

# Biotic Resources Survey

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*The Oakland Zoo in Knowland Park*

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# Introduction

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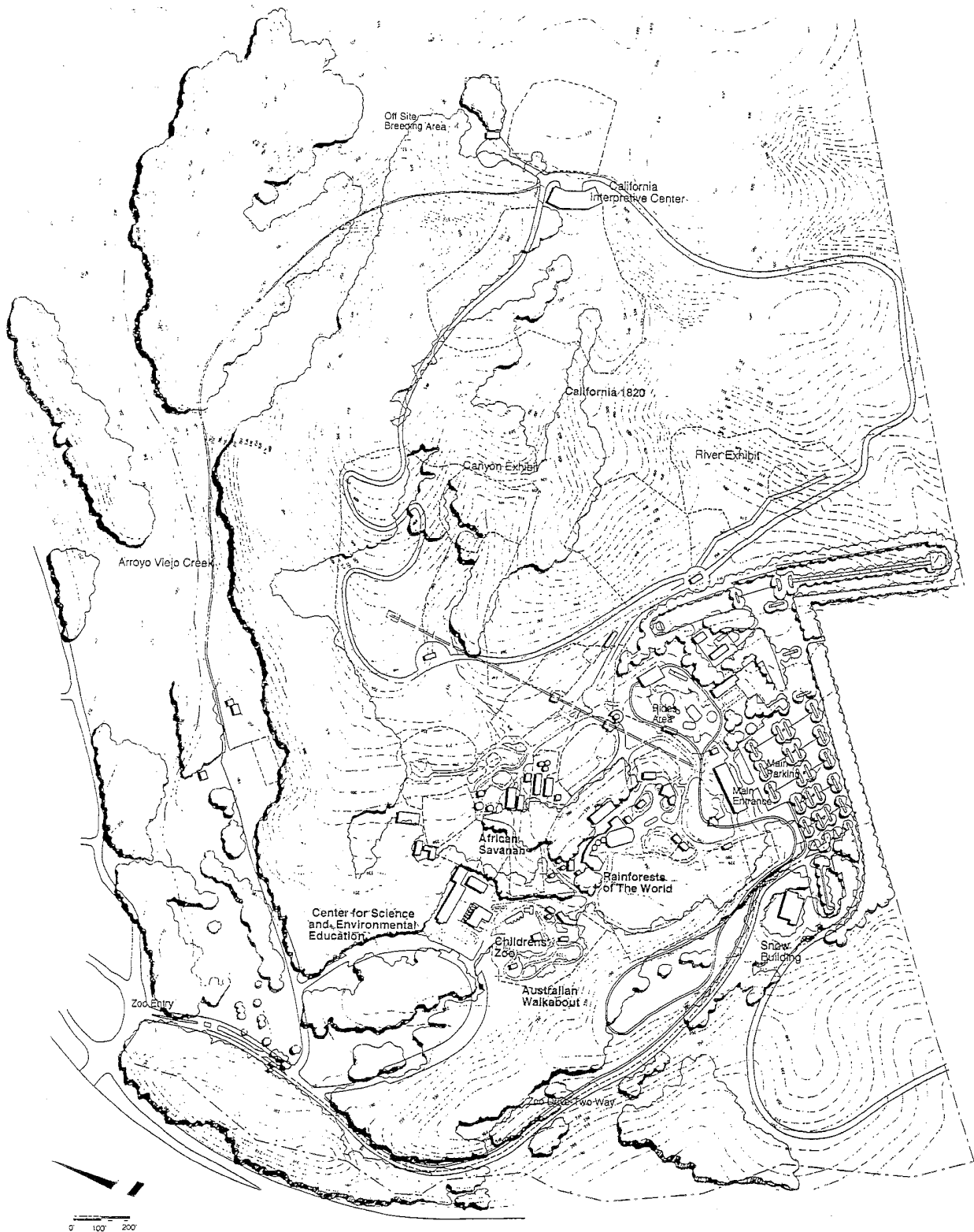
The East Bay Zoological Society (EBZS) has prepared an updated Master Plan for the Oakland Zoo in Knowland Park. The updated Master Plan represents a refinement of an earlier Master Plan completed in 1990. The Master Plan provides a development program for new facilities proposed to be constructed over the next 20 years. The biotic resource surveys were undertaken in 1995 and 1996 to assist in developing the updated Master Plan.

The Oakland Zoo in Knowland Park is composed of three landscape environments: the Historical Park Landscape and Arboretum, the Zoological Park, and Upper Knowland Park. It totals 443 acres, of which 350 acres are in the undeveloped Upper Knowland Park, 56 acres are within the Historical Park Landscape and Arboretum, and 37 acres are in the Zoological Park.

This report analyzes opportunities and constraints for development under consideration in the California 1820 area. The theme of the California 1820 area is native California species which occurred prior to the Gold Rush. Development would occur on approximately 25 acres of open space. In addition, the Master Plan proposes habitat enhancement and revegetation with native plants. Project components include:

- the Canyon Exhibit featuring golden eagle, jaguar, bald eagle, white-tailed deer, bobcat, great horned owl, walk-through aviary, and California reptile;
- the River Exhibit featuring grizzly bear, Tule elk, river otter, great blue heron, and sand crane;
- American bison, cougar, barn owl, and grey wolf exhibits;

- the California Interpretive Center providing a viewing platform and interpretive exhibits;
- the Off-site breeding area; and
- Paving of an existing fire road to accommodate a shuttle bus.



# Methodology

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This section describes the methodology used for mapping and describing the natural communities occurring at the project site, the surveys for sensitive plant species, the tree survey, and the surveys for sensitive wildlife, insect, and invertebrate species. Botanists Barbara Malloch Leitner and Dianne Lake conducted the botanical surveys. Dr. Samuel McGinnis and Karen Swaim, wildlife biologists, performed the wildlife surveys. Dr. Richard Arnold, entomologist, conducted the insect and invertebrate surveys.

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## Botany

### Literature Review

Literature was reviewed for records of special status plants known in the vicinity of the project site. Sources included the California Native Plant Society's (CNPS) *Inventory of Rare and Endangered Plants of California* (Skinner and Pavlik, 1994), the California Natural Diversity Data Base Electronic Inventory (CNDDB, 1994), the East Bay Chapter of the CNPS' *Status of Rare, Threatened and Endangered Vascular Plants in Alameda and Contra Costa Counties* (Olson, 1994) and Lake and Olson's (1995) *Unusual and Significant Plants of Alameda and Contra Costa Counties*. In addition, CNDDB records were reviewed for records of significant natural communities known from the region.



### **List of Target Resources**

Under the California Environmental Quality Act (CEQA), plants are considered sensitive if they are on any of the following lists:

- federal candidate, proposed, or listed threatened or endangered species;
- state proposed or listed rare, threatened or endangered species; or
- CNPS lists 1A, 1B or 2.

Natural communities are considered sensitive if they are listed by CNDDDB as rare (Holland, 1986).

Following this literature review, a list was compiled of the species and natural communities known to occur in habitat similar to that in the study area. These resources were given particular attention during field surveys. However, other species or natural communities may have local significance, such as plants on CNPS lists 3 or 4, or on a local list of unusual or significant plants in the Alameda and Contra Costa counties (Olson and Lake, 1994).

### **Consultation with Knowledgeable Persons**

Contacts were made with knowledgeable individuals, such as biologists of the California Department of Fish and Game (CDFG), the unusual plant coordinator for the East Bay Chapter of CNPS, and EBZS staff. These contacts allowed refinement of the list of target resources, and identification of those considered most sensitive and/or most likely to occur within the project site.

### **Vegetation mapping**

Natural communities within the project site were mapped on 1:12,000 scale aerial photographs using categories described by CNDDDB (Holland, 1986) and several types appropriate to describe human-modified vegetation assemblages found within the project site.

### **Field Surveys for Sensitive Plants**

Several sensitive plants are known from the vicinity of the study area. Field surveys consisted of walking over the project site as thoroughly as possible, with particular attention given to areas where development is proposed. In addition, particular attention was given to noting and mapping colonies of *Plantago*, annual *Castilleja*, and *Viola*, genera that serve as food plants for some invertebrates of special concern.

All plant species encountered were recorded. If the species could not be identified in the field, it was collected and identified in the laboratory. Populations of sensitive plant species were recorded on base maps provided by the EBZS. Field survey forms were completed and forwarded to the CNPS East Bay Chapter for species on CNPS lists 1 through 4.

Botanical surveys were initiated on May 30, 1995 and continued through September 2, 1995. Because field surveys began late in 1995, sensitive plant surveys were also conducted from March 8 through April 21, 1996. Surveys for sensitive plants and tree surveys focused on envelopes of land around sites under consideration for development -- areas envisioned for a proposed hiking trail along Arroyo Viejo Creek to a new interpretive center, enclosures for animals, a breeding center, new exhibit areas, and shuttle road.

### Tree Survey

Oakland City Ordinance 11556, a tree protection ordinance, calls for the identification and preservation of trees. Protected trees include coast live oak (*Quercus agrifolia*) larger than 4 inches and other tree species at least 9 inches diameter at breast height (dbh, measured at 4 to 4.5 feet from the ground). Monterey pine (*Pinus radiata*) and blue gum (*Eucalyptus globulus*) are exempted or partially exempted from protection.

The purpose of the tree survey is to guide detailed planning so that the most significant tree resources may be avoided. Trees were mapped and permanently marked. Species and diameters of all trees within areas proposed for development were recorded.

The diameter of trees was measured by placing a tape calibrated to read the diameter directly around the tree's circumference. The tapes were calibrated in centimeters and were later converted to inches. All stems greater than 4 cm (1.6 in) dbh were recorded. Dead stems were excluded. Stems with a visible connection, even at their base, were considered a single tree. The location of each tree was recorded, as closely as possible, on a 1:1,200 scale aerial photograph.

The Oakland tree protection ordinance calls for measurement of each individual stem, with the sum reported as the diameter of the tree. However, when a tree that divided well above ground level and the diameter measured below the division was smaller, this single measurement was recorded instead.

Marking the trees consisted of nailing 1-1/4 inch diameter, numbered aluminum tags nailed into the trunk, usually at eye level. One exception to this procedure was in the bison/tule elk enclosure, where the tree tags were nailed to the tree as high as possible and on an inner surface of a multiple-stemmed tree so they would be less accessible to the animals for rubbing against or possible ingestion.

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## Wildlife

Wildlife surveys were conducted from July 19, 1995 through August 5, 1995 by Dr. McGinnis and on September 3, 1996 by Karen Swaim. The wildlife survey was accomplished through direct observation and interpretation of animal sign (tracks, scat, etc.) observed on the project site. Special emphasis was directed towards determining the suitability of habitats on the project site for the Alameda whipsnake and California red-legged frog. The habitat evaluation system for the Alameda whipsnake, developed by Dr. McGinnis for the CDFG, was used to determine whether or not there is a combination of suitable habitat characteristics present on the project site.

Dr. Richard Arnold conducted a field reconnaissance for special status insect and invertebrate species on April 23, 1996. During the site visit, he inspected natural communities to evaluate their suitability to support special status insects and invertebrates.

In addition to determining the wildlife complement of the site, the biologists searched for vernal pools and other aquatic habitats. Aquatic habitats which may exist on the site were assessed for their potential qualifications as U.S. Army Corps of Engineers jurisdictional wetlands.

# Botany

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The characteristics of the natural communities and other mapping units found in the study area are described below. Figure 2, mapped at a scale of 1"=100', (inside the back cover of the binder) presents the distribution of natural communities in the study area. Appendix A lists botanical species observed during field surveys.

Seven natural communities as described by Holland (1986) were found in the study area. In addition, there are three types of vegetation or mapping units not described by Holland but which describe associations of vegetation observed.

