



Friends of Sausal Creek

Promoting Watershed Protection

Fern Ravine Restoration Plan



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Oakland, CA
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Front Cover (clockwise from top left): Main Wetland, Redwood Understory, Uplands, Fern Ravine Creek

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1. Introduction

This document describes the plan for restoration and enhancement of a portion of the Fern Ravine sub-basin of the Sausal Creek Watershed in Alameda County, Oakland, California. The Fern Ravine sub-basin includes Fern Ravine Creek and the adjacent wetlands and uplands, including an area with natural, second-growth redwood (*Sequoia sempervirens*) forest. The document assesses existing site conditions and recommends management actions for site hydrology, sediment, and the control of invasive plants. The plan also details short- and long-term native plant revegetation and vegetation maintenance measures.

The Friends of Sausal Creek (FOSC) and the Friends of Joaquin Miller Park (FOJMP) have adopted the Fern Ravine site through the City of Oakland's Adopt-a-Creek volunteer program. This program provides support to groups who adopt creek areas in need of cleaning, greening, or maintenance. Project partners include:

- Friends of Sausal Creek;
- Friends of Joaquin Miller Park;
- City of Oakland Environmental Services Division, Office of Parks and Recreation, Public Works Agency, and Watershed and Stormwater Management Program; and
- U.S. Environmental Protection Agency (USEPA) – Wetlands Regulatory Office.

The restoration plan is funded by the USEPA, Wetlands Regulatory Office, San Francisco, CA, under the federal Clean Water Act (CWA). The goal of the CWA is to maintain and restore the physical, chemical, and biological integrity of the nation's waters, including streams and wetlands. One approach to meeting CWA goals is the development and implementation of restoration and enhancement plans aimed at protecting important aquatic resources. Beginning in September 2009, FOSC and the USEPA initiated a collaborative effort to assess site conditions and to develop a strategy for improving the habitat functions of Fern Ravine aquatic habitats and adjacent uplands. This led to the creation of a Redwood Forest Committee by the Friends of Joaquin Miller Park in September 2009 and to procurement of USEPA funding for this plan. The FOJMP Redwood Forest Committee is currently working on a circulation plan for the entire Joaquin Miller Park redwood forest area.

2. Project Area

Fern Ravine Creek is one of Sausal Creek's most ecologically important tributary streams. The headwaters of Fern Ravine Creek rise in Joaquin Miller Park in the Oakland Hills (Figure 1 and Figure 2). The 8.6-acre project site is located in the upper portion of the Fern Ravine sub-basin. It generally encompasses:

- A regionally-rare palustrine wetland which lies near the headward extent of Fern Ravine Creek;
- Fern Ravine Creek and its adjacent riparian wetland and redwood forest; and
- Degraded upland characterized by a mixture of invasive, non-native forbs, grasses, shrubs, and trees, and native species typical of grassland, coastal scrub, and woodland communities.

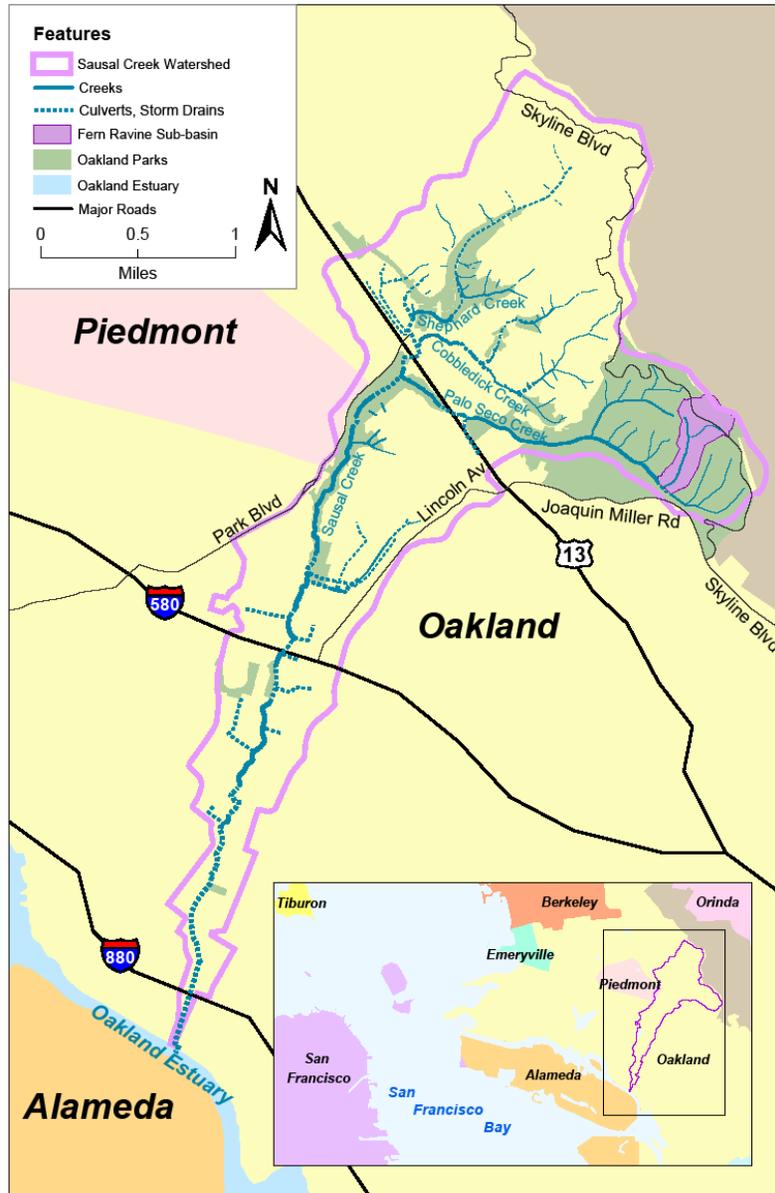


Figure 1 Creek Watershed and Project Site

The most heavily degraded habitats include the redwood forest understory, Fern Ravine streambed and banks, and uplands adjacent to the palustrine wetland.

From its source at the palustrine wetland near the entrance to Sequoia Horse Arena off of Skyline Blvd., Fern Ravine Creek flows into a redwood forest for a distance of about 1,000 feet before crossing Sequoia-Bayview Trail. It then flows approximately 0.25 mile to its confluence with Palo Seco Creek. Palo Seco Creek flows another 1.75 miles where it joins Shephard Creek to form Sausal Creek slightly downstream from Highway 13.

All of the land west of Skyline Blvd. is within the City of Oakland's Joaquin Miller Park. On the east side of Skyline Blvd., within an area administered by the East Bay Regional Park District's Redwood Regional Park, there is a parking lot for the Metropolitan Horsemen's Association Clubhouse and Redwood Bowl, a general use recreational area surrounded by redwood forest.

The redwoods of Joaquin Miller Park were logged starting in the 1840s and continuing for about 20 years. Here is the description from the *Sausal Creek Watershed Enhancement Plan*:

Over a 20-year period the redwood forest was completely clear-cut. There were a number of lumber mills in the area, including one on Palo Seco Creek near the present location of Highway 13. Over 98% of the redwood forest in the Sausal Creek watershed was clear-cut. Between 1870s-1880s, the stumps of the redwoods were taken for shingles and firewood, providing more than half of the firewood for East Bay households. The redwood forest was burned after logging and then grazed. Many of the original logging roads and skid trails are now used as hiking trails or major roads.

An 1878 "Alameda County Farm Map" of the area shows several parcels and two dwellings in or near the project area. The map was published by Thompson and West and is available at www.davidrumsey.com.

The redwood groves in Joaquin Miller Park have been the site of recreational activities since the park was created in the 1920s. Remnants of old concrete fire pits can be found throughout the grove. The Horseshoe Picnic Area, which is adjacent to the Fern Ravine wetland area, is used by the public and is also used by the City of Oakland for city-sponsored day camps. The Sequoia Horse Arena hosts the Metropolitan Horsemen's Association's shows and trail rides. With the nearby restrooms, available parking, picnic areas, and horse shows, this part of Joaquin Miller Park experiences a high volume of on- and off-trail foot and bicycle focused recreational use, especially during the summer months. There is also an orienteering course that has several markers in the redwood grove.

Past and ongoing poor land use practices have degraded Fern Ravine Creek, its adjacent wetlands and uplands, and the redwood forest understory. Fern Ravine Creek and the adjacent redwood forest above its junction with the Sequoia-Bayview Trail are experiencing significant losses of native understory vegetation, soil compaction, erosion, and sedimentation. A result of poor land use is the establishment of invasive, non-native

plants throughout the sub-watershed. Native plant communities have been severely reduced and degraded. In addition, other important ecosystem functions performed by Fern Ravine Creek have been significantly degraded.

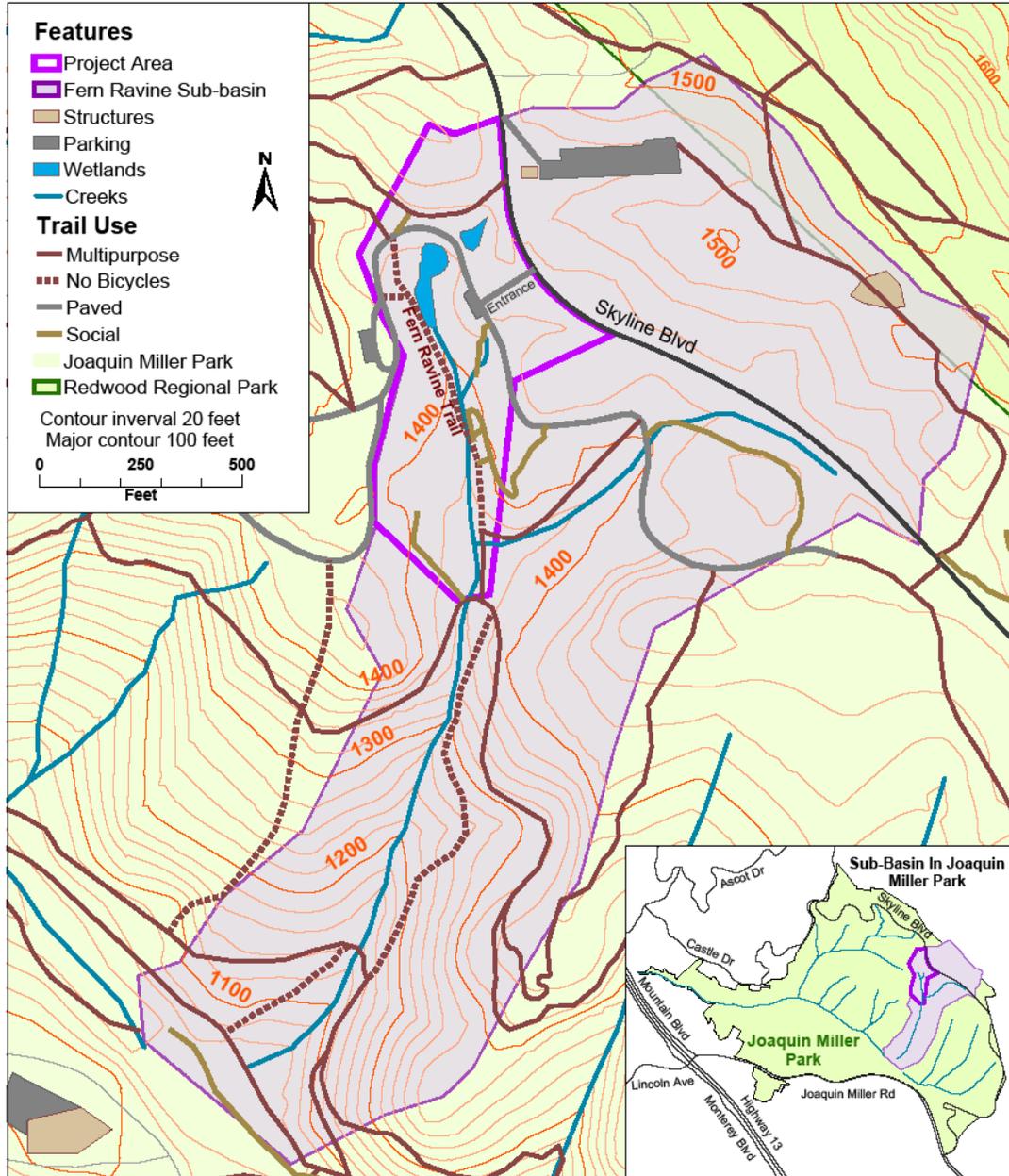


Figure 2 Fern Ravine Sub-Basin and Project Site

3. Project Description and Objectives

The Fern Ravine Restoration Plan will guide short- and long-term restoration activities in the sub-watershed. By studying the existing conditions, alternatives for improving the overall ecological health of the sub-watershed can be identified. This plan seeks to identify, characterize, and develop solutions for the primary “hotspots” of environmental degradation including both structural remedies and land management modifications. The current patterns and intensity of recreation activities cannot continue without further degradation to ecological functions of the Fern Ravine sub-watershed. Remedies will seek to balance authorized recreational use with measures to protect and enhance the ecological integrity of Fern Ravine. Options for reducing human impacts will be explored, including public outreach, volunteer participation, and installation of barriers and interpretive signage. The objectives of the Fern Ravine Restoration Plan are to:

- Reduce non-native plant cover, with focus on the most invasive species;
- Increase native plant cover and species diversity, thereby enhancing the biodiversity and habitat support functions of native plant cover;
- Restore/enhance the denuded redwood plant understory;
- Reduce erosion through improved sediment management practices to protect and enhance wetlands and tributary creeks; and
- Increase public awareness of the importance and interconnectedness of wetland, stream, redwood forest, and other upland habitats to overall ecosystem health through interpretive signage, public outreach, and volunteer opportunities.

4. Existing Site Conditions and Critical Management Issues

This section provides a general ecological overview of the Fern Ravine sub-basin. Each section includes a description of existing conditions and identifies important management issues and opportunities for environmental improvement. Figure 3 shows the major features of the site.

4.1 Geology

The source of Fern Ravine Creek is the geological contact zone that generally parallels Skyline Blvd. (Figure 3). This geologically active contact zone is characterized by areas of shallow subsurface groundwater storage and discharge that are best observed in the sites seeps (*i.e.*, Main and Upper Wetlands). As a result, the areas below this contact zone support lush stands of native wetland plants, such as sedges, rushes, and cattails, that rely on saturated soils. The geologic units at the site are illustrated in Figure 4 and described in Table 1.

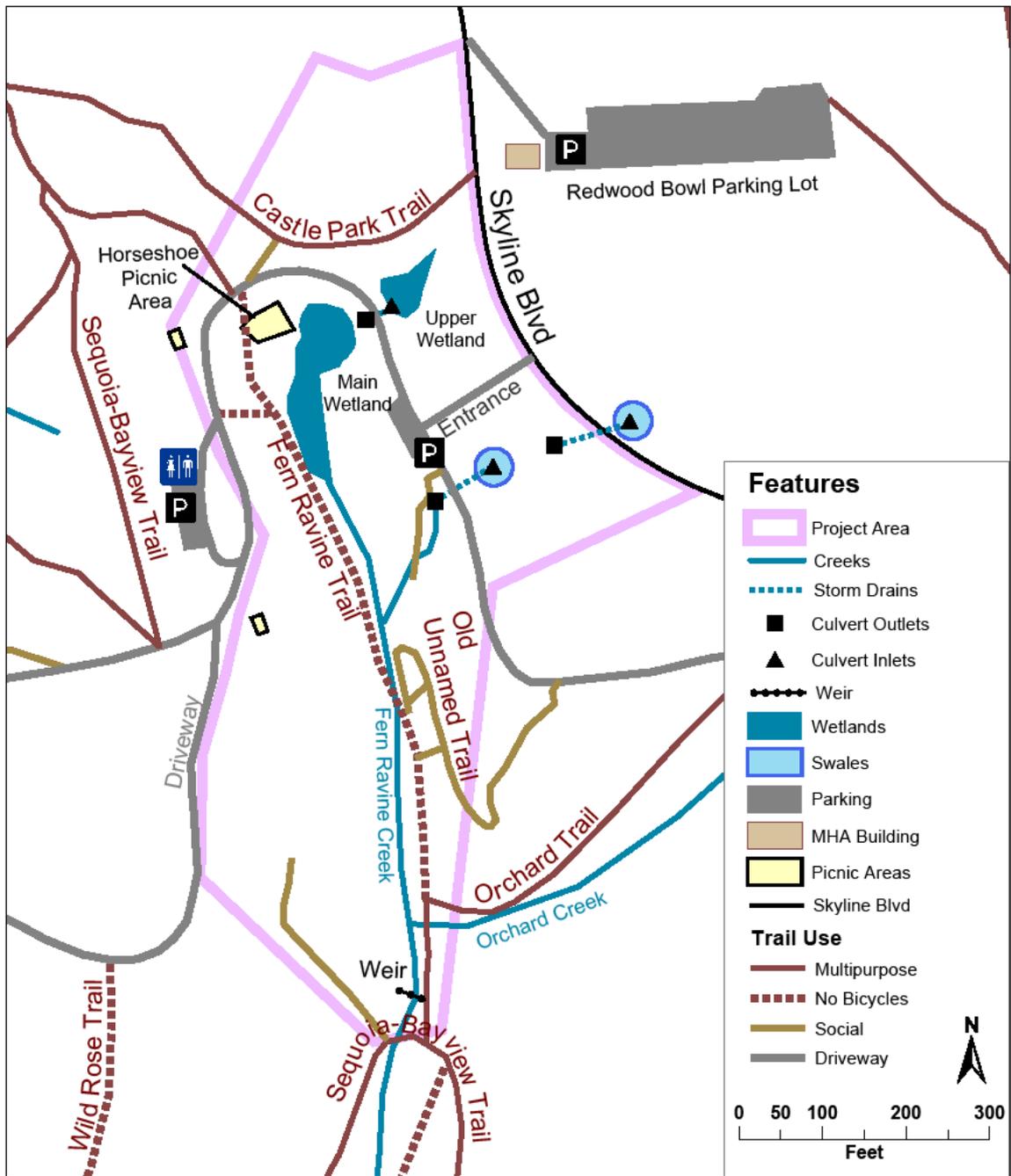


Figure 3 Major Site Features

Table 1 Geologic Units

Key	Type	Description
Ko	Oakland Conglomerate	Massive, medium-to coarse-grained, biotite and quartz-rich wacke and prominent interbedded lenses of pebble to cobble conglomerate. Conglomerate clasts are distinguished by a large amount of silicic volcanic detritus, including quartz porphyry rhyolite.
Kjm	Joaquin Miller Formation	Thinly bedded shale with minor sandstone. The shale grades into thinly bedded, fine-grained sandstone near the top of the formation. The contact with the overlying Oakland Sandstone is gradational.

