that contain a greater diversity of native graminoids, forbs, and bulbous species and the use of plugs are discussed below. Native perennial grasses are particularly well-suited for the park because they have been observed to flourish following fire and flash grazing because, among other reasons, they are freed of a substantial amount of interspecies competition when they emerge later in the growing season. Fire and grazing also reportedly facilitate the fragmentation of individual native perennial grass plants, which is an important means of asexual regeneration for this plant functional group, and especially for purple needlegrass (Bartolome 1987, Dyer 1993, Langstroth 1991, Steinburg 2002). Further, purple needlegrass is an excellent species for restoration projects because it is tolerant of disturbed soils, and its deep roots can prevent erosion.

As mentioned above, seeding should occur in September or October, always following (and never directly preceding) the implementation of other invasive species removal/control techniques occurring at that time of the year. Two straightforward methods of seeding can be used immediately following the preparation of a site: broadcast seeding or drilling. Broadcast seeding has the lowest establishment rate, but it is the most inexpensive. Seeds may be broadcasted by hand across the ground surface, followed by raking to ensure the seeds are covered and in full contact with the soil. This could be accomplished by properly trained volunteers. Drilling requires the use of a rangeland or agricultural drill that deposits the seed at a specified interval and depth. It also requires the removal of awns from grass seeds during processing. Although expensive, drilling is a highly efficient method of sowing scarce seed when high germination rates are essential. Although temporary irrigation is not recommended as part of this Management Plan unless needed for the survival of young planted oaks, it is worth noting that an extended dry season may inhibit the germination of seeds.

Establish a Native Wildflower Meadow

The establishment of a native wildflower meadow(s) in open, grassy areas of the park would require some additional effort in comparison to seeding prolific native, herbaceous species solely for the purpose of "tipping the balance" and preventing infestations of invasive species from returning once they are treated, as described in the preceding section. Increasing the diversity of wildflowers at the park would directly benefit native pollinators (e.g. birds and insects such as bees, moths, and butterflies), and would also provide a focal point and educational opportunity for park visitors. During the December 2015 reconnaissance survey, we identified an ideal and visible area of the park for a future wildflower meadow once it is successfully treated for invasive species (Figure 4). This area is now a moderately sized patch of ruderal grassland that is infested with weedy mustards and Italian thistle, situated on a south-facing slope that is visible from numerous trails and park facilities.

The site would be prepared and seeds could be applied using the same methods as described above. An appropriate seed mix should be designed using native graminoids and forbs, and seeds sourced from local ecotypes may be collected by volunteers or purchased from a nursery. The acquisition of native bulbs or plugs for direct planting at the wildflower meadow site may also be considered. If it is determined that success of the first revegetation effort is critical, one can hire commercial growers to grow-out seed in greenhouses in trays that produce individual plants, each in a small container about the size of an ice cube. Planting should occur between the months of December and February, as the soil must be moist. Using a digging or "dribble" stick, a hole in the ground is made that is approximately the same size as the plug itself. Individuals are then deposited into the hole, and a small amount of soil is tamped down around the base of the plant. Volunteers with proper training can accomplish this task, and may efficiently work in teams of three that include a hole-puncher, a planter, and a tamper. Using this method, it is possible to plant 300 to 500 plants per hour (M. Goklany, pers. obs.). Plugs are often used to establish a small plot that is used to increase seed for larger plantings. Survivorship of plugs, when planted properly, is often 95% or greater, as the critical time period for native grasses is the seedling stage.

3.5 Management and Monitoring – Decision Tree

Prior to the commencement of the active management alternatives described herein, the Partners would be responsible for ensuring the following baseline activities are implemented at the park, in the manner set forth above under *Section 3.3*. The baseline activities include those related to general maintenance, biotic surveys and reporting. The level and/or type of management activities outlined under Alternatives 1-3 (see *Section 3.3*) may need to be customized for each of the Management Plan Objectives (see *Section 1.4*) in a given year thereafter. Decisions regarding which specific management and monitoring activities to implement at the park will be made by the Partners, and the City will ultimately determine which resource agencies, conservation groups, or trained volunteers from the general public shall perform the activities.