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## Natural Communities

### **Non-native Grassland**

This grassy vegetation type is dominated by annual grasses and herbs introduced from the Mediterranean area of Europe and the Middle East. It may include many native species, both grasses and herbs, but these are significantly outnumbered by non-natives. The composition of non-native annual grassland varies from site to site, with management practices, and from year to year due to differences in precipitation. Typically in the Bay

Area, the predominant grass species are wild oats (*Avena fatua*), several species of brome (*Bromus* spp.), Italian ryegrass (*Lolium multiflorum*), farmer's foxtail (*Hordeum murinum* ssp. *leporinum*), and several species of annual fescue (*Vulpia* spp.).

The only areas identified as non-native annual grassland were areas west of the southern ravine where compost is stored. These contained a number of weedy herbs such as black mustard (*Brassica nigra*), bull thistle (*Cirsium vulgare*), Italian thistle (*Carduus pycnocephalus*), and fennel (*Foeniculum vulgare*). Although non-native grassland typically grades into a number of shrubby or woodland types, this natural community is being rapidly replaced by non-native French broom scrub.

Non-native grassland is very common in the coastal and valley parts of California. It is not rare from either a statewide or local perspective.

### Needlegrass Grassland

This herbaceous natural community contains a visible component of native perennial grasses, such as purple needlegrass (*Nasella pulchra*), narrow needlegrass (*N. lepida*), California oatgrass (*Danthonia californica*), and junegrass (*Koeleria cristata*). The native perennial grasses are generally not the dominant species, as measured by percent cover, but are usually present at densities of at least several clumps per square meter. The herbs include a wide variety of native and non-native species including several genera in the lily family (*Brodiaea*, *Calochortus*, *Chlorogalum*, *Triteleia* and *Zigadenus*), the sunflower family (*Hemizonia*, *Madia*, and *Wyethia*), legumes (*Lotus*, *Lupinus*, and *Vicia*) and others. Non-natives, which often comprise more cover, include the grasses and herbs described in the section on non-native annual grassland.

Nearly all of the grasslands in the study area support noticeable stands of perennial grasses. There is evidence of a variety of native herbs in many areas. The apparent quality of the grasslands varied within the study area; some of the most diverse grasslands are on the steeper and more sheltered slopes, such as the north-facing hills south of the southern ravine which stored compost. The most disturbed parts were in the central part of the upper, level area where the broadleaf herbaceous flora had little diversity and contained a high proportion of non-natives, such as radish (*Raphanus*), mustard (*Brassica* spp.), thistle (*Cirsium* spp.), fennel (*Foeniculum vulgare*) and cat's ear (*Hypochaeris* spp.). The reason for the low diversity in this extensive area was not clear. Goats graze the site in late summer for purposes of fire management. The site has not been recently grazed by cattle and there appeared to be no evidence of feral pigs. Residues were observed on some ridgetops that could be old sheep pellets. Fires occur occasionally on the study area; there was evidence of two small fires during the 1995 field reconnaissances.

Needlegrass grassland is considered a rare natural community statewide, and has become much reduced in extent in the Bay Area. The quality and extent of the grasslands in the study area suggest that they are a significant resource.

### **Northern Coyote Brush Scrub**

This natural community is dominated by a single species, coyote brush (*Baccharis pilularis*), although several other shrubby species are present, such as poison-oak (*Toxicodendron diversilobum*), bush monkeyflower (*Mimulus aurantiacus*), coffeeberry (*Rhamnus californica*), elderberry (*Sambucus mexicana*), and coastal sagebrush (*Artemisia californica*). The understory usually resembles the adjacent grasslands. Northern coyote brush scrub tends to encroach into grasslands in the absence of fire or browsing by large herbivores. Likewise, this natural community tends to be invaded by coast live oaks (*Quercus agrifolia*) and California bay (*Umbellularia californica*) in moister sites, deeper soils, and in the absence of other disturbance. Northern coyote brush scrub is on many parts of the upper elevations of the site.

Northern coyote brush scrub is not considered a rare natural community statewide, and it is common and widespread in the East Bay.

### **Diablan Sage Scrub**

Diablan sage scrub is the phase of coastal sage scrub found in the Bay Area. Its name refers to Mount Diablo. Diablan coastal sage scrub is dominated by coastal sagebrush, poison-oak, bush monkeyflower, and occasional coyote brush. Coastal sage scrub is typically confined to relatively steep, rocky, often south-facing slopes, as it is in the study area. Patches too small to map were found in the canyon through which the hiking trail is proposed. There is much intergradation of Diablan sage scrub and Northern coyote brush scrub, since the predominant of one natural community is almost always found in the other, though in lesser amounts. Intermediate or transitional vegetation was mapped as Diablan sage scrub because of its importance as wildlife habitat.

Diablan coastal sage scrub is not considered a rare natural community, but derives its importance from supporting the State-threatened Alameda whipsnake.

### **Chamise Chaparral**

This natural community is dominated by chamise (*Adenostoma fasciculatum*), growing in tall (up to 10 feet or more), dense stands. In the study area, several other woody species were found in chamise chaparral: on the more shaded slopes with deeper soil, silktassel (*Garrya elliptica*), brittle manzanita (*Arctostaphylos tomentosa* ssp. *crustacea*), coyote brush, poison-

oak and coast live oak occur. On more exposed slopes, often in particularly rocky places, small patches or isolated individuals of coastal sagebrush and bush monkeyflower are found. There is little understory in this natural community within the study area. Chamise chaparral is a natural community adapted to repeated fires (Holland 1986) due to its ability to stump sprout. In the study area, however, the stands do not appear to have experienced fire in many decades. The shrubs are tall and somewhat decadent.

Chamise chaparral is found on the south- and west-facing slopes of the upper part of the study area, on very steep slopes. It occurs along much of the proposed hiking trail and borders the proposed shuttle road along the ridge north of the proposed interpretive center.

### **French Broom Scrub**

This vegetation type is not described by Holland (1986), although it occupies extensive and increasing acreage in the coastal regions of California. It is dominated by a non-native shrub, French broom (*Genista monspessulana*) which forms a nearly pure stand. French broom invades grasslands, coyote brush scrub and open oak savanna, outcompeting much of the understory. Soil disturbance greatly encourages the spread of French broom. French broom is in every natural community within the study area.

The existing bison/tule elk enclosure is an example of the spread of French broom in disturbed or heavily trampled areas, although it also is in natural landslides in chamise chaparral and even invading apparently undisturbed grassland.

### **Coast Live Oak Woodland**

This natural community varies from an open savanna with herbaceous or shrubby understory to a closed-canopy woodland. It is dominated by coast live oak. The second most frequently occurring tree is California bay. Other species that occur occasionally in the study area are California buckeye (*Aesculus californica*) and elderberry. The understory of this community varies. When the oaks have an open canopy, the understory is much the same as the adjacent needlegrass grassland or open Northern coyote brush scrub. When coast live oak woodland exists as a closed-canopy woodland, there is a rich understory of herbs and shrubs, including poison-oak, hazelnut (*Corylus cornuta* var. *californica*), gooseberry (*Ribes* spp.), snowberry (*Symphoricarpos albus* var. *laevigatus*), and blackberry (*Rubus* spp.).

The oaks comprising the dominant species in this natural community are quite large and often multi-trunked, especially in the closed-canopy phase. Elsewhere, small oaks are invading coyote brush scrub, especially on deeper soils. Coast live oak woodland occurs throughout the study area on shaded, often north- or east-facing slopes.

Oak woodland is not considered a rare natural community, either locally or statewide, but oaks are protected by the Oakland tree ordinance and by the policy of the CDFG, which requires avoidance where possible and mitigation by planting replacement trees.

### Freshwater Seep

Seasonally to permanently saturated soils supporting a characteristic vegetation were found in several areas within the study area. The largest originated approximately 200 feet south of the main access road (about 400 feet south of the large eucalyptus tree) in a broad swale. Here water seemed to well up or collect from the surrounding uplands, then flow down a gentle gradient toward the southern edge of the study area property, a distance of approximately 700 feet. The water formed a small impoundment, the size of which was limited by a drain. In the spring of 1996 the water in this impoundment was several inches deep, but dried out during the summer months. The characteristic species of this seep included several species of rush (*Juncus* spp.), wood-rush (*Luzula comosa*) and sedge (*Carex dudleyi*) grading into wild-rye (*Elymus glaucus* ssp. *glaucus*) and other upland grassland species.

A smaller example of this natural community was observed at the top of the access road. In early September 1995 it appeared to have recently held standing water, and the ground was nearly saturated. In addition to the rushes and moisture-loving grasses such as wildrye and bentgrass (*Agrostis* spp.), the seep also supported cattails (*Typha angustifolia*), a species typically found in areas with standing water for long periods. Surrounding the seep was a dense thicket of poison-oak, coffeeberry, and gooseberry bushes. There was evidence of much wildlife use of the area.

A third example was located just outside the study area near the road on the northeast side. It was on the southern side of the road, then ran northward down a small and narrow drainage. It supported a narrow stand of rushes.

Seeps are a relatively uncommon natural community in the East Bay Hills, and are highly important to wildlife, which depends on them for water and cover. Seeps and springs are protected by CDFG policy.

### Ornamental Plantings

Most of the lower portion of Knowland Park has been landscaped for many years, providing shade for picnicking and other recreation, defining roadways, and providing aesthetic value. We have not subdivided the ornamental plantings because the species and their arrangements are not natural. Instead, areas dominated by ornamental species are mapped and noted as such. Frequently observed ornamental species include Monterey pine (*Pinus*



*radiata*), blue gum eucalyptus (*Eucalyptus globulus*), acacia (*Acacia* spp.), and Russian olive (*Eleagnus angustifolius*). Some of these species have escaped from cultivation and have established themselves within the native landscape. Areas mapped as ornamental plantings include the lowest part of the shuttle access road nearest the administration center and strips along the edge of the shuttle road and the edge of the project site nearest residences on the south side.

As a non-native vegetation type, ornamental plantings have no significance from a local or regional perspective.

### **Barren/Disturbed/Developed (Including Temporarily Poned Areas)**

A number of areas have been disturbed and de-vegetated, but now support a sparse or weedy vegetation, mostly of non-native plants. Such areas include the compost area and the graded dirt roads. The roads support a variety of non-native species, including sand-spurry (*Spergularia rubra*), plantain (*Plantago* spp.), pigweed (*Chenopodium album*), skunkweed (*Navarretia squarrosa*) and knotweed (*Polygonum arenastrum*). Most such species are well adapted to hard-packed soils and trampling. The compost area supports a different assemblage of species, many thistles belonging to the genera *Cirsium*, *Centaurea*, and *Carduus*, as well as vegetables and fruit such as cantaloupe, pumpkin, and other cultivated species, resulting from discarded food materials from the zoo.

The lowest-lying parts of the hard-packed dirt roads collect rainwater, sometimes for several weeks at a time during the winter months. Several temporarily ponded areas are found at topographic low points on the roads within the study area. Although they are not natural vernal pools, they support some species that require saturated soils or ponded water (obligate hydrophytes); for example, popcorn flower (*Plagiobothrys stipitatus* var. *micranthus*), flowering quillwort (*Lilaea scilloides*), waterwort (*Elatine* sp.) and brass-buttons (*Cotula* spp.). Because the roads intercept the natural drainage patterns and are scraped and hard-packed, reducing infiltration, the tendency for water to form ponds at the surface is much greater than in natural soils within the study area. No natural vernal pools were observed within the study area.

### **Central Coast Live Oak Riparian Forest**

The riparian vegetation along Arroyo Viejo Creek has been altered so much that it is difficult to categorize in a natural community type. Since the natural parts of the stream are mainly bordered by coast live oak, the name, Central Coast Live Oak Riparian Forest was assigned to the riparian area. In the lower, more landscaped part of the creek, much of the stream course is bordered by blue gum eucalyptus and acacia, with an understory of English ivy (*Hedera helix*), French broom, and a mixture of other escaped ornamentals. A few native

species remain in small numbers, big-leaf maple (*Acer macrophyllum*), cottonwood (*Populus fremontii*), and willow (*Salix laevigata*). Farther upstream, coast live oak and California bay are the principal trees, and the understory is a more native mix, including some typical streamside genera, such as virgin's-bower (*Clematis* spp.), rose (*Rosa* cf. *californica*), sneezeweed (*Helenium* cf. *puberulum*), snowberry, and others. Although the riparian vegetation in the study area is degraded, riparian resources are generally considered significant resources and should be protected.