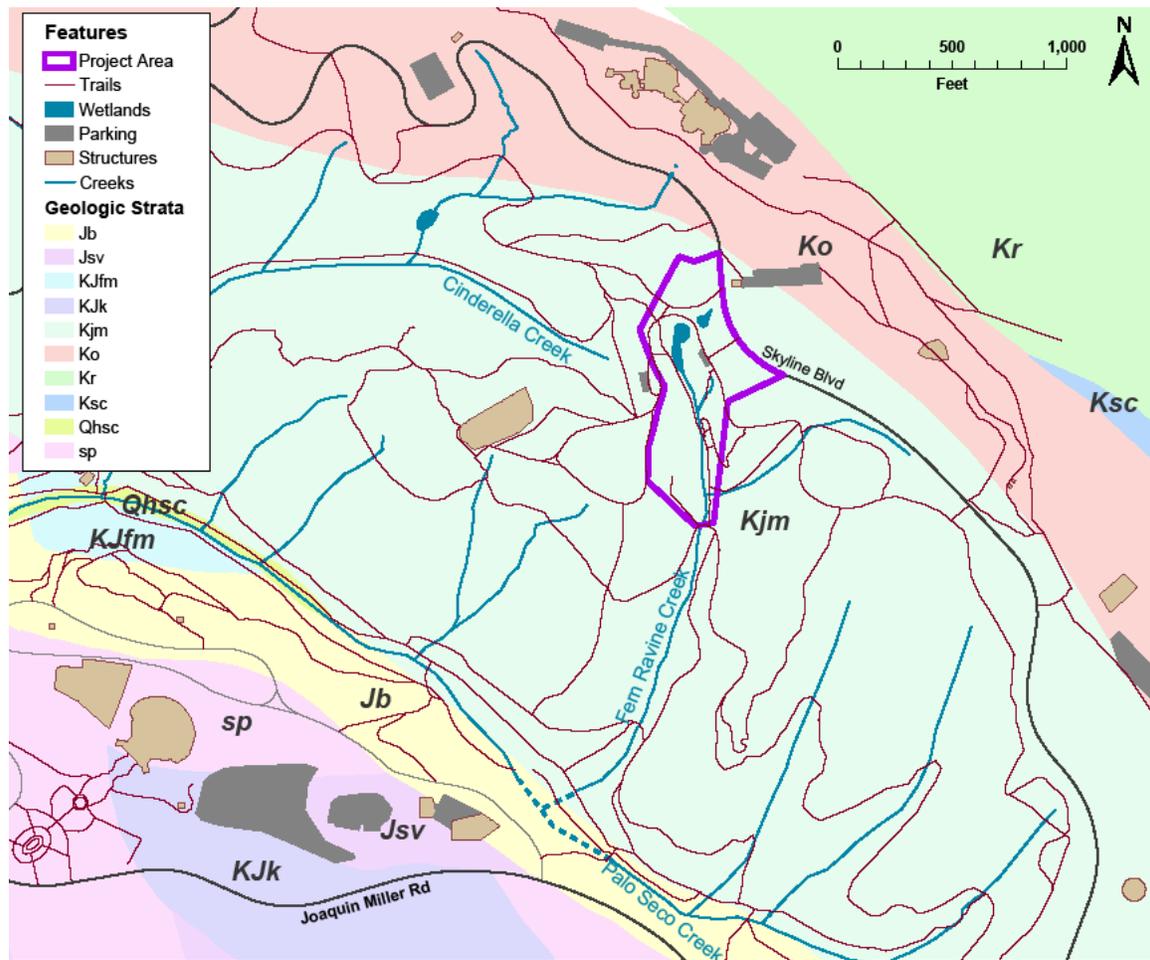


Figure 4 Fern Ravine Geology

4.2 Hydrology and Water Quality

Project site drainage patterns are depicted in Figure 5. Alterations to the hydrology of the area began with the logging of the redwoods in the 1840s. Construction of Skyline Blvd., park access roads, and parking areas have changed the natural drainage patterns at the project site. Development of the upper Fern Ravine sub-watershed as a park with facilities for hiking, mountain biking, and horseback riding has had a significant impact on site hydrology and sediment transport processes. The loss of native understory vegetation has resulted in a concomitant loss of soil stability leading to erosion, especially around the base of the redwoods. Soil compaction from off-trail recreational activities increases the amount and rate of surface water runoff, which results in increased sediment transport and delivery to Fern Ravine Creek and wetland. In addition, increased flows to Fern Ravine Creek have caused localized channel incision and bank erosion. Continuation of the current patterns of erosion in Fern Ravine will jeopardize the integrity of the biological resources and ultimately the recreational trails themselves.

The Redwood Bowl parking lot (approximately 24,000 square feet or just over one-half acre in size) was altered from a gravel to asphalt surface in approximately 2005. The parking lot drains toward its southwest corner. Water then flows down the northeast side of Skyline Blvd. and into a small swale. The rest of the area above Skyline Blvd. also drains into the swale. The swale has a storm drain at its lowest point; the outlet is across Skyline Blvd. in a second swale. Another storm drain inlet carries water under the park road, forming a small tributary in the project area that ultimately joins Fern Ravine Creek in the redwood forest area of the project site. Further study may look at the possibility of using these swale areas for stormwater detention and groundwater recharge.

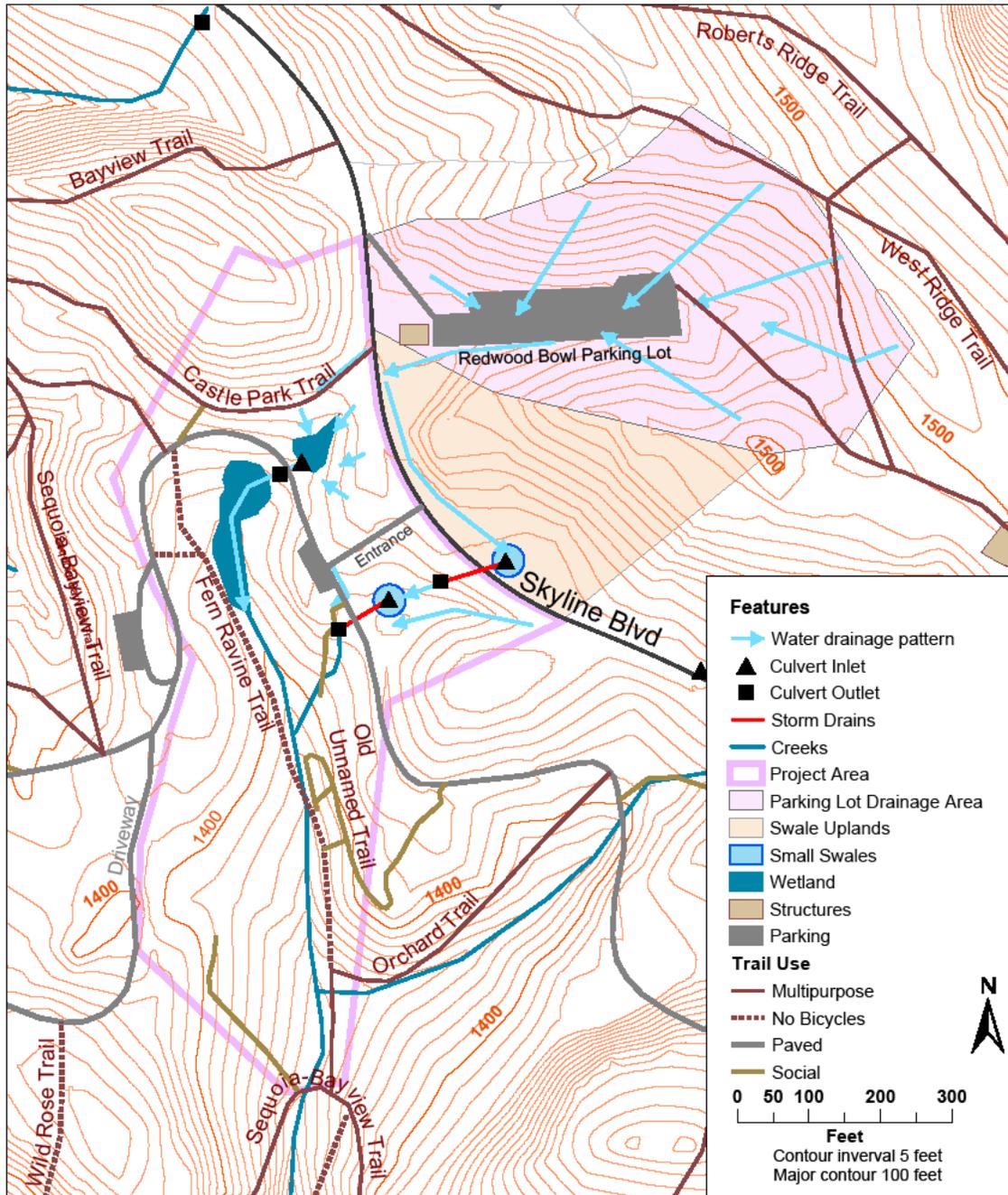


Figure 5 Drainage Patterns in the Fern Ravine in the Project Area

Problematic Hydrologic Features

Site visits to the project area by a civil engineer and an environmental planner identified three problematic areas. These areas are discussed from upstream to downstream (*i.e.*, north to south) and are shown on Figure 6.

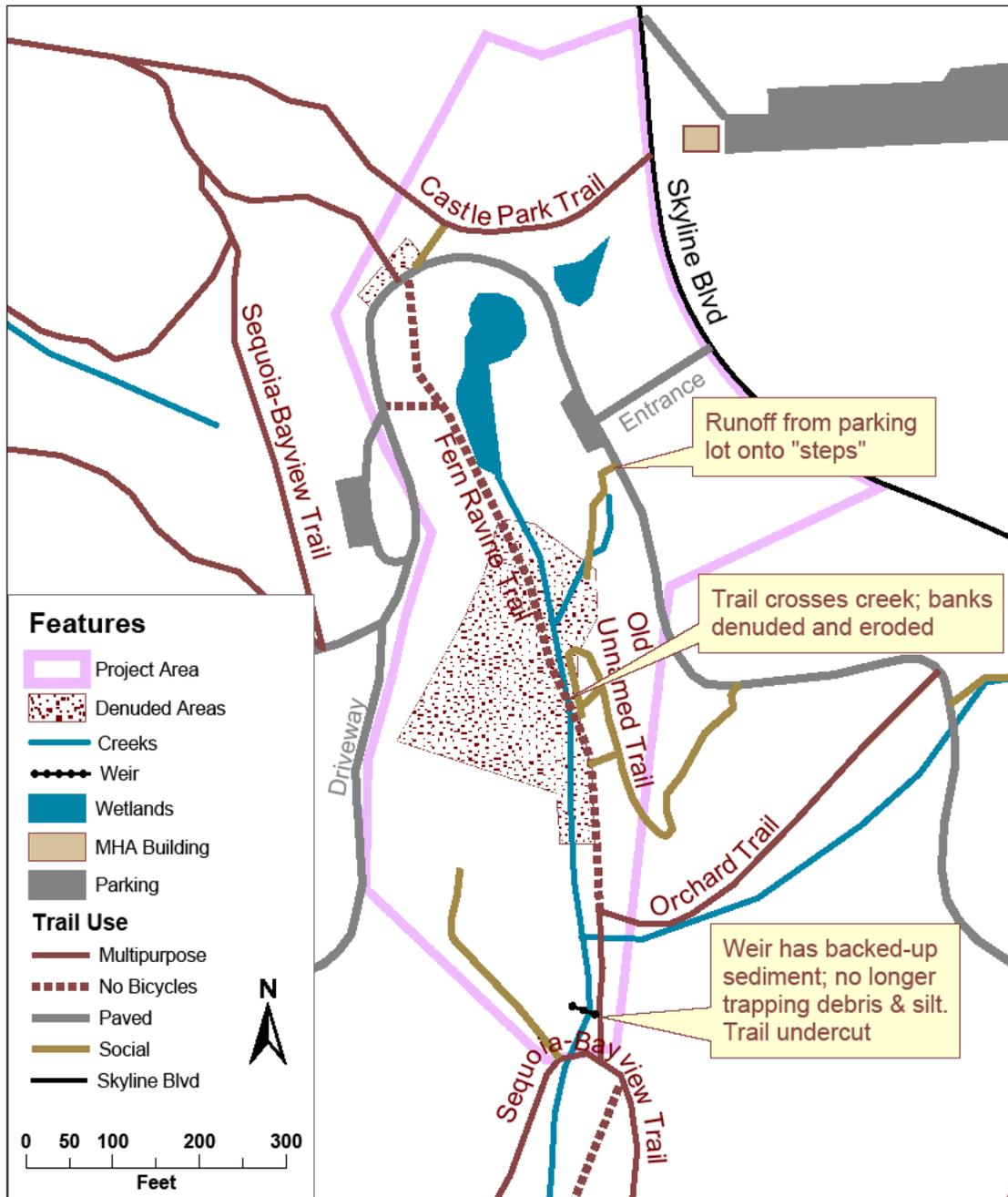


Figure 6 Fern Ravine Creek Hydrology and Erosion Issues in the Project Area

Road Drainage Down “Steps” by Gate

Currently, storm water runoff from the paved entrance road to Sequoia Arena and from the parking area flows southward along the road and cuts a small gully before cascading down a slope into the redwood bowl and Fern Ravine Creek. Over time, pedestrian use of this slope has led to serious erosion. Concrete and wooden steps have been placed along the gully (Figure 6). While the steps serve some stabilization function, they seem to be primarily installed to enable access to a social trail down the slope. Erosion beneath the steps is severe (Figure 7).

FOSC recommends that a small exclusion fence or barricade be placed along the side of the roadway to prevent pedestrian access to the steps. The steps should be removed and the embankment revegetated to further discourage its identification as an unauthorized trailhead. The social trail below the steps should be blocked with logs and brush to discourage users from creating a new route up the steep embankment. Afterwards, the site should be monitored for the success of vegetation re-establishment. Embankment restoration and revegetation will likely need to be maintained in case all park users are not deterred from continuing to use this spot as an access point to the Fern Ravine area.

The problem originated with runoff from the driveway and parking area. FOSC should work with Joaquin Miller Park personnel to determine whether runoff can be retained on the roadway by a small raised barrier-curb or by filling the small gully by the side of the road. If the water is retained on the road, it will drain slightly farther south along the roadway, where other runoff collects and is slowly filtered through vegetation at the edge of the embankment. This area collects some silt and leaf litter. Periodically removing silt and litter will help maintain the filtering function.



Figure 7 Hiker-built steps across an eroding gully lead to a social trail under the redwoods

Fern Ravine Creek/Fern Ravine Trail Crossing

The Fern Ravine Trail crosses the Fern Ravine Creek channel shortly after the creek and trail enter the redwood understory (Figure 6). The crossing sits in a deeply shaded “bowl” amidst towering redwood trees.

Above the redwood bowl, surface water flows from the Main Wetland, meanders through dense riparian vegetation in multiple shallow channels, and eventually forms the single distinct, shallow channel of Fern Ravine Creek near the upstream edge of the redwood bowl. Historically, the redwood bowl area was likely a continuation of the same dense riparian vegetation, with slow, overland sheet and shallow subsurface flows that eventually collected into the beginnings of the Fern Ravine Creek towards the downstream end of the bowl as it enters the confined channel that characterizes most of the rest of the creek.

Many recreational activities are ongoing in this area. Virtually all understory vegetation on the west side of the bowl has been lost, and social or undesigned trails are woven throughout the bowl. Redwood leaf-litter, important for preventing erosion, stabilizing soil temperatures, retaining moisture and providing the deep loose soil required by many understory natives, is worn away or compacted by the traffic. Recreational users cross the creek at many locations, as the trail is not well defined. Evidence of soil erosion and compaction is widespread on site slopes and stream channel banks (Figure 8, Figure 9, Figure 10, Figure 11, and Figure 12).



Figure 8 Looking upstream along Fern Ravine Trail, toward wetland: Dense riparian vegetation covering multiple shallow channels is to the right of the trail



Figure 9

Looking upstream toward the wetland: Dense riparian vegetation ends as single, distinct channel forms Fern Ravine Creek at the edge of the redwoods; denuded banks are evident

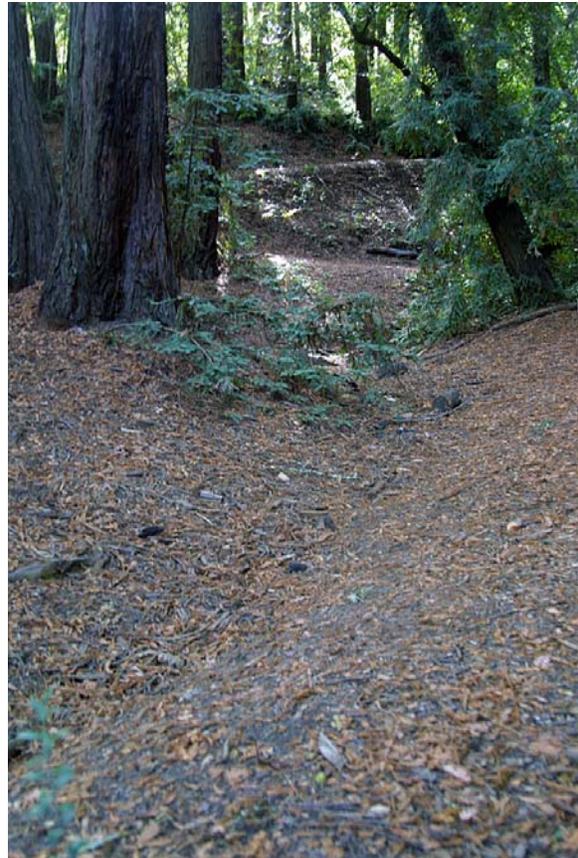


Figure 10 Denuded banks of Fern Ravine Creek, looking downstream from edge of redwoods; the “old unnamed trail” is in the background; photo taken in November thus layer of redwood duff covers the ground



Figure 11 Fern Ravine Creek bed at Fern Ravine Trail crossing: Trail on far (east) side of creek is well-defined, but there is no clear crossing point on near (west) side, so all vegetation is gone due to multiple crossing points



Figure 12 Looking west into denuded redwood forest understory from Fern Ravine Creek trail crossing; the orienteering course “Start/Finish” post is at the top of this hill, requiring course users to descend through the redwoods to reach the next post

Hiking and cycling off designated trails and other recreational activities are the greatest issues faced at this location. Therefore, proposed solutions for the Fern Ravine Creek trail crossing focus on greater restriction of activities in the area and re-establishment and monitoring of understory vegetation. In 2010, double-fence, horse-friendly barriers were constructed and signage posted to help direct bicyclists using the Fern Ravine Trail segment to connect between the Sequoia-Bayview Trail and the Orchard Trail. The efficacy of these installations should be assessed and structures and signage modified as needed in the future.

Recommendations for the Fern Ravine Creek trail crossing area include:

- Installation of logs or other barriers, as described in Section 5.2;
- Relocation of the campfire area used by the summer camps to a less sensitive location (see Section 5.1, Summer Camps);
- Relocation of orienteering control posts to reduce off-trail traffic (see Section 5.1, Orienteering Course);
- Revegetation of the understory in off-trail areas, with temporary exclusion fencing installed as needed to protect plantings from unauthorized off-trail activities;
- Vegetation monitoring to determine success of revegetation planting; and
- Construction of a new bridge crossing over the creek to eliminate impacts to the creek itself and prevent hiking off of the designated trail.

A new bridge built to span the beginnings of the Fern Ravine Creek channel along the Fern Ravine Trail should provide pedestrian and equestrian access and prevent these recreational activities from impacting the creek channel. The bridge should be sized to pass a minimum 1- 2-year return flow event and to reduce the potential for bridge-induced channel scour.

Construction of a new bridge will likely require, but not necessarily be limited to, building permits from the City of Oakland, a Section 401 water quality certification from the San Francisco Bay Regional Water Quality Control Board, a Section 404 Clean Water Act permit from the U.S. Army Corps of Engineers, and a Section 1602 streambed alteration agreement from the California Department of Fish and Game.