It is recommended that the Partners have an initial meeting in 2016 to plan for implementing baseline activities. Thereafter, it is advised that the Partners meet on an annual basis to determine which management alternatives shall be implemented in subsequent years. The results presented in the baseline report, data collected in subsequent monitoring efforts, and incidental observations from the Partners, resource agencies, conservation groups, and other volunteers at the park shall guide the Partner's decision-making process, and each meeting shall address whether the Management Plan Objectives are being met. Annual meetings should also address projected environmental conditions, funding, among other circumstances which are subject to frequent change.

Alternative 1, a "no action" alternative, may be selected for years of low growth, when a particular Management Plan Objective is being met, or in habitat types that are least impacted by the regional management issues described above under *Section 1.3*. Any Objective or habitat that is not being actively managed should be re-assessed at least every 5 years to ensure that the lack of management is not leading to undesirable conditions or an inability to meet Objectives. Alternatives 2 and 3 include activities that collectively represent efforts that would be necessary to avoid and minimize potential adverse impacts on the park's natural resources from

invasive species, disease, fire, and lack of blue oak recruitment. It should be noted that the activities outlined under Alternative 3 represent the maximum effort that may be employed at the park to meet the Management Plan Objectives, but they will likely be futile unless they are implemented in parallel with the activities outlined under Alternative 2. For instance, revegetation activities may not be successful unless invasive species removal/control efforts are implemented. Once a desirable state meeting Management Plan Objectives is reached in any given habitat (or for any given Objective), more active, intense Alternative 3 management selections are best downgraded to Alternative 2 levels of effort to maintain the positive conditions.

3.5.1 Timing

The Partners, in collaboration with prospective volunteer groups and/or contractors (e.g., professional shepherd), shall determine the timing of chosen management and monitoring activities at the park. While the timing of some activities may be flexible, many are dependent on plant phenology, which is variable on an annual basis. As such, all of the parties involved with implementing management and monitoring activities must retain some flexibility for unanticipated events. Table 2 lists the recommended timeframe for implementing activities at the park to help guide the Partners in their decision-making process.

Table 2. Timeframe to Implement Management and Monitoring Activities

Management and Monitoring Activities		Timeframe
Baseline Activities		
Invasive Plant Species Survey		Conducted June- July 2016 and every 5 years thereafter
Tree Assessment/Vegetation Monitoring		Conduct during peak growing season if possible
Reduce the Potential for Spread of Invasive Plant Species and Harmful Pathogens		Implement continuously
Signage		Conduct during 2016
Baseline Report		Complete by August 2016
Alternative 1		
No management		Revaluate every 5 years
Alternative 2		
Monitoring		
	RDM Monitoring	Conduct in April (only if grazing is implemented)
	Active Planting Monitoring	Conduct April - June
Oak Preservation		Dependent on management needs and tree work requirements
Prevent Fire Hazard		Control fuels before the onset of the dry conditions (April - June)
Invasive Species Removal/Control		
	Mowing	Dependent on phenology of target invasive species and vegetation height Best accomplished outside of nesting bird season (February 1 to August 31)
	Herbicide Application	Target winter annual species from January - March Target stinkwort in July Prepare restoration area(s) for seeding August - September
	Grazing	First grazing round March - April Second grazing round in June
	Fire	During wet conditions December - April
	Hand Removal	Dependent on phenology of target invasive species

Alternative 3	
Oak Planting and Replacement	
Plant acorns	Plant in 5-10 year intervals
Plant seedlings	Plant in 5-10 year intervals
Shrub Canopy Enhancement	Plant shrub seedlings October - January
Seeding to Increase Cover of Native Grassland Plants	Plant seeds September - October
Establish a Wildflower Meadow	Plant seeds September - October Plant plugs December - February

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Appendix A. Photos from December 2015

Photo 1. A patch of yellow star thistle along a trail in the park.

Photo 2. A dense infestation of weedy mustard in ruderal grassland habitat.

Photo 3. Italian thistle seedlings in ruderal grassland habitat.

Photo 4. Non-native annual grasses dominate the herbaceous layer of the mixed oak woodland.

Photo 5. Coast live oak canopy in the mixed oak woodland.

Photo 6. Coast live oak saplings in the understory of the mixed oak woodland.

Photo 7. A stand of blue oaks in the mixed oak savanna.

Photo 8. Much of the ruderal grassland habitat in the park is infested with weedy mustards.

Photo 9. California buckeye woodland habitat.

Photo 10. California sagebrush scrub habitat.

Photo 11. Trail and interpretive sign in California sagebrush scrub habitat.