In summary, three natural communities found in the study area are considered rare from a local or statewide perspective, needlegrass grassland, freshwater seep, and riparian forest. The temporarily ponded areas supporting obligate hydrophytes may require special consideration as wetlands, despite the fact that they are formed as a result of the roads and are not naturally occurring features. In addition, oak woodlands are protected by city ordinance and CDFG policy, and Diablan sage scrub is important at the site because it provides potential habitat for the Alameda whipsnake.

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## Sensitive Plants

Table 1 presents the name, status, habitat and flowering period of sensitive plants known to occur within the region and from habitats similar to those found in the study area. Surveys for sensitive plants were conducted from May 30 through September 2, 1995 and from March 8 through April 21, 1996.

In the course of the surveys, two colonies of coyote mint (*Monardella*) referable to the rare variety, robust monardella (*M. villosa* ssp. *globosa*) we found within the study area. These plants possessed characteristics similar to those of the rare subspecies, but also within the range of characteristics of the non-rare subspecies, *Monardella villosa* ssp. *villosa*. We compared the plants collected from the study area with specimens at the Jepson Herbarium at the University of California, Berkeley, which had a number of specimens from the East Bay Hills annotated as possible hybrids between the two subspecies. We conservatively judge the plants found near the cellular telephone transmission towers to belong to the rare subspecies, *M. v.* ssp. *globosa* (see Figure 2). Common *M. v.* ssp. *villosa* was observed along the proposed hiking trail route, and some plants that appeared to conform more closely to *M. v.* ssp. *globosa* were observed east of the study area.

Several other plants listed as "unusual" by the East Bay Chapter of CNPS were found (Lake, 1995). They include: *Acaena pinnatifida* var. *californica*, *Acer negundo*, *Antirrhinum vexillo-calyculatum*, *Arctostaphylos tomentosa* ssp. *crustacea*, *Calochortus luteus*, *Camissonia ovata*, *Carex dudleyi*, *C. multcostata*, *Claytonia parviflora* ssp. *parviflora*, *Clematis ligusticifolia*, *Corallorhiza maculata*, *Cryptantha torreyana*, *Danthonia californica*, *Epilobium ciliatum* ssp. *ciliatum*, *Garrya elliptica*, *Helenium scoparium*, *Hordeum jubatum*, *Juncus occidentalis*, *Juncus tenuis*, *Lilaea scilloides*, *Navarretia mellita*, *Pedicularis densiflora*, *Plagiobothrys stipitatus*

Table 1. Sensitive plants known to occur in the region of the study area.

Scientific and Common Name	Status* State/Fed/CNPS	Habitat	Bloom Period
<i>Arctostaphylos pallida</i> Pallid manzanita	E/C1/1B	Chaparral, woodland	Dec-Mar
<i>Astragalus tener</i> var. <i>tener</i> Alkali milk-vetch	CEQA/--/1B	Grasslands (adobe clay), alkali vernal pools	Mar-Jun
<i>Balsamorhiza macrolepis</i> var. <i>macrolepis</i> Big-scale balsamroot	CEQA/--/1B	Grassland, woodland on open grassy slopes	Mar-Jun
<i>Clarkia franciscana</i> Presidio clarkia	E/PE/1B	Grassland, coastal scrub (serpentine)	May-Jul
<i>Dirca occidentalis</i> Western leatherwood	CEQA/--/1B	Chaparral, woodland, riparian woodland	Jan-Apr
<i>Fritillaria liliacea</i> Fragrant fritillary	CEQA/C2/1B	Coastal scrub, grassland, coastal prairie	Feb-Apr
<i>Helianthella castanea</i> Diablo helianthella	CEQA/C2/1B	Edges of chaparral, coastal scrub, woodland, on grassy slopes	Apr-Jun
<i>Holocarpha macradenia</i> Santa Cruz tarplant	E/C1/1B	Grasslands, coastal prairie, often in clay	Jun-Oct
<i>Juglans californica</i> var. <i>hindsii</i> Northern California black walnut	CEQA/C2/1B	Riparian woodland	Apr-May
<i>Monardella villosa</i> ssp. <i>globosa</i> Robust monardella	CEQA/--/1B	Chaparral (openings), woodland	Jun-Jul
<i>Streptanthus albidus</i> ssp. <i>peramoenus</i> Most beautiful jewel-flower	CEQA/C1/1B	Chaparral, grassland (serpentine)	Apr-Jun
<i>Trifolium amoenum</i> Showy Indian clover	CEQA/C2/1B	Grassland	Apr-Jun

\* State: E = endangered under the California Endangered Species Act; CEQA = protected under the California Environmental Quality Act. Federal: E = endangered; PE = proposed endangered; C1 = candidate for listing; category 1; C2 = candidate for listing, category 2; C3 = candidate for listing, category 3. California Native Plant Society (CNPS): 1B = rare and endangered in California and elsewhere; 3 = of special concern, more information needed; 4 = not rare, but of limited distribution.

var. *micranthus*, *Rhamnus crocea* var. *crocea*, *Ribes divaricatum* var. *pubiflorum*, *Sagina apetala*, *Sanicula laciniata*, *Scutellaria tuberosa*, *Sidalcea malvaeflora* ssp. *malvaeflora*, *Tauschia hartwegii*, *Vaccinium ovatum*, and *Yabea microcarpa*. There were too many records of these species to describe in detail in this report, but reports of these species have been forwarded to CNPS.

Aside from the finding of the *Monardella*, the observation of the other species serves primarily to confirm that the California 1820 portion of Knowland Park (and elsewhere in the undeveloped parts of the Park property) comprise together an outstanding example of relatively natural vegetation assemblages in the East Bay Hills.

During surveys, special attention was given to locating the plant genera *Plantago*, *Castilleja* and *Viola* which are important food plants for special status invertebrates. No *Viola* were observed during careful surveys for the genus at several periods during its flowering period, although the habitat was suitable. *Plantago erecta* was found in several areas of thin soils, including the highest westernmost hilltops, along the proposed road north of the cellular telephone facility and in several isolated areas of very thin soils. The colonies were generally quite small. Although four annual species of *Castilleja* were observed, there were no extensive colonies, and most observations consisted of only one or a few individuals in a given locality.

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## Tree Survey

Table 2 presents the results of the tree survey. A total of 514 trees meeting the criteria in the Oakland tree ordinance were marked, mapped and recorded.

The most common species found was the coast live oak, which comprised 80 percent of all trees surveyed. It occurs throughout the survey area, as an open savanna and a closed canopy woodland. Coast live oak appeared to be invading shrubby vegetation types; in these areas, the trees were mostly small. The largest trees were found in woodland situations. Most of the coast live oaks had multiple stems. The average number of stems measured on coast live oaks was 2.2 and some had as many as 7 large branches at 4 to 4.5 feet above ground.

Two other native species observed were California bay (*Umbellularia californica*) and elderberry (*Sambucus mexicana*). Several enormous California bay were present in the ravine above the existing bison enclosure. Elderberry is sometimes considered a shrub and sometimes a small tree. The two individuals included in this survey had multiple stems but were very large.

Table 2. Number, average diameter at breast height and range of diameters for each tree species surveyed.

Species	# of Trees	Mean Size (Range), in inches
<i>Acacia</i> sp.	25	17.2 (9.1-36.8)
<i>Eleagnus angustifolia</i>	7	23.8 (13.0-50.8)
<i>Pinus walteri</i>	46	21.7 (9.6-60.4)
<i>Pinus sabiniana</i>	3	11.0 (9.7-12.6)
<i>Prunus c. dulcus</i>	2	12.7 (12.4-13.0)
<i>Quercus agrifolia</i>	414	21.3 (4.1-98.3)
<i>Sambucus mexicana</i>	2	16.8 (13.6-20)
<i>Umbellularia californica</i>	<u>15</u>	20.4 (9.4-68.7)
<b>Total</b>	<b>514</b>	

Several ornamental species were recorded in the study area, mainly along the shuttle road. The most common species were Monterey pine (*Pinus radiata*) and acacia (*Acacia* sp.). Monterey pine were the largest in diameter, however, many of the trees appeared senescent and may not live many years longer. The Russian olive (*Eleagnus angustifolia*) was notable for its multiple-trunked form. Trees were identified with as many as 13 stems that exceeded the criteria of 1.6 inches minimum in diameter.

# Wildlife

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The botanical section of this report describes the several plant communities which exist on the project site. Each of these has its own complement of animal species, and these plant/animal associations or biomes, are considerably more complex and varied than those which exist on similar size parcels in most other areas in North America. Knowland Park is also unique in that much of it remains as a relatively undisturbed peninsula of Bay Area biomes amidst dense, urban development. Its physical connection to East Bay Regional Park District land, Anthony Chabot Regional Park, to the east also makes possible the movement of the more mobile wildlife species between these sites.

The purpose of the surveys were to assay the potential for occurrence of those special status wildlife species whose geographic range includes the study area.

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## Endangered, Threatened, and Other Special Status Species

Table 3 lists the wildlife species whose geographic ranges include the project site. The list of special status species was compiled by consulting the following: the program "RAREFIND", which summarizes information on special status plant and wildlife species in the CNDDDB; the BUGGY database, which summarizes information on special status insects and invertebrates, compiled and maintained by Dr. Arnold; pertinent scientific literature; and

Animal Notices of Review (USFWS, 1984, 1989, 1991, 1994, and 1996) of federally listed and candidate species, plus subsequent publications in the Federal Register. Species listed as endangered or threatened are protected either by the Federal Endangered Species Act or by the California's Endangered Species Act. In addition there are a number of animal species which, though not presently protected by law, are being considered for such protection. At the federal level these are Species of Concern. In California there is also a relatively large list of California Species of Special Concern which are being closely watched and evaluated for possible inclusion on the state's endangered or threatened species lists.

In addition to these animal species, several habitats whose preservation are of special concern to the CDFG were inspected or searched for during the field surveys. These included permanent and intermittent creeks and vernal pool basins.

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## Results of Field Survey

Because of the large size of Knowland Park and the fact that only several relatively small portions of the current open space area is being proposed for land use changes, this report focuses primarily on these sites. They include the proposed sites for the exhibit areas, an interpretive center, a breeding center, a new bison enclosure, a shuttle road, and the Arroyo Viejo Creek hiking trail.

### Mammals

All proposed building sites and selected portions of the proposed shuttle road and trail were inspected for kangaroo rat burrow systems. Burrow openings and thresholds of the genus *Dipodomys* are quite distinct in that they display a long, relatively narrow deposit of soil which is kicked out some distance from the burrow entrance by the powerful hind legs of these rodents. Paw prints left in these fine soil deposits are also distinct for this genus. No burrows or prints characteristic of kangaroo rats were observed on or near any of the proposed development areas.

No buildings or other structures exist on the areas proposed for development, and thus the chance that any bat species are using this area for daily roosting or as a winter hibernation site is extremely low. It is more likely that some bats utilize some of the structures within the zoo area proper for such purposes. In such a case, they would presumably utilize the open space area for foraging. However, the proposed new structures would be relatively minimal in extent and a potential loss of foraging space would not be significant. The installation of moderate night lighting on the proposed structures may attract and concentrate flying insects which could in turn assist bats in their foraging efforts.

Table 3. Special status animal species which have geographic ranges that include or are in the vicinity of the project site.