Where Fern Ravine Trail crosses Orchard Creek, the current wood plank bridge has deteriorated to the point of requiring replacement. Loose planks and large holes create safety hazards. If the bridge is redesigned, it may trigger some of the same permitting requirements for Fern Ravine Creek listed above. Combining these two projects might reduce administrative, consultant fees, and construction costs.

Weir and Trail Undercut

A flow control structure is installed in the Fern Ravine Creek channel at the lower end of the project site, above the intersection with the Sequoia-Bayview Trail (Figure 6). The creek formerly ran in a culvert under the trail; the culvert has since been removed, and the creek now runs across cobbles. Seven metal pipes are installed vertically across the

width of the channel (Figure 13). The original purpose of the pipes may have been to trap small woody debris to prevent blockage of the culvert.



Figure 13 Weir traps sediment at hump upstream, diverts flow to the right

These pipes and the debris trapped above them now function like a weir and slow the surface water velocity within the channel during storm events. Sediment and debris carried downstream during storms settle out at this location due to the reduction in flow velocity. Sediment has accumulated to about 8 inches from the top of the pipes on the left side of the weir (facing upstream), and a rounded mound of sediment has built up above the pipes. Therefore, the flow reducing and sediment settling function of the structure is at or near capacity. In addition, since all creek flow is diverted to the right side of the weir, it is undercutting the trail (Figure 14). The structure seems to be important for long-term maintenance of the downstream channel crossing and sediment transport. The City of Oakland should evaluate and maintain this structure (*i.e.*, remove the accumulated sediment).



Figure 14 Diverted flow from weir undercuts trail

4.3 Biological Resources

The 57-acre Fern Ravine Creek sub-watershed contains regionally rare palustrine-emergent, shrub-scrub, and riverine riparian wetlands and second growth redwood forest. The Fern Ravine Creek ecosystem plays a critical role in maintaining the health of the aquatic ecosystem of the entire Sausal Creek Watershed. Important ecosystem functions performed by Fern Ravine Creek and its wetlands and adjacent redwood forest habitats include the maintenance of water quality, element and compound cycling, organic carbon storage and export, surface and shallow subsurface water storage that reduces downstream flooding, landscape hydrologic connections, faunal habitat interspersions and connectivity, and plant and animal habitat support. Notably, Fern Ravine Creek and its wetlands contribute to the maintenance of the aquatic environment of a regionally significant population of threatened rainbow trout, *Oncorhynchus mykiss*, which occurs downstream from the site.

Fauna

Wetlands are among the most productive habitats in California (and in the world) and include a diverse array of plants and wildlife. Wetlands are important to numerous amphibians, wading birds, waterfowl, and shorebirds. Freshwater emergent wetlands are vegetated habitats that are inundated with water with enough frequency to support plant species adapted to wet conditions. This includes areas that are transitional between terrestrial and aquatic systems (*e.g.*, the fringes of ponds and streams) as well as

frequently flooded areas within terrestrial systems. Wetlands also occur within ditches adjacent to roadways, adjacent to or within the channel of streams, or in discrete areas of low ground (depressions).

Riparian habitat occurs adjacent to perennial and intermittent streams. Riparian areas are helpful in maintaining the stability of stream banks and the configuration of streams. Vegetation in this habitat is also beneficial to water quality, since polluting nutrients are absorbed before reaching open water. The importance of riparian areas to wildlife is related primarily to vegetation structure and the presence of water. Riparian habitat provides abundant food, water, escape, nesting, and thermal cover for mammals, birds, amphibians, reptiles, and invertebrates, while also serving as migration and dispersal corridors for these animals (Mayer and Laudenslayer 1988). Many invertebrates that are important food sources for other animals live entirely in or near riparian habitats. Some amphibians are dependent on these habitats for breeding. Riparian areas provide important refuge areas and winter habitat for migratory bird species in the Pacific Flyway. The leaf litter and fallen branches in riparian habitats provide cover for amphibians. Lizards, skinks, snakes, and small mammals may also be found in riparian habitats. If there is an abundance of prey, predator mammals are likely to be attracted to the wooded riparian habitats.

Upland grassland areas can support a variety of mammals, birds, and reptiles, and provide foraging habitat for raptors. Many species use the grassland for only part of their habitat requirements, foraging in the grassland and seeking cover in the surrounding tree and scrub cover. Grassland cover provides foraging, nesting, and denning opportunities for resident species such as lizards, snakes, squirrels, voles, gophers, rabbits, and deer, as well as some bird species.

With the exception of bird monitoring in the Fern Ravine area, no studies have been done on faunal diversity. No fish are known to occur in any portion of Fern Ravine Creek. There are no year-round pools of sufficient size in Fern Ravine Creek to support fish species and downstream natural migration barriers such as falls and cascades would block colonization by fishes. Given that the study area contains a variety of habitats (wetlands, riparian, grassland, scrub, redwood forest, and hardwood forest), and transition zones between each habitat, a diversity of wildlife species is expected to be present. See Appendix D for a list of mammals, amphibians, and reptiles that are known or likely residents of the Sausal Creek Watershed. Increasing native vegetation cover within each of these habitat types should serve to further enhance wildlife in both quantity and diversity.

Birds

Friends of Sausal Creek has conducted bird point counts over many years. The Fern Ravine site was added in spring 2010 to track possible changes in bird use as the site is restored. Table 2 presents the results of the three point counts conducted to date. Birds counted at a nearby site over a period of eight years are presented in Appendix E. Of particular significance is that the area near the Main Wetland is the last known location in Joaquin Miller Park for California quail (*Callipepla californica*), which historically were widespread.

Table 2 Fern Ravine Bird Point Counts

Common Name	Observation Date			Total
	01/23/10	04/24/10	10/16/10	
American Goldfinch		1		1
American Robin	2		4	6
California Gull			6	6
California Thrasher		1		1
California Towhee	1			1
Chestnut-backed Chickadee	5	2	2	9
Dark-eyed Junco	13	1	1	15
Hairy Woodpecker		1	2	3
Hutton's Vireo	1			1
Northern Flicker		1	2	3
Northern Flicker (Red-shafted)	2			2
Orange-crowned Warbler (orestera)		1		1
Pacific-slope Flycatcher		2		2
Purple Finch (Western)		3		3
Pygmy Nuthatch	15	4	2	21
Red-breasted Nuthatch	2		4	6
Ruby-crowned Kinglet			1	1
Song Sparrow	3	3	1	7
Stellar's Jay	1			1
Grand Total	45	20	25	90

Vegetation

The vegetation types in this small site include redwood forest, mixed hardwood forest (with added non-native conifers), wetland/riparian, grassland, and coastal scrub. To date, 44 native species have been identified; Appendix B lists these species by area, and includes a list of the non-native species in each area as well. Figure 15 shows the overstory and understory vegetation in the project area.

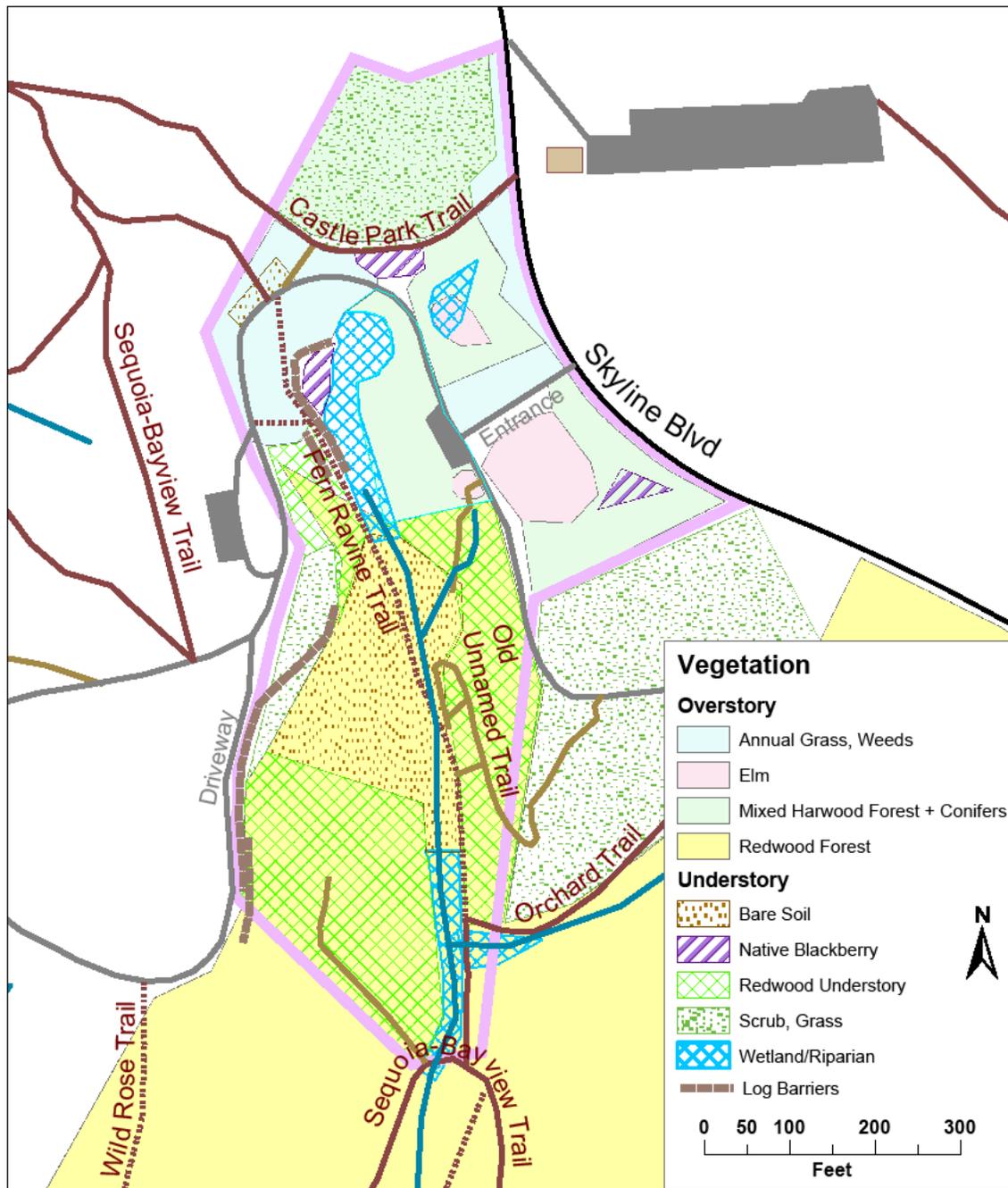


Figure 15 Fern Ravine Vegetation

Main and Upper Wetlands

The Main Wetland is dominated by California blackberry (*Rubus ursinus*) and Pacific bog rush (*Juncus effusus* var. *pacificus*). Other native species include cattails (*Typha latifolia*), coyote brush (*Baccharis pilularis*), and small-bracted sedge (*Carex subbracteata*). Major non-native plants in the Main Wetland are Himalayan blackberry (*Rubus discolor*), poison hemlock (*Conium maculatum*), and forget-me-not (*Myosotis latifolia*). See Figure 16.



Figure 16 Main wetland: A mix of rushes, cattails, coyote brush, and native and non-native blackberry; most non-native blackberry and the thistles (at edge) have been removed since this photo was taken

The dominant native species characteristic of the Upper Wetland include California blackberry and Pacific bog rush, plus many lady ferns (*Athyrium filix-femina*). The overstory is dominated by many aging Monterey pines (*Pinus radiata*) which are not native to the East Bay. There is a large amount of elm (*Ulmus* sp.) in the wetland and surrounding uplands.

Fern Ravine Creek Wetland and Riparian

Fern Ravine Creek begins near the lowermost edge of the Main Wetland. Riparian vegetation is healthy and lush and there are few non-native plants. The natives include small-bracted sedge, California blackberry, and lady ferns. There is both the native

strawberry (*Fragaria vesca*) and the similar-looking non-native, mock strawberry (*Duchesnea indica*). Velvetgrass (*Holcus lanatus*) is dotted through portions of the area.

At the edge of the redwood forest, the creek bed and banks are denuded of vegetation for an area of about 250 feet where the trail crosses the creek. Only a few struggling native blackberries survive in this stretch of the creek.

Below the denuded area, the creek drops more sharply in elevation, with steep banks that support a mix of native and non-native vegetation. Natives include bracken fern (*Pteridium aquilinum* var. *pubescens*), sword fern (*Polystichum munitum*), lady fern, California blackberry, and small-bracted sedge.

Redwood Forest

Off-trail park users have denuded the middle reach of Fern Ravine Creek and the surrounding redwood understory. In areas where the understory has not been trampled, there is a diverse mix of redwood understory vegetation that varies in species mix depending on light, slope, and soil moisture. There is abundant California blackberry and many sword ferns, and some stands of huckleberry (*Vaccinium ovatum*). Within heavily shaded areas, there is little vegetation, but the soil is well protected by redwood needle mulch. See Figure 17.



Figure 17 Healthy redwood understory: A mix of ferns, honeysuckle, and numerous other species

With the exception of veldt grass (*Ehrharta erecta*), some ivy (*Hedera helix ssp. canariensis*), and cotoneaster (*Cotoneaster sp.*), there is very little non-native vegetation in most of the redwood area. Most of the *Ehrharta* is found along trails (including social trails); the other invasives occur in small patches.

Near the “steps” area (see Figure 6), there are some large elms, and many short sprouting elm stumps, plus a small stand of holly (*Ilex aquifolium*). There is also a patch of Cape ivy (*Delairea odorata*) in this area. The only population of woods phacelia (*Phacelia nemoralis*) known in the Sausal Creek watershed occurs along the road edge near the steps.

Uplands

Uplands may be classified as disturbed grassland, coastal scrub, and oak woodland vegetation types. Non-native vegetation, primarily annual grasses and thistles, dominates the uplands that surround the wetlands, with a mix of several weedy annuals as well. The thistle is predominantly bull thistle (*Cirsium vulgare*). Annual grasses found in the uplands include the slender wild oat (*Avena barbata*), ripgut brome (*Bromus diandrus*), and Italian ryegrass (*Lolium multiflorum*). At low elevations, there is also poison hemlock. There are some small coast live oaks (*Quercus agrifolia*) and coyote brush. Native annuals such as tarweeds (*Madia sp.*) and cudweeds (*Gnaphalium sp.*) are mixed with the annual grasses. The only native grass at the site is blue wildrye (*Elymus glaucus*).

On the steep slope below between the entrance parking lot and the wetland, there are several silver wattles (*Acacia dealbata*.) The natives in this area include coast live oaks, madrone (*Arbutus menziesii*), and bay laurel (*Umbellularia californica*).

Many of the Monterey pines in the uplands are nearing the end of their life span, although there are a few younger trees and many seedlings. There are some large acacias, and areas where acacias have been repeatedly cut and have resprouted. Vegetation removal efforts have cleared almost all of the large French broom from the uplands.

5. Site Use and Management Recommendations

5.1 Site Use

The project site is impacted by a wide variety of recreational uses, including hiking, bicycling, horseback riding, picnicking, and summer camps. Figure 18 shows some of the traffic patterns that impact the site. The “entry points” on the map indicate the origins of social trails and places where park users climb over log barriers. This section describes the impacts of the various recreational practices at the site then makes sustainable management recommendations.

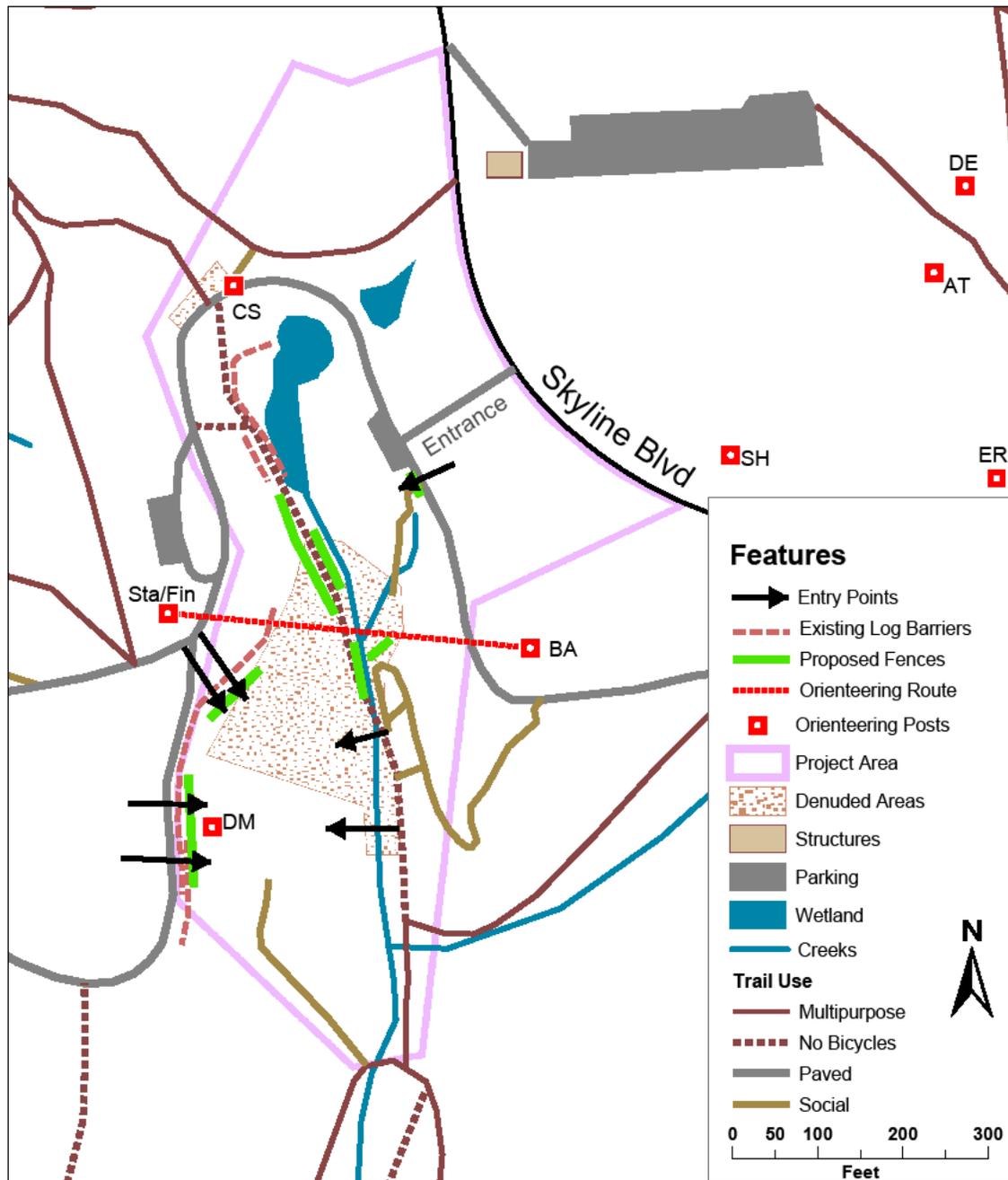


Figure 18 Off-Trail Impacts on the Redwood Understory

Parking

There are two paved parking areas at the site, the first just inside the entrance, and the second near the restrooms. When the area is busy, vehicles also park along the edges of the park road.

Hikers

The major impact of hikers seems to be at the creek/trail crossing. Hikers are also contributing to creation of bootleg trails through off-trail use. Until recently, mushroom collecting was legal in Joaquin Miller Park, and probably continues to add to off-trail traffic even though it has been banned. The site is also rich in native plant species and is consequently used by medicinal herb gatherers.