Scientific Name	Common Name	Status	
		State	Federal
<b>Mammals</b>			
<i>Antrozous pallidus</i>	Pallid bat	CSC	--
<i>Dipodomys heermanni berkeleyensis</i>	Berkeley kangaroo rat	CSC	SC
<i>Eumops perotis californicus</i>	Greater western mastiff bat	CSC	SC
<i>Plecotus townsendii townsendii</i>	Townsend's western big-eared bat	CSC	SC
<b>Birds</b>			
<i>Agelaius tricolor</i>	Tricolored blackbird	CSC	SC
<i>Aquila chrysaetos</i>	Golden eagle	CSC	--
<i>Athene cunicularia</i>	Burrowing owl	CSC	--
<i>Accipiter cooperii</i>	Cooper's hawk	CSC	--
<i>Accipiter striatus</i>	Sharp-shinned hawk	CSC	--
<i>Circus cyaneus</i>	Northern harrier	CSC	--
<i>Dendroica petechia</i>	Yellow warbler	CSC	--
<i>Elanus caeruleus</i>	White-tailed kite	CSC	--
<i>Eremophia alpestris actia</i>	California horned lark	CSC	--
<i>Falco mexicanus</i>	Prairie falcon	CSC	--
<i>Falco peregrinus anatum</i>	Peregrine falcon	E	E
<i>Lanius ludovicianus</i>	Loggerhead shrike	CSC	--
<b>Reptiles</b>			
<i>Clemmys marmorata</i>	Western pond turtle	CSC	--
<i>Masticophis lateralis euryxanthus</i>	Alameda whipsnake	T	PE
<b>Amphibians</b>			
<i>Ambystoma californiense</i>	California tiger salamander	CSC	C
<i>Rana aurora draytonii</i>	California red-legged frog	CSC	T
<b>Insects</b>			
<i>Euphydryas editha bayensis</i>	Bay checkerspot	--	T
<i>Speyeria callippe</i>	Callippe silverspot	--	PE
<i>Speyeria adiastra adiastra</i>	Unsilvered fritillary butterfly	--	SC
<i>Danaus plexippus</i>	Monarch butterfly	--	NIS
<i>Adela oplerella</i>	Opler's longhorn moth	--	SC
<i>Grapholita edwardsiana</i>	San Francisco tree lupine moth	--	FC
<i>Hydrochara rickseckeri</i>	Ricksecker's water scavenger beetle	--	SC
<i>Nothochrysa californica</i>	San Francisco lacewing	--	SC
<i>Ischnura gemina</i>	San Francisco forktail damselfly	--	FC
<b>Arachnids</b>			
<i>Microcina leei</i>	Lee's microblind harvestman	--	SC
<i>Microcina lumi</i>	Lum's microblind harvestman	--	SC



**Crustaceans**

<i>Branchinecta longiantenna</i>	Longhorn fairy shrimp	--	E
<i>Lepidurus packardii</i>	Vernal pool tadpole shrimp	--	E

**Snails**

<i>Helminthoglypta nickliana bridgesi</i>	Bridge's Coast Range snail	--	SC
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\* State: E = endangered; T = threatened; CSC = California species of special concern. Federal:  
E = endangered; T = threatened; PE = proposed endangered; C = candidate for listing; SC = species of  
concern; NIS = possible National Insect Status; FC = former candidate

Source: CDFG, 1994 and The Resources Agency, 1994.

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### **Birds**

Because of their mobility, all of the listed bird species have the potential of alighting on the project site during the course of a year, and "fly-overs" by both the peregrine or prairie falcon may occur. The most probable visitors listed on Table 3 are the northern harrier, white-tailed kite, California horned lark, and loggerhead shrike, all of which are regularly observed in the Bay Area. However, none of these were seen during the site visits.

No golden eagles were seen foraging over the site, and the relative scarcity of their preferred prey, the California ground squirrel, may be the reason for lack of observations. This also appears to be the reason for no sightings of the burrowing owl, a species which relies primarily on ground squirrel burrows for nesting sites. Although there is good brush and woodland cover on the site, neither the Cooper's hawk or sharp-shinned hawk were observed. It is probable that one or both of these secretive woodland hawk species forage or even nest on the project site. The hawks primarily prey on songbirds and small mammals. The absence of any suitable stands of cattail or tule bulrush also makes the site inhospitable for the tricolored blackbird. The yellow warbler was searched for during a survey of the Atroyo Viejo Creek course on the site. It was neither observed or heard, and the lack of a cottonwood-willow-alder community here is perhaps the main factor which discourages its presence.

### **Terrestrial Reptiles**

The Alameda whipsnake inhabits several locations on the western slopes of the East Bay Hills. The closest documented records of the Alameda whipsnake to Knowland Park are a historic locality in Leona Regional Open Space, less than three miles to the northwest and in the Upper San Leandro Reservoir watershed, approximately two miles to the northeast. To the south, it has been found at several locations between Castro Valley and Garin Regional Park.

To determine the probability of Alameda whipsnake's occurrence at the project site, an evaluation of the suitability of the habitat for this snake was conducted. It was based on a system which Dr. McGinnis and Karen Swaim developed for the CDFG. They trapped 22 sites in Alameda and Contra Costa counties where there was a potential for Alameda whipsnake occurrence, based on the presence of either northern coastal scrub or chaparral stands (Swaim & McGinnis, 1992). Over 50,000 trap days revealed the presence of Alameda whipsnake at 10 of these sites. Several habitat features which might influence Alameda whipsnake presence were carefully documented for each site. The system is also based on habitat use by six Alameda whipsnakes which were radio-tracked (Swaim, 1994).

A comparative habitat analysis of the 22 study sites revealed that the Alameda whipsnake is nearly always associated with open or partially open canopy chaparral and scrub communities, although it also uses ungrazed grassland and oak savannah associations if they are adjacent to these shrub habitats. A radio-tracking study showed that this snake regularly leaves the scrub or chaparral community to forage in grassland or oak savannah (Swaim, 1994). One egg-laying site was detected by radio-tracking a gravid female whipsnake in a grassland area near the edge of scrub. Rock outcrops and talus with deep crevices and rodent burrows are also important features of Alameda whipsnake habitat. These features serve as nightly retreats and winter hibernating places and, in the case of the outcrops, a prime habitat for lizard prey of the Alameda whipsnake, the northwestern fence lizard (*Sceloporus occidentalis occidentalis*). Moderate to high numbers of northwestern fence lizard plus at least one other lizard species were present at all whipsnake sites. Prey selectivity experiments have demonstrated that lizards are an important prey item (Swaim, 1994).

Slope exposure to sunlight is very important for Alameda whipsnake. This is because the Alameda whipsnake maintains the highest body temperature when active, of any Bay Area reptile (Hammerson, 1979). By emerging from an evening retreat early in the morning and warming rapidly through basking, it is able to gain a neuro-muscular advantage over the later-emerging fence lizards and thus increase its prey capture efficiency. Alameda whipsnakes are primarily active on slopes with a south-, southwest-, southeast-, or east-facing exposure (Swaim, 1994).

In summary, when south-, southwest-, southeast-, or east-facing hillsides within the geographic range of the Alameda whipsnake support an open canopy scrub or chaparral community, rock outcrops and/or abundant rodent burrows, and a substantial population of the northwestern fence lizard and at least one other lizard species is present, the habitat is optimal for the Alameda whipsnake.

Although no Alameda whipsnakes were observed during the field visits at Knowland Park, most of the study area exhibits all or most of the evaluation system features optimal for the Alameda whipsnake and would be considered potential core habitat. Because the whipsnakes use several plant communities and potential core habitat is on the project site, nearly the entire California 1820 area is potential Alameda whipsnake habitat, with the exception of disturbed areas (i.e. the existing bison/tule elk enclosure) and areas with dense broom.

Figure 1 in Appendix A is a photograph depicting an area of potential core Alameda whipsnake habitat. Potential core Alameda whipsnake habitat is within the areas proposed for new exhibits, the interpretive center, and the shuttle road. Appendix A, Figure 2 is of a potential core Alameda whipsnake habitat area on the south-facing wall of the steep ravine near the proposed River Exhibit. Appendix A, Figure 3 shows potential core Alameda whipsnake habitat on the south-facing wall of the ravine in the proposed Canyon Exhibit.

The Alameda whipsnake habitat evaluation system only defines core habitat for this snake and not its presence. To determine actual presence or absence of Alameda whipsnake, a spring trapping survey following CDFG survey protocol would be necessary. It should also be noted that when potential habitat for the Alameda whipsnake is present in an area where trapping has not or will not be done, the CDFG and United States Fish and Wildlife Service (USFWS) has, in the past, assumed Alameda whipsnake presence and based all mitigation requirements upon that assumption.

### **Aquatic Reptiles and Amphibians**

Arroyo Viejo Creek was surveyed by Dr. McGinnis for the presence of adult western pond turtles, adult and larval California red-legged frogs, and California tiger salamander larva. None of these species were observed. The lack of observations appears to be directly related to the absence of any moderate to large pools with good sunlight input and plant growth along this creek course. Such an absence of observations is typical of the upper reaches of most Bay Area coastal creeks. In addition to the lack of such pools, the high water flows which occur in such drainages during moderate to heavy rainfall years scours their creek beds during the early spring season, washing out most, if not all, amphibian eggs and larva.

### **Invertebrates**

Knowland Park is in a geographic area that historically supported numerous special status insect and invertebrate species. Fourteen special status insects and invertebrates, whose historical or present-day geographic ranges include the general vicinity of Knowland Park, were analyzed.

Several of the taxa would not be expected to occur at Knowland Park due to the absence of suitable habitats with which these taxa are associated. For example, taxa associated with serpentine grasslands (Bay checkerspot, Opler's longhorn moth, Lee's and Lum's harvestmen), vernal pools (longhorn and tadpole shrimp), and ponded water (Ricksecker's water scavenger beetle and San Francisco forktail damselfly), would not be expected to occur at the site.

Five small patches of the Bay checkerspot's larval foodplant, native plantain (*Plantago erecta*), were observed during botanical surveys, growing in barren/disturbed areas such as the shoulders of dirt roads and areas of thin soils. These patches were inspected and found to be too small in size (collectively less than one acre) and too small in numbers of plants to support a population of the checkerspot.

Botanical surveys failed to find the requisite larval foodplant, wild pansy (*Viola pedunculata*), of the Callippe silverspot and unsilvered fritillary. Due to the absence of this foodplant, neither of these butterflies are expected to occur at the project site.

Because suitable roost sites for over-wintering Monarch butterflies were not observed at the site, it would be unlikely to over-winter there. Undoubtedly, transient adult Monarchs routinely visit the site to nectar at various flowers during other times of the year.

Of the 14 special status insects and invertebrates considered in this evaluation, only the San Francisco lacewing and Bridge's Coast Range snail have some potential to occur at the site due to the presence of appropriate habitats. Historical records for both species include several locations in the East Bay hills, in particular in the Berkeley and Oakland areas. If the San Francisco lacewing uses the site, it probably occurs in the Coast Live Oak woodland, particularly at its ecotone with the adjacent scrub habitats. If Bridge's Coast Range snail inhabits the site, it would probably be found in association with Coast Live Oak woodland or Central Coast Live Oak Riparian Forest where there are downed limbs, rock outcrops, or an understory of grass and brush to provide shelter for the snail. Potential habitat for the snail is degraded because the riparian forest is dominated by exotics; the native components of the understory have been replaced by English ivy (*Hedera helix*), French broom (*Genista monspessulana*), and other escaped ornamentals.

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## Findings

In summary, although no special status animal species were observed either directly or indirectly (burrows, tracks, etc.) on the project site, good quality habitat does exist for the threatened Alameda whipsnake.

With the exception of impacts to potential Alameda whipsnake habitat, the proposed siting of the new interpretive center, shuttle road, and upland portion of the hiking trail should not result in significant adverse impacts to sensitive wildlife habitats on the site. A mitigation plan for the Alameda whipsnake will be required by CDFG.

Several opportunities exist for the enhancement of previously degraded habitat within the project site area. These include the western terminus of the two central ravine sites and the Arroyo Viejo Creek area.

# Opportunities and Constraints

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Even the somewhat focused botanical surveys of this study made clear the remarkable extent and quality of the native grasslands, oak woodlands, and scrublands present in the undeveloped portions of Knowland Park. These lands possess a considerable species diversity, including a number of plant species that are uncommon or unusual in the East Bay Hills. Development of the master plan, emphasizing the California natural resources would allow for highlighting many of the natural features already present, providing excellent educational opportunities for students of natural history, plants, vertebrates, and invertebrates. Ideally, some of the exhibits would meld with the natural setting.

The primary concerns about botanical resources involve the fact that implementation of the updated master plan would involve loss of natural lands and would increase the risk of the rapid spread of weedy species through the undeveloped portions of Knowland Park, as they are spreading elsewhere in the East Bay Hills. Development may bring a focus to the management of the natural areas of Knowland Park, and a consideration of ways in which weedy species may be discouraged and the native assemblage enhanced. Exhibits containing large animals, especially herbivores, such as tule elk or bison, may be expected to significantly alter the environment within their enclosures, and any such enclosures are expected to result in a complete or near complete alteration of habitat. Careful consideration should be given to ways in which the public can be invited to enjoy the natural resources present in Knowland Park while maintaining the quality of the site. Some issues that may

arise might include: increased fire hazard; increased access by wheeled vehicles to other undeveloped parts of Knowland Park; and erosion and trampling from treading.

The opportunities for increased environmental education opportunities and enhanced management of the remaining resources -- enhancement of Arroyo Viejo Creek, grassland research and management opportunities, and weed management -- could well offset potential impacts if the EBZS would make a substantial commitment to mitigation.

The purpose of this section is to explore opportunities for plant and wildlife species habitat preservation and enhancement along with considerations to prevent sensitive habitat loss which could result from development of the master plan as currently envisioned. Constraints are suggested for any proposed development activity which may result in a significant adverse impact as defined by the California Environmental Quality Act (CEQA 1986). Such an impact is one which may cause "a substantial or potentially substantial adverse change in the environment". In addition, impacts which substantially affect threatened or endangered plants and animals or their habitats, interfere substantially with major movement corridors for wildlife, or substantially diminish habitat for fish, wildlife or plants are considered significant impacts, as outlined by the CEQA Guidelines, Appendix G.

The specific criteria for determining the level of significance of an environmental impact which may result from future development within the survey site are listed below. An impact would be considered significant if it would:

- substantially affect a special-status plant or animal species or the species habitat;
- interfere substantially with the movement of any resident wildlife species;
- substantially affect, reduce the number of, or restrict the range of an endangered or threatened species of animal, or the habitat of such a species;
- deteriorate existing wildlife habitat, both on and adjacent to the site;
- adversely affect significant riparian lands, wetlands, or other wildlife habitats; and
- result in filling of United States Army Corps of Engineers jurisdictional wetlands.

Opportunities and constraints comments are presented for each area proposed for development.

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# Arroyo Viejo Creek and its Riparian Community

A possible route for the hiking trail was surveyed, from the vicinity of the cellular transmission facility, traversing northerly down the chamise chaparral-covered slopes, descending into oak woodland before turning west and following Arroyo Viejo Creek past the zookeeper's residence into the picnic area of the park. Much of the trail could pass through a wild and natural-looking canyon. The wooded area at the lower part of the proposed trail has impressive-looking oaks and California bay trees.

Developing a trail through the chaparral would provide a major route for the spread of weeds. This area contains thickets of poison-oak and probably habitat for ticks, so the trail should be regular maintained. The chaparral is very senescent and fire prone.

CDFG requires the preservation of a buffer zone for permanent creeks of 100 feet, measured outward from the upper banks on each side. In addition, when a stand of native riparian vegetation occurs along a creek, buffer zone preservation is often requested by CDFG to begin at the outer edge of such vegetation. Before any development plans are finalized for this area, a representative of CDFG should be contacted to discuss the plans and give an initial determination as to what size buffer zone would be acceptable. CDFG has also recommended to negate most, if not all, human disturbance within a buffer area. Hiking trails are usually an acceptable use in buffer zones as long as they are positioned along the outer edge of such zones. By following such a siting here, an opportunity exists to preserve one of the few remaining natural coastal creek course segments in the Bay Area.

To achieve this goal however, constraint must be exercised in the placement of the creek portion of the proposed trail. The trail position should be sited at the outer edge of the riparian zone on the south creek bank. Several viewing decks could be positioned at good vista sites along this route so that hikers could look down into and across this good example of Central Coast Live Oak Riparian Forest. Interpretive displays providing picture guides to the major tree and bird species in the creek canyon could be installed on decks to enhance the viewing experience.

At the point where the proposed trail leaves the creek ravine and winds up the steep chamise-covered hillside to the south, an opportunity exists to enhance this latter community for a number of vertebrate species, including the Alameda whipsnake. Mature, closed canopy stands of chamise support only a fraction of the wildlife species which exist in open canopy stands of this community (Appendix A, Figure 4). Opening the stands in the trail would help rectify this situation. It would also be beneficial to cut back (but not dig out) the chamise along a four- to six-foot wide swath along each side of the trail. This would



stimulate new growth which in turn would benefit several resident herbivores, including the black-tailed deer.

The San Francisco lacewing and Bridge's Coast Range snail have some potential to occur in the riparian area and woodlands. If the EBZS would like to verify the presence of the snail at the project site, surveys could be performed during the rainy season, while surveys for the lacewing could be conducted between January and July. Surveys are not required by the USFWS because the San Francisco lacewing and Bridge's Coast Range snail are designated Species of Concern (Mead, USFWS, 1996). Careful siting of project components to avoid or minimize impacts to the woodland habitats likely to support either of these invertebrates is recommended. For the proposed hiking trail, fill should only be taken from the project site so that the snail, if present, could continue to travel without hindrances (for example, lava rocks should not be imported and placed on the trail). The trail should be as narrow as feasible. Dust control measures should be undertaken while the project is being constructed (such as watering) to reduce potential impacts to air passages of San Francisco lacewings.

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## Proposed New Bison Enclosure Area

The bison enclosure is proposed on a slope consisting of grassland, chamise chaparral, and oak woodland near the cellular transmission facility (Appendix A, Figure 5). This area contains *Monardella villosa* var. *globosa* and *Helenium scoparium* and should be avoided.

As evidenced in the existing tule elk/bison enclosure, the grasslands in this area would be obliterated and French broom may begin to take over, resulting in a complete loss of natural values within the enclosure. Constraint should be exercised in the siting of any ungulate (hoofed mammal) enclosure because of the significant impact that confined grazers and browsers have on the natural habitat. The proposed location of this enclosure includes potential core Alameda whipsnake habitat. EBZS will be required to submit a detailed mitigation plan to meet requirements of the CDFG and USFWS. Even if the proposed enclosure avoids the scrub, a sizable barren paddock area could deny grassland foraging opportunities to the Alameda whipsnake and also prevent occasional migration to and from prime scrub areas.

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## Proposed Breeding Area Site

The off-exhibit breeding center is proposed in an area containing bare ground, oak woodland, French broom, and coyote brush scrub.

The breeding center should be sited as much as feasible in the area that is already barren and in the area containing French broom. The oak woodland and coyote brush scrub should be avoided to the maximum extent feasible.

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## Proposed California Interpretive Center Site

The area proposed for the interpretive center could offer educational experiences with easy access to many natural communities, oak woodland, grassland, chamise chaparral, Diablan sage scrub, and coyote bush scrub.

The proposed location of the interpretive center, east of the cellular telephone transmission facility, is near potential core Alameda whipsnake habitat. Careful planning should be used in the precise selection of the building site. Across the road from the proposed interpretive center is the proposed wolf exhibit.

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## Proposed Exhibit Sites

The ravine proposed for the Canyon Exhibit includes the existing bison/tule elk enclosure. The understory in the oak woodland has been completely grazed, the grassland has been degraded, and French broom has invaded (Appendix A, Figure 6). The upper portion of the ravine has dense, natural oak woodland on one slope and a more open oak woodland with Diablan sage scrub on the other. The south-facing hillside supports potential core Alameda whipsnake habitat. Careful siting of the exhibit so that there is no further infringement on the natural scrub and oak woodland communities should be done.

The River Exhibit is proposed on the lower portion of the southern ravine. The upper part of the ravine has Diablan sage scrub, oak woodland, and grasslands. The mouth of the ravine was filled with manure and other materials for composting (Appendix A, Figure 7). It is highly disturbed, with barren/disturbed areas, and incursions of French broom and other weeds. It is recommended that vegetation management to remove French broom be implemented in this area for mitigation. It appears that filling began by trucks backing as far into the ravine as possible and then dumping their loads. In the years over which this has taken place, both the lower portion of the ravine's intermittent creek course has been obliterated and what one may assume was high grade Alameda whipsnake habitat has been covered. The zoo is removing the compost so that the ravine mouth and intermittent creek bed is restored. The south-facing slope of the ravine has potential core Alameda whipsnake habitat. Careful siting of the exhibit so that there is no further infringement on the natural scrub and oak woodland communities should be done.

The drainage course in both ravines exhibits a small but continuous gravel creek bed, a criteria which often is used by CDFG in determining whether or not a drainage area is actually an intermittent creek (Appendix A, Figure 8).

An opportunity would exist for meaningful reclamation and enhancement of some of the previously degraded areas around these sites or another appropriate location. At the northern ravine this would consist mainly of the enhancement planting of native scrub and riparian woodland plant species. Carefully designed plantings of scrub species and the creation of rock outcrop units in the southern ravine or another area would reclaim some of the potential Alameda whipsnake habitat that was lost. A further opportunity exists to incorporate the enhancement area into an exhibit. Visitors could peer through viewing ports and observe the more common free-living scrub bird and lizard species.

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## Proposed Shuttle Road Route

The proposed shuttle road would utilize an existing dirt road. The dirt road would be paved and in several areas widened to accommodate the shuttle bus. Beginning at the upper parking lot and heading east, the dirt road passes through some areas of disturbed and landscaped vegetation in the lower areas, then up a grassy hillside, past a gully and seep, then crossing more gentle topography toward the proposed interpretive center. The proposed shuttle road would then descend past chamise chaparral through oak woodland toward the starting point. It would pass through or near examples of all natural communities on the project site, thus providing visitors with a good overview of the variety of communities present.

Road improvement would likely require a fair amount of grading in some areas, resulting in loss of needlegrass grassland and perhaps chaparral and scrub. EBZS proposes to preserve as many oak trees as feasible. The road should avoid any impact to the seep at the top of the grassy hill.

The proposed shuttle road route avoids most of those scrub and chaparral areas which exhibit core habitat features for the Alameda whipsnake. It does, however, pass near and between several such habitats, and since this route is proposed to be paved, it could attract snakes, especially during early morning and later afternoon basking periods which this snake often partakes in. Paved road, especially those surfaced with asphalt, warm faster and then hold heat longer than surrounding loose soil areas. Snakes moving in a home range area will occasionally encounter such roads and linger on their surface to absorb substrate heat. This thermal behavior accounts for the majority of snake road kills each year. To avoid such occurrences on the new shuttle road, speed limits should be set as low as possible, and drivers should be instructed to watch out and "break for snakes". The road should be as narrow as possible with no curbs or gutters. In addition, CDFG and USFWS may require specially designed crossings in the road so that snakes would be less impacted by the road.

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## Cumulative Effects of Future Development

The updated Master Plan would incrementally reduce the small islands of intermittent creek canyon and Alameda whipsnake habitat which remain on the East Bay Hills. However, a limited amount of biologically sound development which adheres to the constraints guidelines suggested would reduce potential adverse impacts while at the same time enhancing previously degraded areas.