Equestrians

Most of the year, equestrian use of the Fern Ravine area is very low, and impacts are limited to the creek/trail crossing area. In part, this may be due to the poor condition of the bridge that crosses Orchard Creek.

The Sequoia Arena hosts several horse shows and competitions each year, and the Metropolitan Horsemen's Association participates in a 6-day "Ride the Ridge" event, with one night spent camping at Sequoia Arena. Impact may be greater during those events, as riders explore the surrounding areas. During events at Sequoia Arena, much of the flat grassy area around the loop road that serves the arena is used for parking. Events are listed on the MHA website at: <http://www.mhaoakland.org/>.

Bicyclists

Currently, most of Fern Ravine Trail is only open to hikers and horseback riders. The short segment that links the Sequoia-Bayview Trail to the Orchard Trail is classified as a multipurpose trail and is open to cyclists. However, unauthorized bicycle use of the Fern Ravine Trail is common as cyclists have access to the Fern Ravine Trail from parking areas and other trails that are authorized for bicycle use. The current trailhead barriers are not sufficient to prevent cyclists' entry because they must also enable passage by equestrians. However, the impacts of cyclists' use of Fern Ravine Trail are minor, and generally restricted to the creek crossing.

The more severe impact of cyclists results from off-trail mountain biking. Cyclists have been observed riding straight up the creek bed and climbing over logs at the top of the area to ride down the slopes of the bowl. Tire tracks attest to their use of the slopes of the area. In one area, out of sight of the trails and roads, there is a well-worn set of "cyclocross" trails. Photographs on pages 26-28 show some of the damage. In late 2009 and early 2010, an attempt was made to block some of this access using log barriers along Fern Ravine Trail, and depositing logs and brush at the entry points at the top of the bowl. However, all this work was undone in subsequent months by off-trail park users.



Figure 19 Monterey pine stump at picnic area serves as a mountain-bike jump



Figure 20 Off-trail mountain bike use:
Note that bike track loops
around redwood trees in the
center back of photo



Figure 21 Off-trail bike tracks in redwood forest



Figure 22 Social trail from denuded “cyclocross” area to creek bank



Figure 23 Sequoia Bayview Trail (outside of project area) following a storm

The Bicycle Trails Council of the East Bay (BTCEB) helps coordinate trail repair, which includes improving drainage, removing invasive plants, re-naturalizing informal sections to discourage off trail use (*e.g.*, removing bike jumps), and realigning existing trails to create good experiences for diverse visitors while minimizing user conflict and environmental damage. BTCEB also participates in volunteer bike patrols, educating bike users about low-impact environmentally friendly riding, while keeping tabs on trail conditions, hazards, and maintenance issues.

Orienteering Course

Orienteering is a sport where users navigate between fixed locations using only a compass and map. Individuals and small groups may practice orienteering. There are also competitive events and training sessions for public safety personnel, some involving large numbers of people using the same course over a short period of time.

By its very definition, orienteering requires off-trail use of the terrain. Joe Scarborough and others created the orienteering course in Joaquin Miller Park. It consists of 26 control points (in this case, permanent 6x6 posts with red and white markings) located on both sides of Skyline Blvd. Four control posts are located within or very close to the project area.

The “Start/Finish” post is located near the yellow fire gate that leads to the Horse Arena. In the three maps provided on the Scarborough Orienteering website, two of the courses start at the post and the second post (BA) is on the east side of the site, thereby sending users down the west slope of the bowl area, across the creek, and up the east side of the bowl. The third course uses the “BA” post at the end of the route, so traffic is in the opposite direction. Figure 18 shows these controls.

Summer Camps

The City of Oakland operates the “Touch the Earth” summer camp program in the redwood area along Skyline Blvd. Eight week-long camp sessions last from 9 a.m. to 3 p.m., with “extended care” provided for an additional three hours. Most of the activity takes place farther east in the redwoods, at the Redwood Glen Picnic Area. In addition to this camp, there are times when camps operating in Redwood Regional Park and in Roberts Regional Recreation Area cross Skyline Blvd. to use Joaquin Miller Park.

Much of the activity of these large groups of children is off-trail, and they are sometimes supervised only by teen-aged counselors. Probably the most destructive impact is caused by “fort building,” lean-tos constructed of sticks against the base of trees in the area (Figure 24 and Figure 25). The widespread foraging to collect sticks is very destructive of the mulch surface under the redwoods and leads to severe trampling of the vegetation. In particular, the lack of stabilizing woody debris in the creek bed may be attributable to the fort building. The summer camps use an area on the denuded bank of Fern Ravine Creek to teach fire-building techniques; use of this area in 2010 destroyed the creek-bank plantings FOSC had done the previous winter (Figure 26 and Figure 27).



Figure 24 Fort built by day camp children during summer 2010



Figure 25 Fort built by day camp children during summer 2010



Figure 26 Looking downhill toward Fern Ravine Creek bed, summer 2010 camp fire ring



Figure 27 Looking downhill toward Fern Ravine Creek bed, camp fire ring is in background

Picnickers

There are three picnic sites in the project area. The Horseshoe Picnic Area adjacent to the wetland has nine tables, so it is capable of handling groups of 50 or more. It also has a large grill. In general most activity seems restricted to the mowed area immediately surrounding the tables. A barrier of large logs restricts traffic into the wetland area and serves as extra seating. The other two areas are small, each with two tables. The area across the road from the Horseshoe site has a small grill. The other picnic area is located on the west edge of the site. These are shown in Figure 3, Figure 28, and Figure 29.



Figure 28 Horseshoe Picnic Area, overlooking wetland



Figure 29 Picnic area at west edge of site; log barrier to right of tables was installed to deter entrance into the redwoods from this area

5.2 Management Recommendations

Restricting Users to Legitimate Trails

Although some barriers exist, they are not sufficient to deter off-trail use of the area. Additional barriers are needed, and existing barriers need to be reinforced by a second set of defenses.

Barriers are needed:

- Along Fern Ravine Trail from the picnic area to Fern Ravine Creek;
- Along the west side of the redwood bowl, near the park road;
- At the switchback in the old unnamed trail on the east side of the redwood bowl; and
- Blocking the social trails that weave through the area.

These types of barriers are recommended:

- Log Barriers – In December of 2009, Parkland Resources Supervisor Martin Matarrese and a youth group of moved large logs into place along Fern Ravine Trail from the picnic area to the creek. However, some of the logs, especially near the creek, were fairly small and have been moved out of place

by park users. It is recommended that larger logs be placed along this section of trail.

- **Brush Barriers** – Cut brush is good for deterring traffic down slope, especially when used in quantity and when well placed in entangled piles. When volunteer workdays generate weed free, non-rooting debris, it should be added to existing barriers or stockpiled for later use. Other possible sources of material include the fuel-reduction contractors working for the Oakland Fire Department, and the upcoming tree removal work at Chabot Space and Science Center.
- **Fences** – Along other trails in the park, split-rail fences help keep users on trails. FOSC recommends adding fencing as reinforcement of existing or newly created log barriers at the entry points along the park road on the west side of the bowl (Figure 30). These entry points should be reinforced with fencing high enough to deter access through climbing and by lifting bicycles (Figure 18).



Figure 30 Existing barrier logs at top of redwood forest

All barriers will need to be maintained. Brush and log barriers may need new material added as older material deteriorates or is moved. The west rim of the redwood bowl should be monitored for new entry points created after existing points are blocked.

Signage and Park User Education

On-trail compliance can be improved by educating park users on the role that the native plant understory and natural redwood needle mulch play in maintaining the health of the redwoods, and by reducing soil erosion and creek siltation. A large interpretive panel where the Fern Ravine Trail first enters the redwoods could explain and illustrate the importance of remaining on designated trails. Smaller signs should be placed on the trailhead barriers and the log barriers at the top of the bowl; these signs will notify park users of the restoration project in progress, provide details on the restoration timeline, and give contact information for FOSC, FOJMP, and the City of Oakland. These signs will help park users understand the modifications taking place at the site and encourage participation in the restoration effort.

The October-November 2010 issue of the FOSC newsletter carried an article by Brent Englund, president of the Bicycle Trails Council for the East Bay. The article explained the impacts of off-trail use, and urged cyclists to comply. FOSC and FOJMP should continue to collaborate on outreach to cyclists and other user groups.

Recommendations for Orienteering Courses

FOSC recommends working with Joe Scarborough and the Bay Area Orienteering Club to move orienteering controls (Figure 18) and to modify the orienteering maps provided to participants so that users are not directed to cross sensitive habitats. As part of a larger initiative to reduce impacts on redwood understory throughout the park, Friends of Joaquin Miller Park has asked Martin Matarrese, Parkland Resources Supervisor with Oakland Public Works, to arrange a meeting with Joe Scarborough to discuss changing the routes. Although park rules require permitting of any group activity involving 25 or more participants, no park use permits have been requested or issued for orienteering events. This activity needs to be managed by requiring a park use permit for each event, moving the course out of the redwoods, and requiring orienteering maps be modified to show sensitive areas as “out of bounds.” A complete map of the controls is located at: <http://orienteer.com/poc/allcontrols.pdf>.

Recommendations for Summer Camps

The Friends of Joaquin Miller Park board of directors has discussed the impacts of the summer camps several times during board meetings in 2010. A possible option is moving the camp drop off location and “base” to a grassy meadow area near the park entrance on Joaquin Miller Road. The City of Oakland employee who oversees this activity has so far resisted efforts to move the camp location or to modify their activities in the area. The issue remains on the agenda of the board of Friends of Joaquin Miller Park.

If the camp remains in the Skyline Blvd. area, FOSC recommends that:

- The campfire area be moved to a less sensitive site, in consultation with Martin Matarrese;
- All camp users should remain on-trail when they are in the restoration area;
- Fort building should not be allowed by Touch the Earth campers or any other groups; and

- Camp participants should be educated in park etiquette and the impacts that humans have on our natural areas. Emphasis should be placed on the importance of “leaving no trace” (*e.g.*, stay on delineated trails, woody debris should be left exactly where it is).

Recommendations for the Picnic Area

The picnic area upland is characterized by many non-native weeds. Given the weediness of the slopes around the picnic area, foot traffic into the Main Wetland is an additional vector for weed seeds, including bull thistle and poison hemlock. Trails to the picnic area should be kept cleared and mulched to encourage users to stay on the trail. As the Fern Ravine Restoration Plan project is implemented in the uplands adjacent to the picnic area, temporary barriers will be erected to prevent trampling of new native outplants or seeded areas. To further restrict traffic into the wetlands, a shrub border will be planted just inside the log barrier.

6. Restoration Plan

In collaboration with the USEPA, FOOSC has developed an adaptive management plan to enhance the existing native vegetation communities through invasive plant removal and the planting of additional native plants. Increasing native plant vegetation coverage and decreasing off-trail use will reduce erosion and sediment transport into Fern Ravine Creek.

Adaptive management practices include the assessment of problems at the restoration site through identifying objectives and possible actions; design of a detailed plan to carry out these suggested actions; plan implementation (execution of proposed actions); monitoring of the performance of these actions; evaluation of data gathered through monitoring to compare with original objectives; and adjustment of actions as needed over time (Murray and Marmorek 2003). Throughout each of these steps, the project team may encounter unforeseen changes or challenges surrounding project goals. Many goals within the plan are contingent upon cooperation in efforts among the various interest groups who use the area, environmental conditions, and procuring the necessary funding. The project team will keep in mind that steps toward reaching the stated objectives of this plan may require extended periods of time and flexibility in planning to obtain overall success. Through careful monitoring and assessing effectiveness of actions taken, over time the project team will gain useful knowledge as to how this plan can be continuously improved to reach the stated goals.

Methods for collection and propagation of native plants are described in Appendix A. Also included in Appendix A is a description of monitoring protocols for ongoing implementation of this plan.

FOOSC volunteers, under the leadership of FOOSC’s Restoration and Nursery Manager or a volunteer crew leader, will conduct implementation of the Fern Ravine Restoration Plan. Some work will also be performed by crews in a young-offender diversion program, Project Y, under the supervision of the City of Oakland Parkland Resources Supervisor.

6.1 Vegetation Enhancement Overview

FOSC's initial three-year adaptive management plan, starting in fall 2010, will begin by establishing plots within each habitat type (wetland, upland, redwood understory, and riparian; see Figure 31). Within each of the marked plots, revegetation goals of reducing invasive species cover and increasing native species cover and species diversity will be met through methods listed in the eradication schedule (Table 3) and the initial planting plan in Section 6.4. After the initial three-year plan is complete, results will be assessed and FOSC will continue to expand restoration efforts into additional plots while continuing to maintain the original plots. For full lists of the plant palettes being evaluated for the various habitat types, see Appendix C. Appendix F contains a schedule for the vegetation work.

The map of plots is shown in Figure 31. Plots were determined using these criteria:

- Priority was given to the site's unique wetlands, and to the major erosion problems in the redwood understory.
- Second priority was establishing a buffer zone around the wetlands.
- Plots were divided as vegetation varied, and sized to provide areas that were manageable on volunteer workdays.

There are some highly invasive species in areas not included in the current plots:

- French broom occurs in various upland locations; much has been removed, but control of remaining plants and seedlings needs to be maintained to prevent reseeding.
- A small patch of Cape ivy near the "steps" area needs to be removed before it spreads.
- There is yellow star thistle (*Centaurea solstitialis*) across the park road from the Horseshoe Picnic Area, and another patch near the Redwood Bowl parking lot. Both patches have fewer than 50 plants and should be pulled annually.
- A small stand of holly near the "steps" area should be removed.

6.2 Invasive Plant Removal

Large Non-Native Tree Removal

There are numerous non-native trees that are too large for volunteer removal. Some of these tree removals will require obtaining City of Oakland Tree Removal Permits. In the future, FOSC will GPS the locations of these trees, measure their diameters, tag them, and prioritize their removal. When funding for hiring contractors or City tree-crew days become available, FOSC can proceed with the tree removal.

Most of these trees are elms (*Ulmus* sp.) and acacias (*Acacia melanoxylon*, *A. dealbata*, and *A. mearnsii*). These species resprout from stumps or from roots. Volunteer follow-up will be required to remove sprouts.

The many Monterey pines in the area are not native to the Bay area. The trees live to a maximum age of about 90 years, and many of the pines are reaching the end of their life spans. In most cases, these will be allowed to die without removal, except when the City

of Oakland deems them hazardous. Volunteer efforts will focus on cutting smaller pines, and on weeding out pine seedlings as part of regular invasive plant removal.

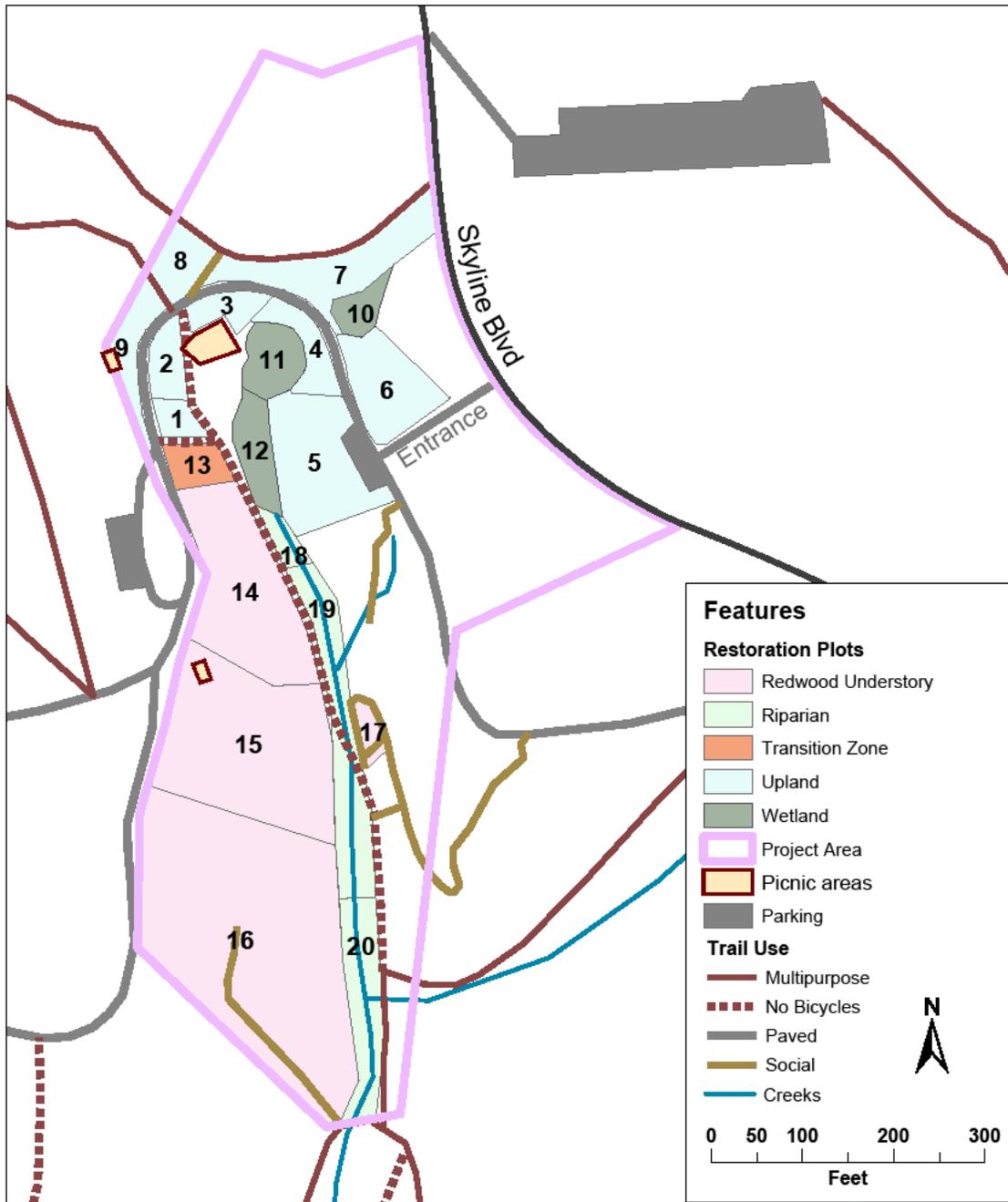


Figure 31 Plots for Non-Native Eradication and Revegetation

Wetlands

The wetland areas are divided into three plots (plots 10-12) containing the upper wetland, the main wetland, and the lower wetland. Each of these plots has differing needs for invasive plant removal strategies. Volunteer based efforts have already begun in the main wetland, working to remove invasive species such as poison hemlock and bull thistle. The upper wetland will require large-scale tree removal by City of Oakland crews to remove invasive elm species, and the lower wetland will also require the removal of several invasive acacia trees. As noted in the eradication schedule (Table 3), efforts in the upper and lower wetland zones (plots 10 and 12) will begin in fall 2011, while efforts in the central wetland zone (plot 11) began in 2010.

Uplands

The upland areas at the site have been divided into nine working plots (plots 1-9). Techniques such as hand-pulling, sheet mulching, dense native plantings, and use of black solarization fabric will be applied throughout these plots based on the needs for controlling different target species. Table 3 describes techniques and timelines that will guide eradication efforts in the uplands area for the first three years of this project.

Redwood Understory

The redwood understory has been divided into five working plots (plots 13-17). The transition zone between redwood understory and the grassy uplands is included in this group.

Invasive species targeted in this area include cotoneaster, veldt grass, and holly. Removal of these and other invasive species found in these plots will require removal of root systems and in some cases girdling of stems and trunks in order for these species to be effectively removed. Volunteer based efforts throughout these plots to remove invasive species and monitor for resprouts will continue as the area is planted.

Fern Ravine Creek

The riparian areas within the project site have been divided into three plots (plots 18-20). Plot 18 will require the removal of species such as veldt grass and velvet grass (*Holcus lanatus*), while plot 19 currently has little to no vegetation due to off-trail use in the area. Plot 20 will require the removal of veldt grass and cotoneaster.

Table 3 Eradication Schedule

Plot Number	Eradication Plan	Timing and Follow-Up
1 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site.	Begin eradication in fall 2010. Continue eradication March-October each following year for three years. Plant area densely with native upland species beginning in winter 2010-2011.

Plot Number	Eradication Plan	Timing and Follow-Up
2 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site. This plot is to be sheetmulched with one layer of cardboard and 4-6 inches mulch.	Apply sheet mulch in fall 2010. Reapply mulch spring 2011. Continue eradication March-October each following year for three years. Begin planting in winter 2011-2012.
3 Upland	Removal of acacia species in this plot will require hand sawing and tarping with black solarization fabric over the stumps. The area will be monitored for up to three years before further removal of acacias may take place.	Begin acacia removal in spring 2011, cover with black fabric during summer 2011. Monitor resprouts until 2014, to assess effectiveness of removal technique.
4 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site.	Begin eradication in fall 2012. Continue eradication March-October each following year for three years. Begin planting winter 2013-2014.
5 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site.	Begin eradication in fall 2012. Continue eradication March-October each following year for three years. Begin planting Winter 2013-2014.
6 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site.	Begin eradication fall 2012. Continue maintenance March-October each year for at least three years. Begin tree planting in winter 2011, continue planting winter 2013.
7 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> . Removed plant debris will be hauled away from the site.	Begin eradication in Fall 2012. Continue maintenance March-October each year for at least three years. Begin planting winter 2014.
8 Upland	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , <i>Cirsium vulgare</i> , and <i>Genista monspessulana</i> . Removed plant debris will be hauled away from the site.	Begin eradication in Fall 2012. Continue maintenance March-October each year for at least three years. Begin tree planting winter 2011.
9 Upland	Sheet mulching, removal of non-native species, including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , and <i>Cirsium vulgare</i> .	Begin fall 2010. Continue maintenance March-October each year for at least three years. Begin planting winter 2012.

Plot Number	Eradication Plan	Timing and Follow-Up
10 Upper Wetland	Removal of invasive species from upper wetland. Long term goal of elm removal with City crews.	Begin eradication in spring 2011. Continue maintenance March-October each year for at least five years. Begin planting once elm trees have been removed.
11 Main Wetland	Removal of invasive species including: <i>Cirsium vulgare</i> , <i>Conium maculatum</i> , and <i>Myosotis latifolia</i> .	Removal began winter 2009. Continue March-October every year for at least five years. Continue planting each year as needed.
12 Lower Wetland	Removal of invasive species including: <i>Erharta erecta</i> , <i>Carduus pycnocephalus</i> , and <i>Holcus lanatus</i> . Acacia removal by City crews. Removed plant debris will be hauled away from the site.	Begin spring 2011. Continue maintenance each year March-October for at least five years. Begin planting once large trees have been removed.
13 Transition zone between uplands and redwoods	Removal of non-native, invasive species including: <i>Avena barbata</i> , <i>Bromus diandrus</i> , <i>Carduus pycnocephalus</i> , <i>Cirsium vulgare</i> , and <i>Erharta erecta</i> . Removed plant debris will be hauled away from the site.	Begin Fall 2011. Continue maintenance March-October each year for at least three years. Begin planting winter 2013.
14 Redwood Understory	Monitor for invasive species; remove as needed.	Begin fall 2010. Begin planting winter 2011.
15 Redwood Understory	Monitor for invasive species; remove as needed.	Begin fall 2010. Begin planting once barriers are established.
16 Redwood Understory	Monitor for invasive species; remove as needed.	Begin fall 2011. Begin planting once barriers are established.
17 Redwood Understory	Remove invasive species, including <i>Erharta erecta</i> and <i>Cotoneaster</i> sp.	Begin fall 2010. Planting began winter 2010. Continue planting winter 2011.
18 Upper Riparian	Monitor for invasive species; remove as needed.	Begin fall 2011. Begin planting once off-trail recreational use has decreased in this area.
19 Middle Riparian	Monitor for invasive species; remove as needed.	Begin fall 2010. Begin planting once off-trail recreational use has decreased in this area.
20 Lower Riparian	Remove invasive species, including <i>Erharta erecta</i> .	Begin fall 2011. Begin planting once off-trail recreational use has decreased in this area.

6.3 Native Vegetation Enhancement

Introduction

During the first three years of vegetation enhancement at Fern Ravine, plots will be planted following invasive species removal and as plots become protected from off-trail recreational practices. The eradication plan provides a timeline for invasive species removal as well as estimated start times for native plant installations on a plot-by-plot basis (Table 3). Some plots will require several years of control methods before they are adequately cleared of invasive species and ready for planting.

Plots that are slated for planting in 2010-2011 currently contain few invasive species or have a manageable amount of invasive species mixed with an already established population of native grasses and shrubs. In areas such as these, dense plantings are expected to help out-compete invasive species. FOOSC staff and volunteers will repeatedly remove invasive resprouts once native plantings are established. Working in small areas and creating “islands” of native plants communities will increase overall success as plantings grow and spread thereby connecting various island plantings.

Timing

Native plant installations in each habitat type will generally take place annually during the months of December and January; these are typically the months with the greatest precipitation. The riparian zone and parts of the wetland may be planted in later months (February-May) during heavy rain years, as these habitats maintain saturated soil conditions later into the season in most years.

Planting Plan

A two-year planting plan has been developed for the initial stages of the revegetation efforts (Section 6.4, below). FOOSC will continue to create new planting plans each year as needed. The plant palette is drawn primarily from lists of plants and habitats in the Sausal Creek Watershed, but may include other species found in East Bay Regional Park District parks in the East Bay hills. The planting palette is focused on plants found along the Skyline Blvd. corridor in areas with similar overstory and hydrology. Species planted in each plot will be appropriate for each habitat type. Once established, species will not require supplemental watering.

Wetland

The majority of plantings that will occur in the Upper Wetland (plot 10) and Lower Wetland (plot 12) will begin once large tree removal within these plots is complete. Planting in the Main Wetland (plot 11) began in spring 2010 and will continue until degraded areas are successfully filled in with native species. A small number of plants were installed in the Upper Wetland in spring 2010. Specific goals within the wetland zones are to increase biodiversity and improve habitat value; to create a living barrier of plants between the wetland and the public picnic area to discourage off-trail use in the wetland; and to add native tree cover along wetland edges to replace the invasive elm and acacia trees that are to be removed from the site.

Uplands

Native vegetation in the upland plots includes grassland, coastal scrub, and woodland species. Plantings in the upland plots, which are currently heavily covered with invasive annual grasses and thistles, will be installed in clusters once the areas are sufficiently cleared of invasive species. Planting in clusters allows for better competition against annual invasive species in the area. Improvement of California quail habitat is a major goal in upland restoration at this site. The restoration plan includes the propagation and planting of appropriate species to meet this goal. Several upland plots, as mentioned in the eradication plan (Table 3), will require the removal and control of French broom and acacia species prior to planting.

Redwood Understory

The redwood understory is divided into five plots. Much of the redwood understory in plots 14 and 15 is denuded of understory vegetation. Areas intended for planting within these plots must be protected from bicycle use and other activities before plants are installed. The initial vegetation enhancement goal over the next three to five years is to restore the understory from the current 1-5% native cover to 5-25% native species cover in plots 14, 15, and 17. Vegetation enhancement efforts in plots 13 and 16 will begin in the winter of 2013. Appropriate native species that spread quickly via rhizomes (such as California blackberry and hedge nettle (*Stachys ajugoides*)) will be installed heavily during the initial plantings in each plot in order to obtain stable native cover before sensitive and slow growing species (such as huckleberry and false Solomon's Seal (*Smilacina stellata*)) are added. FOOSC will begin planting in small patches within each plot and expand outward as the patches become successfully established.

Fern Ravine Creek

The riparian habitat is divided into three plots:

- The upper riparian plot (18) connects to the lower wetland area (plot 12) and currently has established native vegetation.
- The middle riparian plot (19) is almost completely denuded of all riparian vegetation. Once barriers are established to protect this area, FOOSC will begin dense plantings working outwards from the vegetated ends of the adjacent plots. Plot 19 includes the site of the proposed footbridge at the trail crossing. FOOSC will refrain from adding plants near the footbridge site until it is completed.
- The lower riparian plot (20) starts at the end of the denuded area. The steep banks of the confined channel have moderate to good coverage of native plants.

Plantings in both plots 18 and 19 are scheduled to begin in winter 2012 or once barriers are successfully established. Even with barriers in place, FOOSC may also install signage alerting the public to the restoration efforts occurring in the area in order to further protect the plantings. After the initial three-year restoration plan, plot 20 will be considered for future plantings as well.

Long-Term Vegetation Enhancement

Over time, FOSC will continue to enhance biodiversity by adding additional plants as they become available from the nursery. Updated planting plans will be developed each year at the end of each planting season in order to prepare for the following year. Select species listed in the planting plan may be rare in the watershed, or may be difficult to propagate, therefore potentially decreasing the number of available species in a given year. FOSC will aim to meet the goals of the planting plan design each year, though adjustments may be made at the time of outplanting. FOSC staff and nursery volunteers will determine species readiness at the onset of each planting season in order to adjust the planting plan as needed.

6.4 Planting Plans 2010-2012

This section describes the planting plans for 2010-2012 and lists plants that have already been planted at the site. Each table below indicates species, plot number, and quantity of plants to be installed at the time of each scheduled planting. Detailed planting plans will be prepared on a yearly basis for plants to be installed during the following rainy season. Shrubs and trees will be propagated at the Joaquin Miller Native Plant Nursery one to two years ahead of their scheduled planting time. Species that germinate most effectively through direct sowing methods are listed as “direct sow” in the quantity category in each table below. The plant palette is drawn from the watershed species list and more particularly from study of the species in the Skyline Blvd. area that share common overstory, hydrology, and soil conditions.

Main and Upper Wetland

A small number of plants were added to the wetlands in Spring 2010.

Spring 2010 Wetland			
Scientific Name	Common Name	Plot #	Quantity
<i>Carex deweyana ssp. leptopoda</i>	short-scale sedge	11	6
<i>Carex obnupta</i>	slough sedge	11	8
<i>Carex obnupta</i>	slough sedge	10	2
<i>Helenium puberulum</i>	Sneezeweed	11	6
<i>Lonicera involucrata</i>	black twinberry	11	9
<i>Mimulus guttatus</i>	yellow monkeyflower	11	16
Total Planted			47

The wetland planting plans for 2010 and 2011 are shown below.

Fall 2010 Wetland			
Scientific Name	Common Name	Plot #	Quantity
<i>Carex deweyana ssp. leptopoda</i>	short-scale sedge	11	20
<i>Helenium puberulum</i>	Sneezeweed	11	16
<i>Lonicera involucrata</i>	black twinberry	11	5
<i>Mimulus cardinalis</i>	red monkeyflower	11	10
<i>Mimulus guttatus</i>	yellow monkeyflower	11	16
Total			67

Fall 2011 Wetland

Scientific Name	Common Name	Plot #	Quantity
<i>Helenium puberulum</i>	Sneezeweed	11	16
<i>Lonicera involucrata</i>	black twinberry	11	5
<i>Mimulus cardinalis</i>	red monkeyflower	11	10
<i>Mimulus guttatus</i>	yellow monkeyflower	11	16
Total			47

Plantings will avoid areas with elms and sites planned for other large tree removal and debris removal in order to avoid trampling. FOSC will monitor soil-moisture patterns during late summer/fall, to help determine what and where to plant.

Uplands

Winter 2010 - 2011 Uplands

Scientific Name	Common Name	Plot #	Quantity
<i>Achillea millefolium</i>	white yarrow	1	48
<i>Artemisia californica</i>	California sage brush	1	12
<i>Elymus glaucus</i>	blue wild rye	1	50
<i>Eschscholzia californica</i>	California poppy	1	direct sow
<i>Gnaphalium ramosissimum</i>	pink everlasting	1	direct sow
<i>Grindelia hirsutula</i> var. <i>hirsutula</i>	gumplant	1	direct sow
<i>Holodiscus discolor</i>	oceanspray	1	10
<i>Mimulus aurantiacus</i>	sticky monkeyflower	1	32
<i>Rhamnus californica</i> ssp. <i>californica</i>	coffee berry	1	10
<i>Ribes sanguineum</i>	pink flowering current	1	10
Total			172

Winter 2011 - 2012 Uplands

Scientific Name	Common Name	Plot #	Quantity
<i>Achillea millefolium</i>	white yarrow	2	32
<i>Artemisia californica</i>	California sage brush	2	6
<i>Elymus glaucus</i>	blue wild rye	2	50
<i>Gnaphalium californicum</i>	cudweed	2	direct sow
<i>Eschscholzia californica</i>	California poppy	2	direct sow
<i>Gnaphalium ramosissimum</i>	pink everlasting	2	direct sow
<i>Grindelia hirsutula</i> var. <i>hirsutula</i>	gumplant	2	direct sow
<i>Madia</i> sp.	tarweed	2	direct sow
<i>Holodiscus discolor</i>	oceanspray	2	6
<i>Mimulus aurantiacus</i>	sticky monkeyflower	2	32
<i>Rhamnus californica</i> ssp. <i>californica</i>	coffee berry	2	6
<i>Ribes sanguineum</i>	pink flowering current	2	6
Total			138

Tree Plantings

FOSC has received funding from the East Bay Municipal Utility District to plant trees in various locations of the watershed. The following table lists the trees to be planted in the Fern Ravine project area.

Upland Tree Plantings 2010 – 2011

Scientific Name	Common Name	Plot #	Quantity
<i>Acer macrophyllum</i>	big leaf maple	4	1
<i>Acer negundo</i>	box-elder	4	2
<i>Arbutus menziesii</i>	Pacific madrone	5	3
<i>Arbutus menziesii</i>	Pacific madrone	9	5
<i>Arbutus menziesii</i>	Pacific madrone	6	6
<i>Sambucus mexicana</i>	blue elderberry	9	3
<i>Quercus agrifolia</i>	coast live oak	6	5
<i>Quercus agrifolia</i>	coast live oak	9	3
Total			28

Redwood Understory

Winter 2010 – 2011 Redwood Understory

Scientific Name	Common Name	Plot #	Quantity
<i>Lonicera hispidula</i>	black twinberry	14	10
<i>Polystichum munitum</i>	western sword fern	14	2
<i>Rhamnus californica</i> ssp. <i>californica</i>	coffee berry	14	5
<i>Rubus ursinus</i>	California blackberry	14	16
<i>Smilacina stellata</i>	false Solomon's seal	14	5
<i>Stachys ajugoides</i>	hedge nettle	14	32
<i>Trientalis latifolia</i>	star flower	14	25
<i>Vaccinium ovatum</i>	huckleberry	14	6
Total			101

Winter 2010 - 2011 Redwood Understory

Scientific Name	Common Name	Plot #	Quantity
<i>Lonicera hispidula</i>	black twinberry	17	10
<i>Polystichum munitum</i>	western sword fern	17	3
<i>Rubus ursinus</i>	California blackberry	17	20
<i>Stachys ajugoides</i>	hedge nettle	17	32
<i>Trientalis latifolia</i>	star flower	17	25
Total			90

Winter 2011 - 2012 Redwood Understory

Scientific Name	Common Name	Plot #	Quantity
<i>Dryopteris arguta</i>	wood fern	14	6
<i>Lonicera hispidula</i>	California honeysuckle	14	16
<i>Polystichum munitum</i>	western sword fern	14	6
<i>Rubus parviflorus</i>	thimbleberry	14	16
<i>Rubus ursinus</i>	California blackberry	14	32
<i>Smilacina stellata</i>	false Solomon's seal	14	6
<i>Stachys ajugoides</i>	hedge nettle	14	32
<i>Tellima grandiflora</i>	fringecups	14	16
<i>Trientalis latifolia</i>	star flower	14	25
<i>Urtica dioica</i>	stinging nettle	14	6
<i>Vaccinium ovatum</i>	huckleberry	14	6
Total			161

Winter 2011 - 2012 Redwood Understory

Scientific Name	Common Name	Plot #	Quantity
<i>Dryopteris arguta</i>	wood fern	17	4
<i>Lonicera hispidula</i>	California honeysuckle	17	8
<i>Polystichum munitum</i>	western sword fern	17	3
<i>Rubus parviflorus</i>	thimbleberry	17	16
<i>Rubus ursinus</i>	California blackberry	17	16
<i>Stachys ajugoides</i>	hedge nettle	17	16
<i>Tellima grandiflora</i>	fringecups	17	16
<i>Trientalis latifolia</i>	star flower	17	25
Total			100

Fern Ravine Creek

Winter 2012 Riparian

Scientific Name	Common Name	Plot #	Quantity
<i>Asarum caudatum</i>	wild ginger	19	12
<i>Carex subbracteata</i>	small-bracted sedge	18	12
<i>Lonicera hispidula</i>	California honeysuckle	18	16
<i>Polystichum munitum</i>	western sword fern	18	4
<i>Rubus ursinus</i>	California blackberry	18	16
<i>Stachys ajugoides</i>	hedge nettle	18	16
Total			76

Volunteer Training in Planting Methods

Each planting event at the site will be led by FOSC staff and/or trained volunteer leaders who will demonstrate proper planting techniques to school groups and volunteers. Before any area is planted, it will have been prepared appropriately by removing invasive species in the area and establishing barrier protection when needed. Plants will be set in place prior to each planting event so that volunteers can easily understand where each plant should be planted. Demonstrations at the beginning of each event will teach volunteers how to: correctly dig an appropriately sized hole for each plant they install; remove the

plant from its container; prepare roots for planting; fill each hole with an appropriate amount of soil; and carry out any needed follow up methods, such as watering in, applying mulch around the plant, or building a small berm to retain water if planting on a slope.

Supplemental Watering

First and second year upland plantings will receive supplemental watering through late summer and early fall. Plantings in the redwood understory will only receive supplemental watering if water stress is observed. FOSC staff and volunteers will use a sixty-gallon transportable water bladder to supply water to plantings.

When planting events occur between rains, plants will be watered when they are planted. A very helpful method of insuring that water is available at the roots of the soil is to first fill a planting hole with water, let the water penetrate the soil, and then insert the plant and water it.

7. Summary of Recommendations

Table 4 summarizes the recommendations made in this plan. The Friends of Sausal Creek will need to coordinate with the City of Oakland, the Friends of Joaquin Miller Park, and the various stakeholder groups and will need to secure the necessary funding to accomplish the objectives of the plan.