# Report Preparers

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## Appendix A

### Plant Species Observed During Field Visits

PLANT SPECIES OBSERVED, KNOWLAND PARK ZOO EXPANSION PROJECT

(Notations in parentheses indicate California Native Plant Society rarity or endangerment rank. In decreasing order of rarity, they are as follows: List 1B--rare and endangered; Rank A2--unusual for Alameda and Contra Costa counties, three to five known records; Rank B--unusual for Alameda and Contra Costa counties, six to ten known records; Rank C--unusual for Alameda and Contra Costa counties, more than ten records, a watch list. Sources: Skinner and Pavlik 1995 and Lake 1995.)

FERNS AND FERN ALLIES

DENNSTAEDTIACEAE	
Pteridium aquilinum var. pubescens	BRACKEN FAMILY Bracken fern
DRYOPTERIDACEAE	
Polystichum munitum	WOOD FERN FAMILY Sword fern
EQUISETACEAE	
Equisetum cf. arvense	HORSETAIL FAMILY Common horsetail
POLYPODIACEAE	
Polypodium calirhiza	POLYPODY FAMILY California polypody
PTERIDACEAE	
Adiantum jordanii	BRAKE FAMILY
Pellaea andromedaefolia	California maiden-hair
Pentagramma triangularis	Coffee fern Goldback fern

GYMNOSPERMS

CUPRESSACEAE	
Cupressus sp.	CYPRESS FAMILY Ornamental cypress
PINACEAE	
Pinus radiata	Monterey pine (ornamental)
Pinus coulteri	Coulter pine (ornamental)
TAXODIACEAE	
Sequoia sempervirens	BALD CYPRESS FAMILY Coast redwood (ornamental)

MONOCOTYLEDONS

CYPERACEAE	
Carex dudleyi (Rank A1)	SEDGE FAMILY
Carex multicosata (Rank A1)	Dudley's sedge
Cyperus eragrostis	Many-ribbed sedge Nutsedge
IRIDACEAE	
	IRIS FAMILY

*Sisyrinchium bellum*

JUNCACEAE

*Juncus bufonius* var. *bufonius*  
*Juncus effusus* var. *pacificus*  
*Juncus occidentalis* (Rank A2)  
*Juncus patens*  
*Juncus phaeocephalus*  
*Juncus tenuis* (Rank C)  
*Juncus xiphioides*  
*Luzula comosa*

LILAEACEAE

*Lilaea scilloides* (Rank C)

LILIACEAE

*Asparagus officinalis* ssp. *officinalis*  
*Brodiaea elegans* ssp. *elegans*  
*Calochortus luteus* (Rank C)  
*Chlorogalum pomeridianum*  
*Dichelostemma pulchella*  
*Disporum hookeri*  
*Smilacina racemosa*  
*Triteleia laxa*  
*Zigadenus fremontii*

ORCHIDACEAE

*Corallorhiza maculata* (List A2 or B)  
*Epipactis helleborine*

POACEAE

*Agrostis hallii*  
*Agrostis pallens*  
*Agrostis* cf. *stolonifera*  
*Agrostis viridis*  
*Aira caryophylla*  
*Avena barbata*  
*Avena fatua*  
*Brachypodium distachyon*  
*Briza minor*  
*Bromus diandrus*  
*Bromus hordeaceus*  
*Bromus madritensis* ssp. *rubens*  
*Bromus stamineus*  
*Cortaderia sellana*  
*Danthonia californica* (Rank C)  
*Digitaria sanguinalis*  
*Elymus glaucus* ssp. *glaucus*  
*Gastridium ventricosum*  
*Hainardia cylindrica* (= *Monerma* c.)  
*Holcus lanatus*  
*Hordeum vulgare*  
*Hordeum murinum* ssp. *leporinum*  
*Hordeum jubatum* (Rank A2)

Blue-eyed grass

RUSH FAMILY

Toad rush  
Bog rush  
Western rush  
Common rush  
Brown-headed rush  
Slender rush  
Iris-leaved rush  
Wood rush

FLOWERING QUILLWORT FAMILY

Flowering quillwort

LILY FAMILY

Asparagus  
Harvest brodiaea  
Yellow mariposa lily  
Soaproot  
Blue dicks  
Fairy lantern  
False Solomon's seal  
Brodiaea  
Fremont's star-lily

ORCHID FAMILY

Spotted coralroot  
Epipactis

GRASS FAMILY

Hall's bent grass  
Seashore bent grass  
Bent grass  
Water bent grass  
Hair grass  
Slender wild oats  
Wild oat  
Goat grass  
Little quaking grass  
Ripgut grass  
Soft chess  
Red brome  
Brome  
Pampas grass  
California oatgrass  
Digitaria  
Western rye grass  
Nitgrass  
Hainardia  
Velvet grass  
Common barley  
Farmer's foxtail  
Foxtail barley

Hordeum marinum ssp. gussoneanum	Mediterranean barley
Lolium multiflorum	Italian ryegrass
Melica torreyana	Torrey's melic
Nassella pulchra	Purple needlegrass
Nassella lepida	Narrow needlegrass
Paspalum dilatatum	Dallis grass
Poa annua	Annual bluegrass
Poa secunda	Pine bluegrass
Polypogon monspeliensis	Rabbitsfoot grass
Triticum aestivum	Wheat
Vulpia microstachys var. ciliata	Fescue
Vulpia myuros var. myuros	Rattail fescue
Vulpia myuros var. hirsuta	Western six-weeks fescue
Vulpia bromoides	Six-weeks fescue
Vulpia octoflora	Eight-flowered fescue
<b>TYPHACEAE</b>	<b>CATTAIL FAMILY</b>
Typha angustifolia	Narrow-leaved cattail

#### DICOTYLEDONS

<b>ACERACEAE</b>	<b>MAPLE FAMILY</b>
Acer macrophyllum	Big-leaf maple
Acer negundo var. californicum (Rank C)	Box-elder
<b>ANACARDIACEAE</b>	<b>SUMAC FAMILY</b>
Toxicodendron diversilobum	Poison-oak
<b>APIACEAE</b>	<b>CARROT FAMILY</b>
Anthriscis caucalis	Bur-chervil
Conium maculatum	Poison-hemlock
Foeniculum vulgare	Fennel
Heracleum lanatum	Cow parsnip
Osmorhiza chilensis	Osmorhiza
Perideridia kelloggii	Yampah
Sanicula crassicaulis	Pacific sanicle
Sanicula bipinnatifida	Purple sanicle
Sanicula laciniata (List A2)	Coast sanicle
Scandix pecten-veneris	Venus' needle
Tauschia hartwegii (Rank C)	Tauschia
Torilis nodosa	Hedge parsley
Yabea microcarpa (Rank B)	Yabea
<b>APOCYNACEAE</b>	<b>DOGBANE FAMILY</b>
Vinca major	Periwinkle
<b>ARALIACEAE</b>	<b>GINSENG FAMILY</b>
Hedera helix	English ivy
<b>ASTERACEAE</b>	<b>SUNFLOWER FAMILY</b>
Achillea millefolium	Yarrow

Achyrachaena mollis  
Agoseris grandiflora  
Artemisia californica  
Artemisia douglasiana  
Aster radulinus  
Baccharis pilularis  
Carduus pycnocephalus  
Centaurea melitensis  
Chamomilla suaveolens  
Cirsium vulgare  
Conyza bonariensis  
Cotula australis  
Cotula coronopifolia  
Eriophyllum confertiflorum var. confertiflorum  
Filago gallica  
Gnaphalium luteo-album  
Gnaphalium ramosissimum  
Gnaphalium californicum  
Grindelia camporum  
Helenium puberulum  
Hemizonia corymbosa ssp. corymbosa  
Hemizonia congesta  
Hesperis matronalis  
Hypochaeris glabra  
Hypochaeris radicata  
Lactuca serriola  
Lactuca virosa  
Madia gracilis  
Madia sativa  
Madia exigua  
Picris echioides  
Psilocarphus tenellus var. tenellus  
Senecio mikanioides  
Senecio vulgaris  
Silybum marianum  
Solidago californica  
Soliva sessilis  
Sonchus asper  
Sonchus oleraceus  
Taraxacum officinale  
Wyethia angustifolia  
Xanthium strumarium

#### BETULACEAE

Corylus cornuta var. californica

#### BORAGINACEAE

Amsinckia menziesii var. intermedia  
Cryptantha torreyana (Rank A2)  
Plagiobothrys stipitatus var. micranthus  
(Rank B)

#### BRASSICACEAE

Blow-wives  
Large-flowered agoseris  
Coastal sagebrush  
Mugwort  
Aster  
Coyote bush  
Italian thistle  
Napa thistle  
Pineapple weed  
Bull thistle  
South American conyza  
Australian cotula  
Brass buttons  
Woolly sunflower

Narrow-leaved filago  
Cudweed  
Pink everlasting  
California everlasting  
Gumplant  
Sneezeweed  
Tarweed  
Tarweed  
Erect evax  
Smooth cat's ear  
Hairy cat's ear  
Prickly wild lettuce  
Wild lettuce  
Slender tarweed  
Common tarweed  
Small tarweed  
Bristly ox-tongue  
Woolly marbles  
German ivy  
Groundsel  
Milk thistle  
California goldenrod  
Soliva  
Prickly sow thistle  
Sow thistle  
Dandelion  
Narrow-leaved mule ears  
Cocklebur

#### BIRCH FAMILY

Hazelnut

#### BORAGE FAMILY

Common fiddleneck  
Torrey's cryptantha  
Popcorn flower

#### MUSTARD FAMILY

Barbarea orthoceras  
Brassica nigra  
Brassica rapa  
Capsella bursa-pastoris  
Cardamine oligosperma  
Coronopus didymus  
Hirschfeldia incana  
Lepidium nitidum var. nitidum  
Lunaria annua  
Raphanus sativus  
Rorippa nasturtium-aquaticum  
Sinapis arvensis  
Sisymbrium officinale  
Sisymbrium irio

#### CAPRIFOLIACEAE

Lonicera hispidula var. vacillans  
Sambucus mexicana  
Symphoricarpos albus var. laevigatus

#### CARYOPHYLLACEAE

Cerastium glomeratum  
Polycarpon tetraphyllum  
Sagina apetala (Rank B)  
Silene gallica  
Spergula arvensis ssp. arvensis  
Spergularia bocconii  
Spergularia rubra  
Stellaria media

#### CISTACEAE

Helianthemum scoparium (Rank B)

#### CHENOPODIACEAE

Chenopodium album  
Chenopodium ambrosioides  
Chenopodium murale

#### CONVOLVULACEAE

Calystegia purpurata ssp. purpurata  
Convolvulus arvensis

#### CRASSULACEAE

Crassula connata

#### CUCURBITACEAE

Cucumis sp.  
Marah fabaceus

#### ELAEAGNACEAE

Eleagnus angustifolius

#### ELATINACEAE

Elatine sp.