Table 4 Summary of Recommendations

Problem Area or Topic	Recommendation
“Steps” by Sequoia Arena entrance gate	<ul style="list-style-type: none"> • Fence or barricade to prevent access to steps • Remove steps • Revegetate embankment • Block social trail below steps • Monitor revegetation • Explore runoff retention at roadside • Maintain embankment filtering through periodic litter removal
Fern Ravine Creek/ Fern Ravine Trail Crossing	<ul style="list-style-type: none"> • Assess efficacy of double-fence barriers and signage; modify as needed • Install logs or other barriers • Work with the City of Oakland to relocate summer camp campfire area and orienteering control posts • Construct new bridge crossing over Fern Ravine Creek • Repair or replace the Fern Ravine Trail bridge that crosses Orchard Creek
Weir and Trail Undercut	<ul style="list-style-type: none"> • Get City of Oakland to evaluate and maintain weir structure

Problem Area or Topic	Recommendation
Entire Project Area – Restricting Users to Trails (see Section 5.2 for details)	<ul style="list-style-type: none"> • Add additional barriers, including log barriers, brush barriers, and fences • Maintain barriers • Monitor west rim of bowl for new entry points; block as needed
Signage and Park User Education	<ul style="list-style-type: none"> • Add large interpretive panel signage at Fern Ravine Trail redwood entry • Add small signs to trailhead and log barriers at top of redwood bowl • FOOSC and FOJMP to collaborate on educational outreach to cyclists and other user groups
Orienteering Courses	<p>Collaborate with City of Oakland to:</p> <ul style="list-style-type: none"> • Meet with orienteering course representative • Enforce permit for large events • Move course out of the redwoods • Modify orienteering maps to mark sensitive areas as “out of bounds”
Summer Camps	<p>Collaborate with City of Oakland to:</p> <ul style="list-style-type: none"> • Change camp drop off location • Move campfire area to less sensitive location • Require all campers to stay on trail in restoration area • Disallow fort building (by all groups) • Instruct campers on park etiquette and reducing impacts
Horseshoe Picnic Area Upland	<ul style="list-style-type: none"> • Keep trails cleared and mulched • Protect new plantings with temporary barriers • Plant shrub border inside log barrier at wetlands
Large Tree Removal	<ul style="list-style-type: none"> • GPS locations of large trees and measure diameter • Prioritize large tree removal • Get tree removal permits as needed • Secure funding or City help for large tree removal
Entire Project Area – Restoration Plan (see Section 6 for details)	<ul style="list-style-type: none"> • Remove invasive species in plots as described in Eradication Schedule (Table 3) • Remove highly invasive species from all parts of project area • Routinely monitor soil moisture to determine best species for specific areas • Adhere to planting and monitoring methods (Appendix A) • Adhere to Planting Plans 2010-2012 (Section 6.4) • Provide supplemental watering as needed • Create new planting plans each year at end of planting season

8. Restoration Plan Authors

The following people contributed to this plan:

Paul Frank, P.E. – FOSC Board Member

Megan Hess - FOSC Restoration and Nursery Manager

Kimra McAfee - FOSC Executive Director

Karen Paulsell - FOSC long-time volunteer

Jill Sunahara, Environmental Consultant – FOSC Board Member

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Appendix A Planting and Monitoring Methods

A-1 Propagule Collection and Nursery Work

Seeds, cuttings, and divisions for use in the project will be gathered mainly from the Sausal Creek Watershed. See Appendix C for a list of native plant species to be used. FOSC may decide to introduce species found on nearby East Bay Regional Park District (EBRPD) lands.

Seed Collection

FOSC staff and volunteers will collect seed in Joaquin Miller Park and possibly from nearby East Bay Regional Park District lands during the months of May-September. Seeds will then be stored and treated if needed before propagation at the Joaquin Miller Native Plant Nursery.

Cutting Collection

FOSC staff and volunteers will collect cuttings from species found in Joaquin Miller Park and EBRPD lands each year during the months of January-March. All cuttings will be propagated at the Joaquin Miller Native Plant Nursery.

Collection of Divisions

FOSC staff and volunteers will collect divisions of species such as *Asarum caudatum* and *Stachys ajugoides* when appropriate for each species. Divisions will be transplanted at the Joaquin Miller Native Plant Nursery and will be cared for at the nursery until the next appropriate planting season

Fern Spore Collection

FOSC has not attempted propagation of ferns from spores. All ferns we have used in restoration areas so far have been “rescued” from trail building efforts or collapsing trail cuts, or have been dug up from large colonies of ferns in places not visible from trails. This has resulted in far less use of ferns in outplanting than optimal. Both sword ferns and wood ferns would be useful in quantity in the redwood understory restoration work, and lady ferns could be planted in portions of the lower creek with year-round moisture. The nursery stock of these ferns is currently very low.

FOSC can collect a limited number of ferns from Joaquin Miller Park for use in Fern Ravine. To increase the number of ferns available, options include:

- FOSC staff or volunteers could start fern propagation;
- FOSC could seek volunteer help from Merritt College Landscape Horticulture or other institution; and/or
- FOSC could hire a fern propagator, such as Martin Grantham, who teaches fern propagation classes.

FOSC should collect spores from sword, wood, and lady ferns during the summer of 2010 for propagation use.

Nursery

FOSC staff and volunteers at the Joaquin Miller Native Plant Nursery will propagate collected seeds and cuttings. The nursery is equipped with a greenhouse, shadehouse, sunny growing area, and irrigation. Public workdays take place most Saturdays year-round. Local students and other members of the surrounding community visit the nursery regularly to participate in propagation and nursery maintenance.

A-2 Monitoring

Vegetation Monitoring Methods

Vegetation monitoring will consist of quantitative sampling using the line-point intercept method coupled with qualitative observations. Permanent transect and photo points will be established at the outset of the project in order to track consistent data over time.

Vegetation monitoring will occur at least once every twelve months. Photo documentation will occur seasonally.

Maintenance-Related Inspections

Ongoing maintenance inspections will be performed seasonally by FOSC staff and site leaders to monitor plant health, invasive species occurrence, barrier installations, and overall conditions throughout the site. FOSC staff and volunteers will record findings on project record data sheets in order to share information and plan for management of the site based on needs.

Performance Monitoring

Performance monitoring at the site will assess progress toward goals stated at the outset of this project. Areas to be examined include: increase in native species cover; decrease in exotic species cover; condition and success of protective off-trail barriers; and improved hydrological function of the sub-watershed. Photo and written documentation along with vegetation monitoring will contribute to the overall annual assessments.

Hydrology

Hydrology improvement goals include increasing native vegetation cover to better retain sediments in the creek, diversion of the current trail crossing through the creek channel to the proposed footbridge above the creek, and improving problem areas causing erosion from parking lot and road runoff into the site. Vegetation monitoring, photo documentation, and visual observations during rain events will contribute to long-term progress monitoring of hydrological functions at the site.

Vegetation

The goal is to establish self-perpetuating upland, wetland, riparian, and redwood understory plant communities, composed predominately of native plant species throughout the series of marked plots. Cover of exotic species should be stable or decreasing at the five-year mark after restoration has begun in each plot.

Schedule

Overall performance monitoring will occur annually for the first five years of this project.

A-3 Debris Removal at Work Sites

- Debris to be removed should be piled neatly until City can remove it.
- In general, keep as much biomass in the system as possible.
- Large woody debris is needed for blocking off-trail use; it should be piled neatly in an unobtrusive location.
- Remove all non-native material likely to contain viable seeds, as well as resprouting material such as Cape ivy.

Appendix B Vegetation at the Site

Nativity Key

N	Native
E	Exotic
C	California native, not local native
N?	Nativity suspect

Fern Ravine Native Species

Scientific Name	Common Name	Nativity	Uplands	Wetland	Wetland Edge	Creek, Upper	Creek, Lower	Redwoods	Notes
<i>Acer macrophyllum</i>	big-leaf maple	N			✓				
<i>Actaea rubra</i>	baneberry	N					✓		one plant, near thimbleberry
<i>Agoseris grandiflora</i>	California dandelion	N	✓						tentative ID from seedhead, leaves
<i>Arbutus menziesii</i>	Pacific madrone	N	✓						
<i>Athyrium filix-femina var. cyclosum</i>	western lady fern	N		✓		✓			upper wetland
<i>Baccharis pilularis</i>	coyote brush	N	✓	✓	✓				
<i>Carex subbracteata</i>	small-bracted sedge	N		✓	✓	✓	✓		
<i>Corylus cornuta</i>	hazelnut	N					✓	✓	
<i>Cyperus eragrostis</i>	tall nutsedge	N				✓			
<i>Disporum hookeri</i>	Fairy bells	N						✓	one small plant
<i>Dryopteris arguta</i>	coastal wood fern	N		✓				✓	in upper wetland area
<i>Elymus glaucus ssp. glaucus</i>	blue wildrye	N	✓						
<i>Fragaria vesca</i>	woodland strawberry	N			✓				
<i>Galium aparine</i>	Bedstraw	N?		✓	✓				some debate about its origin
<i>Galium californicum</i>	California bedstraw	N						✓	
<i>Gnaphalium californicum</i>	cudweed	N	✓	▪	✓				three spots
<i>Gnaphalium ramosissimum</i>	pink everlasting	N	✓						

Fern Ravine Native Species

Scientific Name	Common Name	Nativity	Uplands	Wetland	Wetland Edge	Creek, Upper	Creek, Lower	Redwoods	Notes
<i>Juncus effusus</i> var. <i>pacificus</i>	bog rush	N		✓		✓			
<i>Juncus patens</i>	common rush	N		✓					
<i>Lonicera hispidula</i> var. <i>vacillans</i>	California honeysuckle	N	✓					✓	
<i>Lotus micranthus</i>	small flowered lotus	N	✓						at edge of Skyline, tentative ID
<i>Madia sativa</i>	tarweed	N	✓		✓				roadside, mostly
<i>Mimulus aurantiacus</i>	sticky monkeyflower	N	✓						above trail at top of upper wetland
<i>Phacelia nemoralis</i> ssp. <i>nemoralis</i>	bristly phacelia	N	✓						
<i>Polystichum munitum</i>	western sword fern	N			✓		✓	✓	upper wetland
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	bracken fern	N					✓	✓	
<i>Quercus agrifolia</i> var. <i>agrifolia</i>	coast live oak	N	✓						
<i>Rhamnus californica</i> ssp. <i>californica</i>	California coffeeberry	N						✓	
<i>Rubus parviflora</i>	thimbleberry	N						✓	high on trail edge near S-B Trail
<i>Rubus ursinus</i>	California blackberry	N		✓	✓	✓	✓	✓	
<i>Sambucus mexicana</i>	blue elderberry	N	✓						
<i>Sanicula crassicaulis</i>	Pacific sanicle	N	✓						
<i>Scrophularia californica</i> ssp. <i>californica</i>	bee plant	N	✓	✓	✓			✓	
<i>Sequoia sempervirens</i>	coast redwood	N		✓				✓	
<i>Sisyrinchium bellum</i>	blue-eyed grass	N	✓						just one, at edge of Skyline Blvd.
<i>Smilacina stellata</i>	small false Solomon's seal	N						✓	
<i>Stachys ajugoides</i> var. <i>rigida</i>	common wood mint	N			✓			✓	
<i>Tellima grandiflora</i>	fringe cups	N						✓	near trail
<i>Trientalis latifolia</i>	star flower	N						✓	
<i>Trillium ovatum</i> ssp. <i>ovatum</i>	white trillium	N						✓	where Orchard Creek enters
<i>Typha latifolia</i>	cattail	N		✓					tentative ID
<i>Umbellularia californica</i>	California bay	N	✓					✓	
<i>Urtica dioica</i>	stinging nettle	N		✓	✓				upper wetland area
<i>Vaccinium ovatum</i>	California huckleberry	N						✓	

Fern Ravine Non-Native Species

Scientific Name	Common Name	Nativity	Uplands	Wetland	Wetland Edge	Creek, Upper	Creek, Lower	Redwoods	Notes
<i>Acacia dealbata</i>	silver wattle	E	✓	✓	✓	✓			
<i>Acacia mearnsii</i>	black wattle	E	✓						leaves like silver wattle, but green
<i>Acacia melanoxylon</i>	blackwood acacia	E	✓						
<i>Aira caryophylla</i>	silver hairgrass	E	✓						tentative ID
<i>Allium triquetrum</i>	three-cornered leek	E	✓						small amount
<i>Alnus rubra</i>	red alder	C			✓	✓			
<i>Avena barbata</i>	slender wild oat	E	✓						
<i>Bellis perennis</i>	English daisy	E	✓						
<i>Briza maxima</i>	quaking grass	E	✓						
<i>Bromus diandrus</i>	ripgut brome	E	✓						
<i>Carduus pycnocephalus</i>	Italian thistle	E	✓						
<i>Cirsium vulgare</i>	bull thistle	E	✓	✓	✓				lots of it
<i>Conium maculatum</i>	poison hemlock	E		✓					
<i>Cotoneaster sp.</i>	Cotoneaster	E	✓					✓	
<i>Cupressus macrocarpa</i>	Monterey cypress	C	✓						
<i>Cynodon dactylon</i>	Bermuda grass	E	✓						
<i>Delairea odorata</i>	cape ivy	E	✓			✓			where road crosses trib creek
<i>Duchesnea indica</i>	mock strawberry	E			✓				
<i>Ehrharta erecta</i>	veldt grass	E	✓				✓	✓	
<i>Erechtites minima</i>	Australian fireweed	E		✓					tentative ID
<i>Genista monspessulana</i>	French broom	E	✓						
<i>Gnaphalium luteo-album</i>	common cudweed	E	✓						
<i>Holcus lanatus</i>	velvet grass	E				✓			
<i>Ilex aquifolium</i>	English holly	E						✓	two spots, one may be extirpated

Fern Ravine Non-Native Species

Scientific Name	Common Name	Nativity	Uplands	Wetland	Wetland Edge	Creek, Upper	Creek, Lower	Redwoods	Notes
<i>Lactuca species</i>	wild lettuce	E			✓			✓	
<i>Lolium multiflorum</i>	Italian ryegrass	E	✓		✓				
<i>Myosotis latifolia</i>	forget-me-not	E		✓			✓		
<i>Oxalis pes-caprae</i>	Bermuda buttercup	E	✓						
<i>Pinus radiata</i>	Monterey pine	C	✓		✓				
<i>Ranunculus muricatus</i>	spiny buttercup	E		✓					
<i>Rubus discolor</i>	Himalayan blackberry	E		✓					
<i>Rumex sp.</i>	dock	E			✓				species?
<i>Silybum marianum</i>	milk-thistle	E	✓						only saw one
<i>Sisymbrium officinale</i>	hedge mustard	E	✓						
<i>Solanum sp.</i>	nightshade	N?	✓	✓					
TBD	chickweed	E	✓						
<i>Torilis arvensis</i>	hedge parsley	E	✓						
<i>Ulmus americana</i>	American elm	E		✓	✓				
<i>Vinca major</i>	greater periwinkle	E	✓						
<i>Zantedeschia aethiopica</i>	calla lily	E	✓						

Appendix C Native Plant Palettes for Revegetation

The tables in this section list local native species for each of the habitat types.

Wetland and Riparian					
Scientific name	Common Name	Lifeform	Aquatic	Wet Meadow	Riparian
<i>Acer macrophyllum</i>	big-leaf maple	Tree			*
<i>Acer negundo</i> var. <i>californicum</i>	box-elder	Tree			*
<i>Alnus rhombifolia</i>	white alder	Tree			*
<i>Alnus rubra</i>	red alder	Tree			*
<i>Aquilegia formosa</i>	columbine	Perennial		*	*
<i>Aralia californica</i>	elk-clover	Perennial		*	*
<i>Aster chilensis</i>	common aster	Perennial		*	
<i>Athyrium filix-femina</i> var. <i>cyclosorum</i>	western lady fern	Fern			*
<i>Baccharis douglasii</i>	marsh baccharis	Perennial		*	*
<i>Brodiaea elegans</i> ssp. <i>elegans</i>	harvest brodiaea	Perennial		*	
<i>Cardamine oligosperma</i>	bitter cress	Annual		*	*
<i>Carex barbarae</i>	Santa Barbara sedge	Perennial			*
<i>Carex deweyana</i> ssp. <i>leptopoda</i>	short-scale sedge	Perennial			*
<i>Carex obnupta</i>	slough sedge	Perennial	*		*
<i>Cornus sericea</i> ssp. <i>sericea</i>	American dogwood	Shrub			*
<i>Cyperus eragrostis</i>	tall flatsedge	Perennial		*	*
<i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>	willow-herb	Perennial		*	*
<i>Equisetum hyemale</i> or <i>laevigatum</i> ?	scouring rush	Perennial			*
<i>Equisetum telmateia</i> ssp. <i>braunii</i>	giant horsetail	Perennial			*
<i>Helenium puberulum</i>	sneezeweed	Perennial			*
<i>Juncus bufonius</i> var. <i>bufonius</i>	toad rush	Grass		*	*
<i>Juncus effusus</i> var. <i>pacificus</i>	Pacific rush	Perennial		*	*
<i>Juncus patens</i>	common rush	Perennial		*	*
<i>Juncus xiphioides</i>	iris-leaf rush	Perennial		*	*
<i>Lomatium</i> sp.	biscuitroot	Perennial			*
<i>Lonicera hispidula</i> var. <i>vacillans</i>	California honeysuckle	Vine			*
<i>Lonicera involucrata</i> var. <i>ledebourii</i>	black twinberry	Shrub			*
<i>Luzula comosa</i>	common woodrush	Perennial			*
<i>Mimulus cardinalis</i>	red monkeyflower	Perennial		*	*
<i>Mimulus guttatus</i>	yellow monkeyflower	Perennial			*
<i>Nemophila heterophylla</i>	small baby-blue eyes	Annual			*
<i>Oenanthe sarmentosa</i>	water parsley	Perennial		*	*
<i>Phacelia nemoralis</i> ssp. <i>nemoralis</i>	bristly phacelia	Perennial			*
<i>Pholistoma auritum</i> var. <i>auritum</i>	blue fiesta flower	Annual			*
<i>Physocarpus capitatus</i>	ninebark	Shrub			*
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	black cottonwood	Tree			*
<i>Ribes divaricatum</i> var. <i>pubiflorum</i>	straggly gooseberry	Shrub			*
<i>Rorippa nasturtium-aquaticum</i>	watercress	Perennial	*	*	*
<i>Rosa californica</i>	California wild rose	Shrub			*
<i>Rubus parviflorus</i>	thimbleberry	Perennial			*
<i>Salix laevigata</i>	red willow	Tree			*

Wetland and Riparian

Scientific name	Common Name	Lifeform	Aquatic	Wet Meadow	Riparian
<i>Salix lasiolepis</i>	arroyo willow	Shrub	▪	▪	□
<i>Sambucus mexicana</i>	blue elderberry	Shrub			*
<i>Sambucus racemosa</i> var. <i>racemosa</i>	red elderberry	Shrub			*
<i>Scirpus microcarpus</i>	small-fruited bulrush	Perennial	*		*
<i>Scrophularia californica</i> ssp. <i>californica</i>	bee plant	Perennial			*
<i>Thalictrum fendleri</i> var. <i>polycarpum</i>	meadow-rue	Perennial			*
<i>Toxicodendron diversilobum</i>	poison oak	Shrub		*	*
<i>Typha latifolia</i>	cattail	Grass	*	*	
<i>Urtica dioica</i> ssp. <i>holosericea</i>	stinging nettle	Perennial			*
<i>Veronica americana</i>	American brooklime	Perennial			*
<i>Vicia gigantea</i>	giant vetch	Perennial			*
<i>Woodwardia fimbriata</i>	giant chain fern	Fern			*

Redwoods

Scientific name	Common Name	Lifeform
<i>Actaea rubra</i>	baneberry	Perennial
<i>Angelica tomentosa</i>	woolly angelica	Perennial
<i>Arbutus menziesii</i>	Pacific madrone	Tree
<i>Asarum caudatum</i>	wild ginger	Perennial
<i>Baccharis douglasii</i>	marsh baccharis	Perennial
<i>Berberis pinnata</i> ssp. <i>pinnata</i>	California barberry	Shrub
<i>Cardamine californica</i>	milk maids	Annual
<i>Carex globosa</i>	round-fruit sedge	Perennial
<i>Ceanothus thyrsiflorus</i>	blueblossom	Shrub
<i>Chrysolepis chrysophylla</i> var. <i>minor</i>	golden chinquapin	Shrub
<i>Corallorrhiza</i> sp.	coral root	Perennial
<i>Disporum hookeri</i>	fairy bells	Perennial
<i>Dodecatheon hendersonii</i>	shooting stars	Perennial
<i>Fragaria vesca</i>	wood strawberry	Perennial
<i>Galium californicum</i> ssp. <i>californicum</i>	California bedstraw	Perennial
<i>Gaultheria shallon</i>	salal	Shrub
<i>Heuchera micrantha</i>	alumroot	Perennial
<i>Holodiscus discolor</i>	ocean spray	Shrub
<i>Lathyrus vestitus</i> var. <i>vestitus</i>	Pacific pea	Perennial
<i>Marah oreganus</i>	coast man-root	Perennial
<i>Mimulus aurantiacus</i>	bush monkeyflower	Shrub
<i>Monardella villosa</i>	coyote mint	Perennial
<i>Oemleria cerasiformis</i>	oso berry	Shrub
<i>Oxalis oregana</i>	redwood sorrel	Perennial
<i>Phacelia nemoralis</i> ssp. <i>nemoralis</i>	bristly phacelia	Perennial
<i>Polypodium calirhiza</i>	licorice fern	Fern
<i>Polypodium scoleri</i>	leather-leaf fern	Fern
<i>Polystichum munitum</i>	Western sword fern	Fern
<i>Ribes californicum</i> var. <i>californicum</i>	hillside gooseberry	Shrub
<i>Ribes divaricatum</i> var. <i>pubiflorum</i>	straggly gooseberry	Shrub
<i>Ribes menziesii</i>	canyon gooseberry	Shrub
<i>Rosa gymnocarpa</i>	wood rose	Shrub
<i>Rubus parviflorus</i>	thimbleberry	Perennial
<i>Rubus ursinus</i>	California blackberry	Vine
<i>Sambucus racemosa</i> var. <i>racemosa</i>	red elderberry	Shrub
<i>Satureja douglasii</i>	yerba buena	Perennial
<i>Scrophularia californica</i> ssp. <i>californica</i>	bee plant	Perennial
<i>Sequoia sempervirens</i>	Coast redwood	Tree
<i>Sidalcea malviflora</i> ssp. <i>laciniata</i>	checker mallow	Perennial
<i>Smilacina stellata</i>	little false Solomon's seal	Perennial
<i>Stachys ajugoides</i> var. <i>rigida</i>	common wood mint	Perennial
<i>Tellima grandiflora</i>	fringe cups	Perennial
<i>Toxicodendron diversilobum</i>	poison oak	Shrub
<i>Trientalis latifolia</i>	star flower	Perennial
<i>Trillium chloropetalum</i>	giant trillium	Perennial
<i>Trillium ovatum</i> ssp. <i>ovatum</i>	white trillium	Perennial
<i>Typha</i> sp.	cattail	Grass
<i>Vaccinium ovatum</i>	California huckleberry	Shrub
<i>Vicia gigantea</i>	giant vetch	Perennial
<i>Viola glabella</i>	stream violet	Perennial
<i>Viola sempervirens</i>	evergreen violet	Perennial
<i>Zigadenus fremontii</i>	zigadene	Perennial

Uplands

Grassland and Coastal Scrub Areas				
Scientific name	Common Name	Lifeform	Grassland	Coastal Scrub
<i>Acaena pinnatifida</i> var. <i>californica</i>	California sheepburr	Perennial	*	*
<i>Achillea millefolium</i>	yarrow	Perennial	*	
<i>Agoseris grandiflora</i>	California dandelion	Perennial	*	*
<i>Agrostis pallens</i>	bent grass	Grass	*	
<i>Anaphalis margaritacea</i>	pearly everlasting	Perennial	*	
<i>Artemisia californica</i>	California sagebrush	Shrub		*
<i>Artemisia douglasiana</i>	mugwort	Perennial	*	*
<i>Aster chilensis</i>	common aster	Perennial	*	
<i>Baccharis pilularis</i>	coyote brush	Shrub		*
<i>Berberis pinnata</i> ssp. <i>pinnata</i>	California barberry	Shrub		*
<i>Bromus carinatus</i> var. <i>carinatus</i>	California brome	Grass	*	*
<i>Calochortus luteus</i>	yellow mariposa lily	Perennial	*	
<i>Calochortus umbellatus</i>	Oakland star-tulip	Perennial	*	
<i>Calystegia purpurata</i> ssp. <i>purpurata</i>	morning glory	Annual		*
<i>Calystegia subacaulis</i> ssp. <i>subacaulis</i>	hill morning-glory	Perennial	*	*
<i>Carex deweyana</i> ssp. <i>leptopoda</i>	short-scale sedge	Perennial	*	*
<i>Carex globosa</i>	round-fruit sedge	Perennial		*
<i>Carex subbracteata</i>	small-bracted sedge	Perennial	*	*
<i>Ceanothus thyrsoiflorus</i>	blueblossom	Shrub		*
<i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	soap plant	Perennial	*	*
<i>Cirsium occidentale</i> var. <i>venustum</i>	Venus thistle	Annual	*	
<i>Clarkia rubicunda</i>	farewell-to-spring	Annual	*	*
<i>Collinsia heterophylla</i>	Chinese houses	Annual	*	
<i>Corylus cornuta</i> var. <i>californica</i>	California hazelnut	Shrub	*	
<i>Dichelostemma capitatum</i> ssp. <i>capitatum</i>	blue dicks	Perennial	*	*
<i>Dryopteris arguta</i>	coastal wood fern	Fern		*
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	blue wildrye	Grass	*	
<i>Elymus multisetus</i>	big squirreltail	Grass	*	
<i>Epilobium canum</i> ssp. <i>canum</i>	California fuchsia	Perennial		*
<i>Eriogonum luteolum</i> var. <i>caninum</i>	Tiburon buckwheat	Annual	*	
<i>Eriogonum nudum</i> var. <i>auriculatum</i>	eared buckwheat	Perennial	*	*
<i>Eriophyllum confertiflorum</i> var. <i>confertiflorum</i>	golden yarrow	Shrub		*
<i>Eschscholzia californica</i>	California poppy	Perennial	*	
<i>Fritillaria affinis</i> var. <i>affinis</i>	checker lily	Perennial	*	*
<i>Galium porrigens</i> var. <i>porrigens</i>	climbing bedstraw	Perennial		*
<i>Garrya elliptica</i>	coast silk-tassle	Shrub		*
<i>Gnaphalium californicum</i>	cudweed	Annual		*
<i>Gnaphalium ramosissimum</i>	pink everlasting	Perennial		*
<i>Grindelia hirsutula</i> var. <i>hirsutula</i>	gumweed	Perennial	*	*
<i>Helenium puberulum</i>	sneezeweed	Perennial	*	
<i>Hemizonia congesta</i> ssp. <i>luzulifolia</i>	hayfield tarweed	Annual	*	
<i>Heracleum lanatum</i>	cow parsnip	Perennial		*
<i>Heterotheca sessiliflora</i> ssp. <i>bolanderi</i>	golden aster	Perennial	*	*
<i>Holodiscus discolor</i>	ocean spray	Shrub		*
<i>Iris douglasiana</i>	Douglas' iris	Perennial	*	
<i>Juncus patens</i>	common rush	Perennial		*
<i>Koeleria macrantha</i>	Junegrass	Grass	*	*

Grassland and Coastal Scrub Areas

Scientific name	Common Name	Lifeform	Grassland	Coastal Scrub
<i>Lotus scoparius</i> var. <i>scoparius</i>	California broom	Shrub		*
<i>Lupinus albifrons</i> var. <i>albifrons</i>	silver bush lupine	Shrub	*	*
<i>Lupinus bicolor</i>	bicolored lupine	Annual	*	*
<i>Lupinus succulentus</i>	Arroyo lupine	Annual	*	
<i>Madia sativa</i>	coast tarweed	Annual	*	*
<i>Marah fabaceus</i>	California man-root	Perennial	*	
<i>Melica californica</i>	California melic	Grass	*	
<i>Mimulus aurantiacus</i>	bush monkeyflower	Shrub		*
<i>Monardella villosa</i>	coyote mint	Perennial		*
<i>Nassella lepida</i>	foothill needlegrass	Grass	*	*
<i>Nassella pulchra</i>	purple needlegrass	Perennial	*	*
<i>Pellaea andromedifolia</i>	coffee fern	Fern	*	*
<i>Pentagramma triangularis</i> ssp. <i>triangularis</i>	goldback fern	Fern	*	*
<i>Perideridia kelloggii</i>	yampah	Perennial	*	
<i>Phacelia californica</i>	California phacelia	Perennial		*
<i>Physocarpus capitatus</i>	ninebark	Shrub		*
<i>Plantago erecta</i>	California plantain	Annual	*	*
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	bracken fern	Fern		*
<i>Ranunculus californicus</i>	California buttercup	Perennial	*	*
<i>Rhamnus californica</i> ssp. <i>californica</i>	California coffeeberry	Shrub		*
<i>Rhamnus crocea</i>	redberry buckthorn	Shrub		*
<i>Ribes divaricatum</i> var. <i>pubiflorum</i>	straggly gooseberry	Shrub		*
<i>Ribes sanguineum</i> var. <i>glutinosum</i>	red-flowering currant	Shrub		*
<i>Rosa californica</i>	California wild rose	Shrub	*	
<i>Rosa gymnocarpa</i>	wood rose	Shrub	*	*
<i>Rubus ursinus</i>	California blackberry	Vine	*	
<i>Sambucus mexicana</i>	blue elderberry	Shrub		*
<i>Sambucus racemosa</i> var. <i>racemosa</i>	red elderberry	Shrub		*
<i>Sanicula bipinnatifida</i>	purple sanicle	Perennial	*	
<i>Sanicula crassicaulis</i>	Pacific sanicle	Perennial	*	
<i>Satureja douglasii</i>	yerba buena	Perennial		*
<i>Scrophularia californica</i> ssp. <i>californica</i>	bee plant	Perennial		*
<i>Sidalcea malviflora</i> ssp. <i>laciniata</i>	checker mallow	Perennial	*	*
<i>Silene californica</i>	Indian pink, scarlet campion	Perennial		*
<i>Sisyrinchium bellum</i>	blue-eyed grass	Perennial	*	
<i>Solanum umbelliferum</i>	blue witch	Shrub	*	*
<i>Solidago californica</i>	California goldenrod	Perennial	*	*
<i>Stachys ajugoides</i> var. <i>rigida</i>	common wood mint	Perennial	*	*
<i>Streptanthus glandulosus</i> ssp. <i>glandulosus</i>	jewelflower	Annual	*	
<i>Triteleia laxa</i>	Ithuriel's spear	Perennial	*	
<i>Uropappus lindleyi</i>	silver puffs	Annual	*	
<i>Urtica dioica</i> ssp. <i>holosericea</i>	stinging nettle	Perennial	*	
<i>Vaccinium ovatum</i>	California huckleberry	Shrub		*
<i>Vicia gigantea</i>	giant vetch	Perennial		*
<i>Wyethia angustifolia</i>	narrowleaf mule-ears	Perennial	*	
<i>Zigadenus fremontii</i>	zigadene	Perennial	*	*

Woodland and Forest

Scientific name	Common Name	Lifeform	Woodland	Oak Woodland	Mixed Hardwood Forest
<i>Acer macrophyllum</i>	big-leaf maple	Tree			*
<i>Actaea rubra</i>	baneberry	Perennial			*
<i>Adiantum jordanii</i>	California maidenhair	Fern	*	*	*
<i>Aesculus californica</i>	California buckeye	Tree	*		*
<i>Agoseris grandiflora</i>	California dandelion	Perennial	*		
<i>Agrostis pallens</i>	bent grass	Grass	*		*
<i>Anaphalis margaritacea</i>	pearly everlasting	Perennial	*		
<i>Angelica tomentosa</i>	woolly angelica	Perennial	*		*
<i>Aquilegia formosa</i>	columbine	Perennial	*	*	
<i>Apocynum androsaemifolium</i>	bitter dogbane	Perennial	*		
<i>Aralia californica</i>	elk-clover	Perennial		*	
<i>Arbutus menziesii</i>	Pacific madrone	Tree	*	*	*
<i>Arctostaphylos pallida</i>	pallid manzanita	Shrub	*		*
<i>Artemisia douglasiana</i>	mugwort	Perennial	*		
<i>Aster chilensis</i>	common aster	Perennial	*	*	
<i>Aster radulinus</i>	rough-leaved aster	Perennial	*	*	*
<i>Baccharis douglasii</i>	marsh baccharis	Perennial	*		
<i>Baccharis pilularis</i>	coyote brush	Shrub	*		*
<i>Barbarea orthoceras</i>	winter cress	Annual	*		
<i>Berberis pinnata</i> ssp. <i>pinnata</i>	California barberry	Shrub		*	*
<i>Brodiaea elegans</i> ssp. <i>elegans</i>	harvest brodiaea	Perennial	*		
<i>Bromus carinatus</i> var. <i>carinatus</i>	California brome	Grass	*		
<i>Bromus laevipes</i>	woodland brome	Grass	*	*	*
<i>Calochortus luteus</i>	yellow mariposa lily	Perennial	*		*
<i>Calochortus umbellatus</i>	Oakland star-tulip	Perennial	*		*
<i>Calystegia purpurata</i> ssp. <i>purpurata</i>	morning glory	Annual	*		
<i>Calystegia subacaulis</i> ssp. <i>subacaulis</i>	hill morning-glory	Perennial		*	
<i>Cardamine californica</i>	milk maids	Annual	*	*	*
<i>Cardamine oligosperma</i>	bitter cress	Annual	*	*	
<i>Carex globosa</i>	round-fruit sedge	Perennial	*	*	*
<i>Carex subbracteata</i>	small-bracted sedge	Perennial	*	*	
<i>Ceanothus oliganthus</i> var. <i>sorediatus</i>	jimbrush	Shrub	*		*
<i>Ceanothus thyrsiflorus</i>	blueblossom	Shrub			*
<i>Cercocarpus betuloides</i> var. <i>betuloides</i>	mountain mahogany	Shrub		*	
<i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	soap plant	Perennial	*	*	
<i>Cirsium occidentale</i> var. <i>venustum</i>	Venus thistle	Annual	*		
<i>Clarkia rubicunda</i>	farewell-to-spring	Annual	*		*
<i>Claytonia parviflora</i> ssp. <i>parviflora</i>	miner's lettuce	Annual	*	*	*

Woodland and Forest

Scientific name	Common Name	Lifeform	Woodland	Oak Woodland	Mixed Hardwood Forest
<i>Claytonia perfoliata</i> ssp. <i>perfoliata</i>	miner's lettuce	Annual	*		*
<i>Clematis lasiantha</i>	pipestems	Vine	*		
<i>Collinsia heterophylla</i>	Chinese houses	Annual	*		
<i>Corallorrhiza</i> sp.	coral root	Perennial			*
<i>Corylus cornuta</i> var. <i>californica</i>	California hazelnut	Shrub	*	*	
<i>Cynoglossum grande</i>	hound's tongue	Perennial		*	*
<i>Deschampsia</i> sp.	hairgrass	Ann/Per	*		
<i>Dichelostemma capitatum</i> ssp. <i>capitatum</i>	blue dicks	Perennial	*		
<i>Dirca occidentalis</i>	Western leatherwood	Shrub	*	*	*
<i>Disporum hookeri</i>	fairy bells	Perennial		*	*
<i>Dodecatheon hendersonii</i>	shooting stars	Perennial	*		
<i>Dryopteris arguta</i>	coastal wood fern	Fern		*	*
<i>Elymus glaucus</i> ssp. <i>glaucus</i>	blue wildrye	Grass	*	*	*
<i>Elymus multisetus</i>	big squirreltail	Grass	*		
<i>Epilobium brachycarpum</i>	annual fireweed	Annual	*	*	
<i>Equisetum hyemale</i> or <i>laevigatum</i> ?	scouring rush	Perennial	*		
<i>Eriogonum nudum</i> var. <i>auriculatum</i>	eared buckwheat	Perennial	*		
<i>Eschscholzia californica</i>	California poppy	Perennial	*	*	*
<i>Festuca californica</i>	California fescue	Grass		*	
<i>Fragaria vesca</i>	wood strawberry	Perennial			*
<i>Fritillaria affinis</i> var. <i>affinis</i>	checker lily	Perennial	*		*
<i>Galium aparine</i>	goose grass	Annual	*		
<i>Galium californicum</i> ssp. <i>californicum</i>	California bedstraw	Perennial			*
<i>Galium porrigens</i> var. <i>porrigens</i>	climbing bedstraw	Perennial	*	*	*
<i>Galium triflorum</i>	sweet-scented bedstraw	Annual	*		
<i>Garrya elliptica</i>	coast silk-tassle	Shrub			*
<i>Gilia achilleifolia</i>	California gilia	Annual	*		*
<i>Gnaphalium bicolor</i>	cudweed	Perennial			*
<i>Gnaphalium californicum</i>	cudweed	Annual	*		
<i>Gnaphalium canescens</i> ssp. <i>beneolens</i>	cudweed	Perennial		*	
<i>Gnaphalium ramosissimum</i>	pink everlasting	Perennial			*
<i>Grindelia hirsutula</i> var. <i>hirsutula</i>	gumweed	Perennial	*		
<i>Hemizonia congesta</i> ssp. <i>luzulifolia</i>	hayfield tarweed	Annual	*		
<i>Heracleum lanatum</i>	cow parsnip	Perennial	*		
<i>Heteromeles arbutifolia</i>	toyon	Tree		*	*
<i>Heterotheca sessiliflora</i> ssp. <i>bolanderi</i>	golden aster	Perennial			*
<i>Heuchera micrantha</i>	alumroot	Perennial	*		*
<i>Holodiscus discolor</i>	ocean spray	Shrub		*	
<i>Iris douglasiana</i>	Douglas' iris	Perennial	*		*