Winter cress  
Black mustard  
Field mustard  
Shepherd's purse  
Bitter-cress  
Swine cress  
Mediterranean mustard  
Shining peppergrass  
Moonwort  
Wild radish  
Watercress  
Charlock  
Hedge mustard  
London rocket

#### HONEYSUCKLE FAMILY

Honeysuckle  
Blue elderberry  
Snowberry

#### PINK FAMILY

Mouse-ear chickweed  
Four-leaved polycarp  
Sticky pearlwort  
Windmill pink  
Corn spurry  
Boccone's sand spurry  
Sand spurry  
Chickweed

#### ROCK-ROSE FAMILY

Rush-rose

#### GOOSEFOOT FAMILY

Pigweed  
Ambrosia-leaved goosefoot  
Wall goosefoot

#### MORNING-GLORY FAMILY

Western morning glory  
Orchard bindweed

#### STONECROP FAMILY

Sand pigmyweed

#### GOURD FAMILY

Cantelope  
Manroot

#### OLEASTER FAMILY

Russian olive

#### WATERWORT FAMILY

Waterwort



ERICACEAE	HEATH FAMILY
Arctostaphylos tomentosa ssp. crustacea (Rank C)	Brittle manzanita
Vaccinium ovatum (Rank B)	Huckleberry
EUPHORBIACEAE	SPURGE FAMILY
Euphorbia peplus	Petty spurge
FABACEAE	LEGUME FAMILY
Acacia cf. melanoxylon	Blackwood acacia
Asparagus gambelianus	Gambel's dwarf locoweed
Genista monspessulana	French broom
Lathyrus vestitus var. vestitus	Pacific pea; hillside pea
Lotus scoparius var. scoparius	Deerweed
Lotus humistratus	Hill lotus
Lotus micranthus	Small-flowered lotus
Lotus wrangelianus	Chile lotus; trefoil
Lupinus sp.	Lupine
Lupinus albifrons	Silver lupine
Lupinus bicolor	Dwarf lupine
Medicago polymorpha	Bur clover
Melilotus indica	Yellow sweet clover
Robinia pseudoacacia	Black locust
Trifolium sp.	Clover
Trifolium depauperatum var. truncatum	Pale sack clover
Trifolium dubium	Shamrock
Trifolium fragiferum	Strawberry clover
Trifolium glomeratum	Round clover
Trifolium microdon	Square-headed clover
Trifolium willdenovii	Clover
Vicia villosa ssp. villosa	Winter vetch
Vicia sativa ssp. nigra	Common vetch
Vicia sativa ssp. sativa	Spring vetch
FAGACEAE	OAK FAMILY
Quercus agrifolia var. agrifolia	Coast live oak
GARRYACEAE	SILK-TASSEL FAMILY
Garrya elliptica (Rank B)	Silk-tassel bush
GERANIACEAE	GERANIUM FAMILY
Erodium botrys	Long-beaked filaree
Erodium cicutarium	Red-stemmed filaree
Geranium dissectum	Cut-leaf geranium
GROSSULARIACEAE	GOOSEBERRY FAMILY
Ribes divaricatum var. pubiflorum (Rank B)	Straggly gooseberry
Ribes californicum var. californicum	Hillside gooseberry
Ribes menziesii	Canyon gooseberry
HIPPOCASTANCEAE	BUCKEYE FAMILY
Aesculus californica	California buckeye

LAMIACEAE	MINT FAMILY
Mentha arvensis	Mint
Monardella villosa ssp. globosa (List 1B)	Coyote mint
Monardella villosa ssp. villosa	Robust monardella
Pogogyne serpylloides	Thyme-leaved pogogyne
Satureja douglasii	Yerba buena
Scutellaria tuberosa (Rank C)	Skullcap
Stachys ajugoides var. rigida	Hedge nettle
LAURACEAE	LAUREL FAMILY
Umbellularia californica	California bay
LYTHRACEAE	LOOSESTRIFE FAMILY
Lythrum hyssopifolium	Hyssop loosestrife
MALVACEAE	MALLOW FAMILY
Malva nicaeensis	Bull mallow
Malva sylvestris	High mallow
Sidalcea malvaeflora ssp. malvaeflora (Rank C)	Checkerbloom
MYRTACEAE	MYRTLE FAMILY
Eucalyptus globulus	Blue gum eucalyptus
OLEACEAE	OLIVE FAMILY
Olea europea	European olive
ONAGRACEAE	EVENING-PRIMROSE FAMILY
Camissonia ovata (Rank C)	Suncup
Epilobium canum ssp. canum	California fuschia
Epilobium brachycarpum	Willow-herb
Epilobium ciliatum ssp. ciliatum (Rank C)	Willow-herb
OXALIDACEAE	OXALIS FAMILY
Oxalis laxa	Oxalis
Oxalis pes-caprae	Bermuda buttercup
PAPAVERACEAE	POPPY FAMILY
Eschscholzia californica	California poppy
PLANTAGINACEAE	PLANTAGO FAMILY
Plantago erecta	Woolly plantain
Plantago coronopus	Cut-leaved plantain
Plantago lanceolata	English plantain
PLATANACEAE	SYCAMORE FAMILY
Platanus racemosa	Western sycamore
POLEMONIACEAE	PHLOX FAMILY
Navarretia squarrosa	Skunkweed
Navarretia mellita (Rank C)	Honey-scented navarretia
POLYGONACEAE	BUCKWHEAT FAMILY

Eriogonum nudum var. nudum  
Polygonum arenastrum  
Rumex acetosella  
Rumex crispus  
Rumex pulcher  
Rumex salicifolius

PORTULACACEAE

Calandrinia ciliata  
Claytonia parviflora ssp. parviflora  
(Rank B)  
Claytonia perfoliata  
Portulaca oleracea

PRIMULACEAE

Anagallis arvensis  
Dodecatheon hendersonii

RANUNCULACEAE

Clematis ligusticifolia (Rank C)  
Ranunculus californicus  
Thalictrum sp.

RHAMNACEAE

Rhamnus californica ssp. californica  
Rhamnus crocea var. crocea (Rank B)

ROSACEAE

Acaena pinnatifida var. californica  
(Rank C)  
Adenostoma fasciculatum  
Aphanes occidentalis  
Cotoneaster pannosa  
Fragaria vesca  
Heteromeles arbutifolia  
Holodiscus discolor  
Potentilla glandulosa ssp. glandulosa  
Prunus cf. dulcis  
Pyracantha angustifolia  
Rosa sp.  
Rubus ursinus  
Rubus vitifolius

RUBIACEAE

Galium aparine  
Galium porrigens  
Galium murale  
Galium parisiense  
Sherardia arvensis

SALICACEAE

Populus fremontii  
Salix laevigata

Coast buckwheat  
Knotweed  
Sheep sorrel  
Curly dock  
Fiddle dock  
Willow dock

PURSLANE FAMILY

Red maids  
Small-leaved miner's lettuce

Miner's lettuce  
Common purslane

PRIMROSE FAMILY

Scarlet pimpernel  
Shooting star

BUTTERCUP FAMILY

Virgin's bower  
California buttercup  
Meadow rue

BUCKTHORN FAMILY

Coffeeberry  
Redberry

ROSE FAMILY

Acaena  
  
Chamise  
Lady's mantle  
Cotoneaster  
Wood strawberry  
Toyon  
Ocean spray  
Sticky cinquefoil  
Almond  
Pyracantha  
Wild rose  
California blackberry  
Himalaya blackberry

MADDER FAMILY

Bedstraw  
Climbing bedstraw  
Wall bedstraw  
Wall bedstraw  
Sherardia

WILLOW FAMILY

Fremont cottonwood  
Red willow

SCROPHULARIACEAE

*Antirrhinum vexillo-calyculatum* (Rank B)  
*Bellardia trixago*  
*Castilleja attenuata*  
*Castilleja densiflora* ssp. *densiflora*  
(Rank C)  
*Castilleja exserta* ssp. *exserta*  
*Castilleja foliolosa*  
*Castilleja lineariloba*  
*Mimulus aurantiacus*  
*Pedicularis densiflora* (Rank C)  
*Scrophularia californica* ssp. *californica*  
*Triphysaria pusilla*

SOLANACEAE

*Solanum americanum*  
  
*Solanum umbelliferum*

URTICACEAE

*Urtica urens*

FIGWORT FAMILY

Wiry snapdragon  
*Bellardia*  
Valley tassels  
Pink owl's clover  
  
Pink owl's-clover  
Woolly Indian paintbrush  
Owl's-clover  
Bush monkeyflower  
Indian warrior  
California bee plant  
  
Dwarf owl's-clover

NIGHTSHADE FAMILY

Small-flowered nightshade  
Blue witch

NETTLE FAMILY

Dwarf nettle

## Appendix B

### Background Information on Sensitive Invertebrate Species

This section provides background information about the known geographic range and habitat requirements of special status insects and invertebrates. Occurrence information is from records contained in the BUGGY (1996) and RAREFIND (1996) databases.

#### **Bay Checkerspot Butterfly**

*Euphydryas editha bayensis* is a nymphalid butterfly that occurs in serpentine grassland habitats, especially those characterized by bunch grasses. Its larval foodplants are *Plantago erecta* and *Orthocarpus densiflorus*. Adults nectar on *Layia platyglossa*, two species of *Lomatium*, two species of *Allium*, and *Lasienia californica*. Today the checkerspot is known only from a handful of localities in San Mateo and Santa Clara counties, but it formerly also occurred in the hills of Alameda, Contra Costa, and Marin counties (Ehrlich et al. 1975).

#### **Callippe Silverspot Butterfly**

*Speyeria callippe callippe* is a nymphalid butterfly that occurs in coastal grasslands where its larval foodplant, *Viola pedunculata*, grows. Although it was formerly widely distributed throughout the San Francisco Bay area, today the butterfly is known only from San Bruno Mountain in San Mateo County, Joaquin Miller and Redwood Regional Parks in Oakland, and the hills of southern Solano County (Arnold 1981). Populations that are intermediate between the Callippe Silverspot and a related subspecies are known from the Livermore area and southern Napa County (Arnold 1983 and 1985).

#### **Unsilvered Fritillary**

Like the Callippe Silverspot, this butterfly feeds on *Viola pedunculata*. Historically, it occurred in the southern portions of the San Francisco Peninsula, from about San Mateo, south through the Santa Clara Valley and Santa Cruz Mountains, and into the Santa Lucia Mountains of Monterey County. A few historical records are from localities in the Oakland hills, including Joaquin Miller Park. It is generally associated with grassland pockets in or near Redwood-Oak woodlands.

#### **Monarch Butterfly**

The Monarch butterfly is one of the most well-known insects in the world. Its annual migrations to over-winter roosting sites located in coastal California and Mexico are legendary. Because many of these over-wintering sites have been destroyed or reduced in size, the Species Survival Commission of the International Union for the Conservation of Nature and Natural Resources (IUCN) has designated the protection of these areas a top priority. Also, the Monarch butterfly may be designated the national insect by the U.S. Congress in the near future.

Over-wintering sites in California are usually found within a mile of the immediate coast (Nagano and Lane 1985). These sites are generally wooded with trees of mixed height and trunk diameter, as well as understory brush. Trees, such as Blue Gum (*Eucalyptus globulus*), Monterey Pine (*Pinus radiata*), and Monterey Cypress (*Cupressus macrocarpa*), are most often used for roosts, although a variety of other native and introduced trees are used by the butterfly. The presence of a nearby source of winter-blooming nectar plants and freshwater are also important factors that determine where the Monarch will roost during the winter.

#### **Opler's Longhorn Moth**

This moth is endemic to serpentine grassland habitat, where its larval foodplant, *Platystemon californicus* grows (Powell 1969). Opler's Longhorn moth occurs at scattered localities in Marin, Alameda, San Francisco, and Santa Clara counties.

#### **San Francisco Tree Lupine Moth**

This moth was described in 1907 based on a series of four specimens collected during the 1880's from an unknown location in San Francisco. It remained unknown until 1961, when Dr. Jerry A. Powell, of the University of California, Berkeley, rediscovered a population along Lobos Creek in association with Tree Lupine, *Lupinus arboreus*, near Baker Beach in San Francisco. The moth is often found in association with sand dunes and sandy soils where its lupine foodplant grows. Subsequent field surveys have demonstrated

that this moth is substantially more widespread, ranging from Marin to Monterey County. More recent taxonomic investigations suggest that it may be conspecific with another, more widely ranging species of *Grapholita*. For these reasons, the U.S. Fish & Wildlife Service (1991) no longer monitors the status of this moth.

#### **Ricksecker's Water Scavenger Beetle**

Ricksecker's Water Scavenger beetle (RWSB) was described by Horn in 1895 as *Hydrocharis rickseckeri* (Coleoptera: Hydrophilidae) from a single male collected by Mr. H. Ricksecker from Harris Pond, near Santa Rosa, on 30 March 1893. Other than a change in the spelling of the generic name to *Hydrochara*, there have been no other taxonomic or nomenclatural changes affecting this species. Smetana (1980) recently revised the genus *Hydrochara*.