Woodland and Forest

Scientific name	Common Name	Lifeform	Woodland	Oak Woodland	Mixed Hardwood Forest
<i>Juncus patens</i>	common rush	Perennial	*		
<i>Koeleria macrantha</i>	Junegrass	Grass	*		
<i>Lathyrus vestitus</i> var. <i>vestitus</i>	Pacific pea	Perennial	*	*	*
<i>Lonicera hispidula</i> var. <i>vacillans</i>	California honeysuckle	Vine		*	*
<i>Lotus humistratus</i>	woolly trefoil	Annual	*	*	
<i>Lotus micranthus</i>	hill lotus	Annual	*		
<i>Lotus stipularis</i> var. <i>stipularis</i>	balsam bird's-foot trefoil	Perennial			*
<i>Lupinus albifrons</i> var. <i>albifrons</i>	silver bush lupine	Shrub	*		
<i>Lupinus bicolor</i>	bicolored lupine	Annual	*		*
<i>Lupinus succulentus</i>	Arroyo lupine	Annual	*		
<i>Luzula comosa</i>	common woodrush	Perennial	*	*	*
<i>Madia gracilis</i>	slender tarweed	Annual	*		
<i>Marah fabaceus</i>	California man-root	Perennial	*		*
<i>Marah oreganus</i>	coast man-root	Perennial		*	*
<i>Melica californica</i>	California melic	Grass	*	*	*
<i>Melica imperfecta</i>	coast range melic	Grass	*		
<i>Melica torreyana</i>	Torrey's melic grass	Grass	*		*
<i>Mimulus aurantiacus</i>	bush monkeyflower	Shrub	*	*	*
<i>Monardella villosa</i>	coyote mint	Perennial	*	*	*
<i>Nassella lepida</i>	foothill needlegrass	Grass		*	
<i>Nassella pulchra</i>	purple needlegrass	Perennial	*	*	
<i>Navarretia squarrosa</i>	skunkweed	Annual	*	*	*
<i>Nemophila heterophylla</i>	small baby-blue eyes	Annual		*	
<i>Oemleria cerasiformis</i>	oso berry	Shrub		*	*
<i>Osmorhiza chilensis</i>	wood cicely	Perennial	*		*
<i>Pellaea andromedifolia</i>	coffee fern	Fern	*	*	
<i>Pentagramma triangularis</i> ssp. <i>triangularis</i>	goldback fern	Fern	*	*	*
<i>Perideridia kelloggii</i>	yampah	Perennial	*		*
<i>Phacelia californica</i>	California phacelia	Perennial	*		
<i>Phacelia imbricata</i> ssp. <i>imbricata</i>	imbricate phacelia	Perennial	*		
<i>Phacelia nemoralis</i> ssp. <i>nemoralis</i>	bristly phacelia	Perennial		*	*
<i>Pholistoma auritum</i> var. <i>auritum</i>	blue fiesta flower	Annual	*	*	
<i>Phoradendron villosum</i>	mistletoe	Perennial		*	
<i>Physocarpus capitatus</i>	ninebark	Shrub	*		
<i>Piperia elegans</i>	rein orchid	Perennial	*		
<i>Plantago erecta</i>	California plantain	Annual	*		
<i>Polypodium calirhiza</i>	licorice fern	Fern		*	*
<i>Polypodium scolieri</i>	leather-leaf fern	Fern			*
<i>Polystichum munitum</i>	Western sword fern	Fern		*	*

Woodland and Forest

Scientific name	Common Name	Lifeform	Woodland	Oak Woodland	Mixed Hardwood Forest
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	black cottonwood	Tree	*		
<i>Potentilla glandulosa</i> ssp. <i>glandulosa</i>	sticky cinquefoil	Perennial	*		
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	bracken fern	Fern		*	
<i>Quercus agrifolia</i> var. <i>agrifolia</i>	coast live oak	Tree	*	*	*
<i>Quercus chrysolepis</i>	canyon live oak	Tree	*	*	
<i>Quercus parvula</i> var. <i>shrevei</i>	Shreve oak	Tree	*		
<i>Quercus wislizenii</i> var. <i>wislizenii</i>	interior live oak	Tree		*	
<i>Quercus X morehus</i>	oracle oak	Tree	*	*	
<i>Rafinesquia californica</i>	California chicory	Annual	*		
<i>Ranunculus californicus</i>	California buttercup	Perennial	*	*	*
<i>Rhamnus californica</i> ssp. <i>californica</i>	California coffeeberry	Shrub	*		*
<i>Rhamnus crocea</i>	redberry buckthorn	Shrub	*	*	*
<i>Ribes californicum</i> var. <i>californicum</i>	hillside gooseberry	Shrub	*	*	*
<i>Ribes divaricatum</i> var. <i>pubiflorum</i>	straggly gooseberry	Shrub	*		*
<i>Ribes menziesii</i>	canyon gooseberry	Shrub		*	*
<i>Ribes sanguineum</i> var. <i>glutinosum</i>	red-flowering currant	Shrub	*	*	*
<i>Rosa californica</i>	California wild rose	Shrub	*	*	
<i>Rosa gymnocarpa</i>	wood rose	Shrub	*	*	*
<i>Rosa spithamea</i>	ground rose	Shrub			*
<i>Rubus parviflorus</i>	thimbleberry	Perennial		*	*
<i>Rubus ursinus</i>	California blackberry	Vine	*	*	*
<i>Rupertia physodes</i>	California tea	Perennial	*	*	
<i>Sambucus mexicana</i>	blue elderberry	Shrub	*	*	
<i>Sanicula bipinnatifida</i>	purple sanicle	Perennial	*	*	
<i>Sanicula crassicaulis</i>	Pacific sanicle	Perennial	*	*	*
<i>Sanicula laciniata</i>	Coastal blacksnakeroot	Perennial	*		*
<i>Satureja douglasii</i>	yerba buena	Perennial	*	*	*
<i>Scrophularia californica</i> ssp. <i>californica</i>	bee plant	Perennial		*	
<i>Sidalcea malviflora</i> ssp. <i>laciniata</i>	checker mallow	Perennial	*		*
<i>Silene californica</i>	Indian pink, scarlet campion	Perennial		*	*
<i>Sisyrinchium bellum</i>	blue-eyed grass	Perennial	*		
<i>Smilacina racemosa</i>	large false Solomon's seal	Perennial			*
<i>Smilacina stellata</i>	little false Solomon's seal	Perennial	*		*
<i>Solanum americanum</i>	common nightshade	Annual	*		
<i>Solanum umbelliferum</i>	blue witch	Shrub	*		*
<i>Solidago californica</i>	California goldenrod	Perennial	*		
<i>Stachys ajugoides</i> var. <i>rigida</i>	common wood mint	Perennial	*	*	*
<i>Streptanthus glandulosus</i> ssp. <i>glandulosus</i>	jewelflower	Annual		*	
<i>Symphoricarpos albus</i> var. <i>laevigatus</i>	snowberry	Shrub	*	*	*

Appendix D Fauna of the Sausal Creek Watershed

The tables in this section are from *The Upper Sausal Creek Watershed (Oakland California): Historical and Contemporary Ecology, Watershed Assessment, and Recommendations for Ecosystem Restoration and Management* by Martha E. Lowe, Sonoma State University, June 2000.

Mammals

Common Name	Scientific Name	Habitat	Probability
Virginia opossum	<i>Didelphis virginiana</i>	Various, never far from water	Observed
ornate shrew	<i>Sorex ornatus</i>	Open areas, grassland, woodland, riparian	Medium
Trowbridge's shrew	<i>Sorex trowbridgii</i>	Redwood forest, mixed forest, chaparral	High
vagrant shrew	<i>Sorex vagrans</i>	Meadows, moist open areas, riparian	Low
broad-footed mole	<i>Scapanus latimanus</i>	Areas with light, sandy soils	Observed
pallid bat	<i>Antrozous pallidus</i>	Most common in open dry habitat, but occurs in a wide variety of habitats	Medium
big brown bat	<i>Eptesicus fuscus</i>	Chaparral, open areas, open woodlands and forests	Medium
silver-haired bat	<i>Lasionycteris noctivagans</i>	Forests	Low
red bat	<i>Lasiurus borealis</i>	Forests and woodlands, edge habitat	Low
hoary bat	<i>Lasiurus cinereus</i>	Wooded areas, open habitat, habitat mosaics	Medium
California myotis	<i>Myotis californicus</i>	Oak woodlands, chaparral, forests	High
long-eared myotis	<i>Myotis evotis</i>	Coniferous forests, chaparral	Low
little brown myotis	<i>Myotis lucifugus</i>	Riparian, chaparral	Low
fringed myotis	<i>Myotis thysanodes</i>	Hardwood and coniferous forests, riparian	High
long-legged myotis	<i>Myotis volans</i>	Woodland, forest, chaparral, coastal scrub	High
Yuma myotis	<i>Myotis yumanensis</i>	Open forests and woodlands	Medium
western pipistrelle	<i>Pipistrellus hesperus</i>	Open, arid areas	Low
Townsend's long-eared bat	<i>Corynorhinus (Plecotus) townsendii</i>	Mesic habitat, habitat edges	High
western mastiff bat	<i>Eumops perotis</i>	Open, arid areas	Low
guano bat (Brazilian free-tailed bat)	<i>Tadarida brasiliensis</i>	Grassland, coastal scrub, chaparral, woodland	High
coyote	<i>Canis latrans</i>	Open country, ecotones, urban fringes	Observed
gray fox	<i>Urocyon cinereoargenteus</i>	Chaparral, forested areas	Observed
red fox	<i>Vulpes vulpes</i>	Grassland, coastal scrub, mixed chaparral	Observed
raccoon	<i>Procyon lotor</i>	Forest, urban areas, riparian	Observed
striped skunk	<i>Mephitis mephitis</i>	Riparian, edge habitat	Observed
spotted skunk	<i>Spilogale putorius</i>	Open-mature chaparral, riparian, edge habitat	Medium
long-tailed weasel	<i>Mustela frenata</i>	Riparian, open forest, woodland, shrub habitat	High
feral house cat	<i>Felis catus</i>	Various	Observed
mountain lion	<i>Felis concolor</i>	Riparian, brushy stages of various habitats	Observed

Mammals			
Common Name	Scientific Name	Habitat	Probability
bobcat	<i>Lynx rufus</i>	Intermediate stages of riparian and oak habitat, chaparral	Medium
black-tailed deer	<i>Odocoileus hemionus</i>	Forests, scrubland, meadows, urban/wildland interface	Observed
California ground squirrel	<i>Spermophilus beecheyi</i>	Grazed grasslands	Low
fox squirrel	<i>Sciurus niger</i>	Urban/wildland interface, urban parks	Observed
Botta's pocket gopher	<i>Thomomys bottae</i>	Light soils, lawns, meadows	Observed
Heerman's kangaroo rat	<i>Dipodomys heermannii</i>	Annual grassland, coastal scrub, mixed chaparral	Medium
California pocket mouse	<i>Chaetodipus (Perognathus) californica</i>	Grassland/chaparral edges, coastal scrub, hardwood habitats	High
dusky-footed woodrat	<i>Neotoma fuscipes</i>	Hardwood forests and scrub, mature chaparral	High
brush mouse	<i>Peromyscus boylii</i>	Chaparral, oak and riparian associations	Medium
parasitic mouse	<i>Peromyscus californicus</i>	Oak, bay, hardwood woodlands, mature chaparral, coastal scrub	High
deer mouse	<i>Peromyscus maniculatus</i>	Forest, coastal scrub, open chaparral, grassland	High
pi.on mouse	<i>Peromyscus truei</i>	Open woodland and brushy areas	Low
harvest mouse	<i>Reithrodontomys megalotis</i>	Grasslands, open chaparral, coastal scrub, riparian	Medium
California meadow vole	<i>Microtus californicus</i>	Wet meadows, dense annual grassland	High
house mouse	<i>Mus musculus</i>	Houses and nearby, fields, brushy areas	High
brown rat	<i>Rattus norvegicus</i>	Near buildings and in wild areas	High
roof rat	<i>Rattus rattus</i>	Blackberry thickets, trees, attics	Observed
black-tailed hare	<i>Lepus californicus</i>	Shrub habitats with intermediate canopy, open edge habitat	Low
Audubon's cottontail	<i>Sylvilagus audubonii</i>	Mature chapparal, coastal scrub, grassland, brush/grassland edges	Medium
brush rabbit	<i>Sylvilagus bachmani</i>	Mature costal scrub, chapparal	Observed

Mammals

Common Name	Scientific Name	Habitat	Probability
parasitic mouse	<i>Peromyscus californicus</i>	Oak, bay, hardwood woodlands, mature chaparral, coastal scrub	High
deer mouse	<i>Peromyscus maniculatus</i>	Forest, coastal scrub, open chaparral, grassland	High
pi.on mouse	<i>Peromyscus truei</i>	Open woodland and brushy areas	Low
harvest mouse	<i>Reithrodontomys megalotis</i>	Grasslands, open chaparral, coastal scrub, riparian	Medium
California meadow vole	<i>Microtus californicus</i>	Wet meadows, dense annual grassland	High
house mouse	<i>Mus musculus</i>	Houses and nearby, fields, brushy areas	High
brown rat	<i>Rattus norvegicus</i>	Near buildings and in wild areas	High
roof rat	<i>Rattus rattus</i>	Blackberry thickets, trees, attics	Observed
black-tailed hare	<i>Lepus californicus</i>	Shrub habitats with intermediate canopy, open edge habitat	Low
Audubon's cottontail	<i>Sylvilagus audubonii</i>	Mature chaparral, coastal scrub, grassland, brush/grassland edges	Medium
brush rabbit	<i>Sylvilagus bachmani</i>	Mature costal scrub, chaparral	Observed
western mastiff bat	<i>Eumops perotis</i>	Open, arid areas	Low
guano bat (Brazilian free-tailed bat)	<i>Tadarida brasiliensis</i>	Grassland, coastal scrub, chaparral, woodland	High
coyote	<i>Canis latrans</i>	Open country, ecotones, urban fringes	Observed
gray fox	<i>Urocyon cinereoargenteus</i>	Chaparral, forested areas	Observed
red fox	<i>Vulpes vulpes</i>	Grassland, coastal scrub, mixed chaparral	Observed
raccoon	<i>Procyon lotor</i>	Forest, urban areas, riparian	Observed
striped skunk	<i>Mephitis mephitis</i>	Riparian, edge habitat	Observed
spotted skunk	<i>Spilogale putorius</i>	Open-mature chaparral, riparian, edge habitat	Medium
long-tailed weasel	<i>Mustela frenata</i>	Riparian, open forest, woodland, shrub habitat	High
feral house cat	<i>Felis catus</i>	Various	Observed
mountain lion	<i>Felis concolor</i>	Riparian, brushy stages of various habitats	Observed
bobcat	<i>Lynx rufus</i>	Intermediate stages of riparian and oak habitat, chaparral	Medium
black-tailed deer	<i>Odocoileus hemionus</i>	Forests, scrubland, meadows, urban/wildland interface	Observed
California ground squirrel	<i>Spermophilus beecheyi</i>	Grazed grasslands	Low
fox squirrel	<i>Sciurus niger</i>	Urban/wildland interface, urban parks	Observed
Botta's pocket gopher	<i>Thomomys bottae</i>	Light soils, lawns, meadows	Observed
Heerman's kangaroo rat	<i>Dipodomys heermanni</i>	Annual grassland, coastal scrub, mixed chaparral	Medium

Amphibians			
Common Name	Scientific Name	Habitat Type	Probability
California newt	<i>Taricha torosa</i>	In or near streams in mixed-hardwood, mixed conifer	Observed
California tiger salamander	<i>Ambystoma tigrinum californiense</i>	Grassland/open woodland, requires pools or slow streams for breeding	Low
yellow-eyed salamander	<i>Ensatina eschscholtzii xanthopicta</i>	Redwood, other coniferous, mixed chaparral	High
California slender salamander	<i>Batrachoseps attenuatus</i>	Frequents nearly all habitat types	Observed
arboreal salamander	<i>Aneides lugubris</i>	Coastal live oak woodland, mixed-hardwood, redwood	Observed
western spadefoot	<i>Scaphiopus hammondii</i>	Grassland, mixed-hardwood woodlands, washes and floodplains	Low
western toad	<i>Bufo boreas halophilus</i>	Most habitats, standing water essential for reproductive success	Medium
Pacific chorus frog California	<i>Hyla regilla</i>	All habitats but desert	Observed
red-legged frog	<i>Rana aurora draytonii</i>	Highly aquatic, prefers quiet pools of streams and marshes	Low
foothill yellow-legged frog	<i>Rana boylei</i>	In or near rocky streams, mixed-hardwood, riparian, coastal scrub	Medium
Bullfrog (introduced)	<i>Rana catesbiana</i>	Highly aquatic, quiet waters with thick vegetation	Observed

Reptiles			
Common Name	Scientific Name	Habitat Type	Probability
western pond turtle	<i>Clemmys marmorata</i>	Permanent streams or ponds in a variety of vegetation types	Observed
northwestern fence lizard	<i>Sceloporus occidentalis occidentalis</i>	All habitat types	Observed
coast horned lizard	<i>Phrynosoma coronatum</i>	Open country, especially sandy areas	Low
Skilton skink	<i>Eumeces skiltonianus skiltonianus</i>	Early successional stages or open areas in a variety of habitats	Observed
western whiptail	<i>Cnemidophorus tigris</i>	Open mixed-hardwood, riparian, chaparral	Low
California alligator lizard	<i>Gerrhonotus multicarinatus multicarinatus</i>	Grassland and open canopy stages of riparian, chaparral, woodland.	Alligator lizards have been observed but not identified to species
San Francisco alligator lizard	<i>Gerrhonotus coeruleus coeruleus</i>	Grassland, woodland, forested	
Pacific rubber boa	<i>Charina bottae bottae</i>	Usually found near streams or wet meadows in grassland, hardwood, redwood, riparian habitat	Observed
Pacific ringneck snake	<i>Diadophis punctatatus amabilis</i>	Found in open, rocky areas or moist microhabitats in a variety of habitats	Observed
sharp-tailed snake	<i>Contia tenuis</i>	Most common where conditions are somewhat moist and surface debris is present	Observed
western yellow-bellied racer	<i>Coluber constrictor mormon</i>	Common in open country, avoids densely forested habitat	Low
coachwhip	<i>Masticophis flagellum</i>	Open stages of grassland, coastal scrub, chaparral	Low
Alameda whipsnake	<i>Masticophis lateralis euryxanthus</i>	Grassland, open stages of coastal scrub and chaparral, riparian	Low
gopher snake	<i>Pituophis melanoleucus</i>	All habitat types but prefers open stages	Observed
California kingsnake	<i>Lampropeltis getulus californiae</i>	All habitats, most common in upland riparian	Medium

Appendix E Bird Point Count Data

Point counts from a site near the Fern Ravine project area, where quarterly counts have been conducted since 2002, are listed below. Data are the total counts per species since 2002.

Common Name	Total
Acorn Woodpecker	1
Allen's Hummingbird	3
American Goldfinch	3
American Robin	54
Anna's Hummingbird	34
Band-tailed Pigeon	37
Bewick's Wren	18
Brown Creeper	2
Bushtit	14
California Quail	6
California Thrasher	1
California Towhee	16
Cedar Waxwing	20
Chestnut-backed Chickadee	57
Common Raven	5
Dark-eyed Junco	13
Dark-eyed Junco (Oregon)	2
Fox Sparrow	1
Golden-crowned Kinglet	1
Hairy Woodpecker	5
Hermit Thrush	5
House Finch	11
House Wren	1
Hutton's Vireo	2
Lesser Goldfinch	8
Mourning Dove	20
Northern Flicker	11
Northern Flicker (Red-shafted)	2
Nuttall's Woodpecker	1

Common Name	Total
Oak Titmouse	1
Orange-crowned Warbler	8
Pacific-slope Flycatcher	9
Pileated Woodpecker	1
Purple Finch	8
Purple Finch (Western)	4
Pygmy Nuthatch	20
Red-breasted Nuthatch	20
Red-breasted Sapsucker	2
Red-shouldered Hawk	1
Red-tailed Hawk	1
Red-tailed Hawk (Western)	1
Ruby-crowned Kinglet	27
Sharp-shinned Hawk	1
Song Sparrow	24
Spotted Towhee	21
Stellar's Jay	104
Swainson's Thrush	2
Townsend's Warbler	3
Varied Thrush	1
Violet-green Swallow	3
Warbling Vireo	1
Western Scrub-Jay	3
Western Scrub-Jay (Coastal)	4
Wilson's Warbler	14
Wilson's Warbler (Pacific Coast)	1
Wrentit	5
Grand Total	644