Specific details of the RWSB's natural history are unknown. However, some inferences can be made based on knowledge of the natural history of related species as described by Malta (1974), Smetana (1980), Wooldridge (1967), and Leech (1948). Other members of this genus are aquatic scavengers as adults, while larvae feed as predators on soft-bodied aquatic invertebrates. Larvae must hold their prey above the water surface to feed; thus they are usually found in relatively calm, shallow water of ponds, streams, marshes, or lakes.

RWSB is known only from the immediate San Francisco Bay area. In addition to the type specimen, only another 14 specimens have been collected at various times during the past century. All are housed at the California Academy of Sciences in San Francisco. The most recent specimen was collected a few years ago at the Jepson Prairie in Solano County, but most of the specimens at the Academy were collected during the 1940's and 1950's. These older specimens were collected in Alameda Co. (Oakland and Livermore), Marin Co. (Bolinas), San Mateo Co. (San Mateo and Woodside at the Pulgas Temple (within the Peninsula watershed), and Sonoma Co. (near Penngrove). Collection dates include the months of January through July.

#### **San Francisco Forktail Damselfly**

*Ischnura gemina* is a coenagrionid damselfly distributed in portions of Alameda, Marin, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties (Garrison and Hafernik 1981; J. Hafernik, San Francisco State University, pers. comm.). This damselfly has been found in shallow ponds and sluggish streams. It may also be found in pools of faster-flowing streams. Both the adults and aquatic immature stage, referred to as a naiad, are predaceous on other insects and invertebrates. Adults have been observed from late February through mid-November. There are at least two broods at some locations.

This damselfly was described in 1917 from specimens collected from Coyote Creek in San Jose, and Sharon Pond in Santa Clara County. Until the late 1970's, this species was known from only 40 specimens and was feared to be extinct. For this reason, the U.S. Fish & Wildlife Service formerly considered the damselfly to be a candidate for endangered status; however, subsequent field surveys have discovered that the damselfly still exists at a number of locations in the San Francisco Bay area, even though many of the populations are small in size and habitat conditions are degraded. Hence, the Service downgraded the damselfly and is no longer monitoring its status.

#### **San Francisco Lacewing**

This species was described from the San Francisco area, but was historically known to occur in coastal areas from Mendocino to Los Angeles counties. In recent years it has been known primarily from the Berkeley hills, where it is found in a scrub-woodland habitat.

#### **Lee's and Lum's Harvestmen**

The animal class Arachnida consists of several orders, including ticks and mites (Acarina), scorpions (Scorpiones), spiders (Araneida), harvestmen and phalangids (Opiliones), false scorpions (Pseudoscorpions), and sun spiders (Solifugae). Harvestmen, phalangids, and harvest spiders are common names for a family, the Phalangodidae, of free-living, spider-like arachnids. The three harvestmen species of concern belong to the

suborder Laniatores, which contains about 1,500 to 2,000 species distributed throughout the world, but principally from southern latitudes (Cloudsley-Thompson 1958).

Harvestmen in the genus *Microcina* are generally found under serpentine rocks, particularly in association with serpentine grassland or oak woodland vegetation (Briggs and Ubick 1989). Collection dates are generally during the winter rainy season, and range from December through early April, depending on the soil moisture conditions in any particular year. During the rainy season, the harvestmen can be found under the serpentine rocks. During the drier seasons of the year, the harvestmen are believed to live in the cracks and crevices of the soil below serpentine rocks. *M. leei* is known from the Berkeley hills north of the Claremont Hotel. *M. lumi* is known from serpentine outcrops in the San Leandro hills.

#### **Longhorn and Tadpole Shrimp**

These shrimp are associated with vernal pools and were both recently recognized as endangered. The Longhorn Fairy shrimp is known from the Altamont Pass area in Alameda County, Kesterson National Wildlife Refuge (Merced County), and the Carizo Plains of San Luis Obispo County. The Vernal Pool Tadpole shrimp is known from scattered vernal pool complexes in the Central Valley from Redding to Merced County. A disjunct population occurs in Alameda County at the San Francisco National Wildlife Refuge.

#### **Bridge's Coast Range Snail**

This terrestrial snail is a subspecies of *Helminthoglypta nickliniana*, the Coast Range Shoulderband Snail, which is widely distributed throughout the Coast Range of California. *H. nickliniana bridgesi* occurs in the San Francisco Bay area, especially in the South bay (San Mateo and Santa Clara counties), and East Bay hills (Alameda and Contra Costa counties). The snail is found in oak woodland-savanna situations, where there are fallen branches or rock outcrops to shelter the snail. It is active in the winter-spring rainy season. Most collection sites are in association with Live Oak (*Quercus agrifolia*: Fagaceae).



Appendix C  
Photographs of the Project Site



Figure 1. A view looking east of grassland and scrub along the east-central border of the project site. This area provides potential core Alameda whipsnake habitat.



Figure 2. A rock outcrop amidst a scrub/grassland stand on the south-facing wall of the southern ravine. The River Exhibit is proposed near this area.

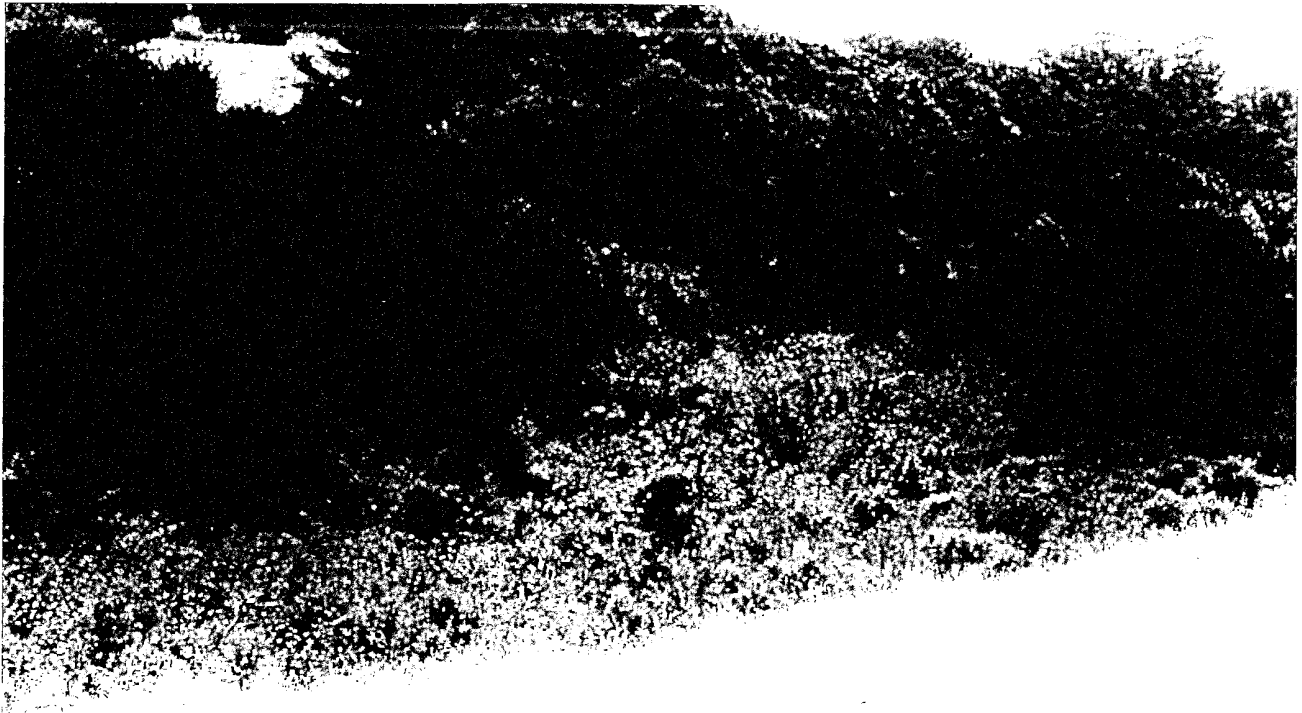


Figure 3. A view looking west along the upper reaches of the northern ravine above the existing bison/tule elk enclosure. The scrub in the foreground is good potential Alameda whipsnake habitat.



Figure 4. A view looking north across a dense chamise-covered hillside. The hiking trail proposed through this area would enhance the site by producing openings in this dense stand.



Figure 5. A view looking north toward the cellular telephone transmission facility. The bison enclosure is proposed in this area.



Figure 6. A view looking west across the bison/tule elk enclosure. The ground is devoid of vegetation and shrub growth in the background is composed of introduced French broom.



Figure 7. A view of the mouth of the southern ravine which was filled with compost. EBZS is restoring the intermittent creek drainage by relocating the compost.

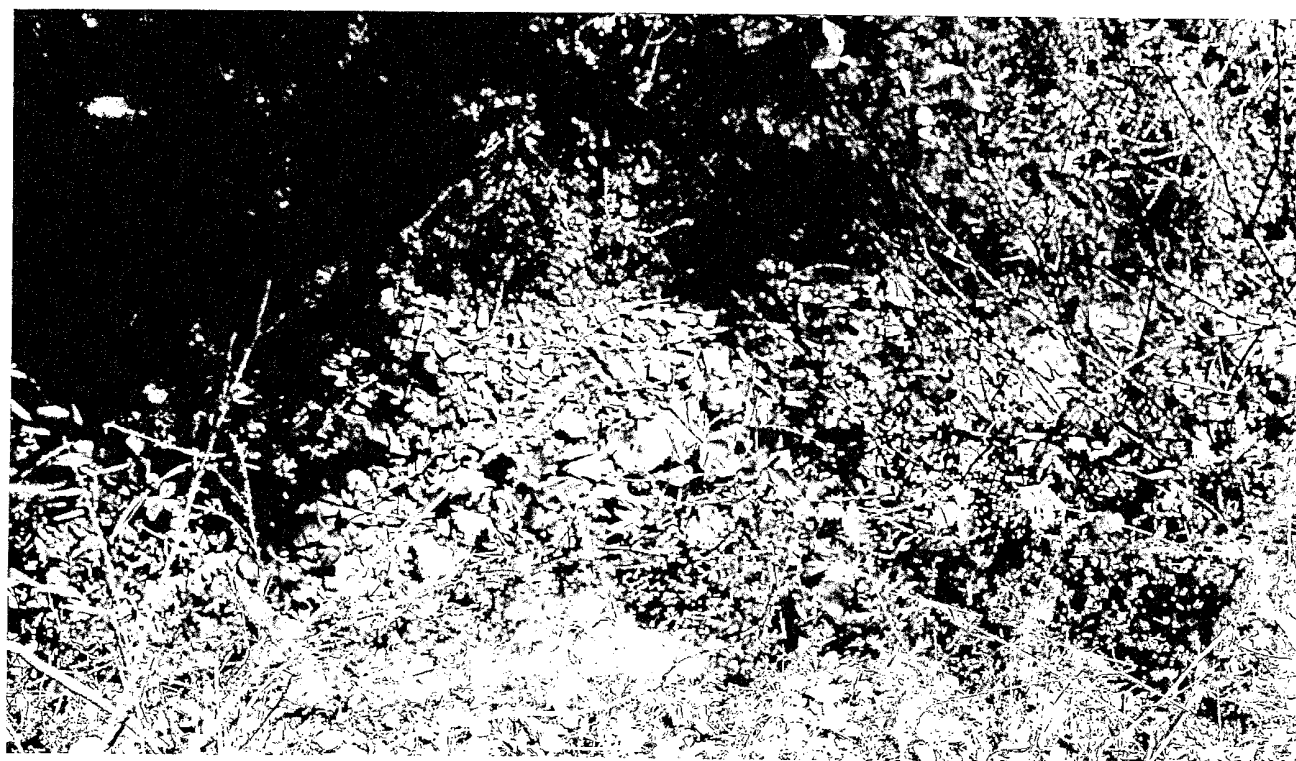


Figure 8. A segment of the intermittent creek bed showing a scoured rock-gravel bed along the southern ravine.

