

APPENDIX A
Glossary of Terms

APPENDIX A

Glossary of Terms

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

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

Brush Fire: A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

Burning Conditions: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

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

Closure: Legal restriction, but not necessarily elimination, of specified activities such as smoking, camping, or entry that might cause fires in a given area.

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

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

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

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

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

Exposure: (1) Property that may be endangered by a fire burning in another structure or by a wildfire; (2) direction in which a slope faces, usually with respect to cardinal directions; (3) the general surroundings of a site with special reference to its openness to winds.

Extreme Fire: A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning

APPENDIX A (Continued)

and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

Fine Fuels: Fast-drying dead fuels that are less than 0.25-inch in diameter and are generally characterized by a comparatively high surface area to volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

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

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

Fire Front: That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, it is assumed to be the leading edge of the fire perimeter.

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

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

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

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

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

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

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

Fire Storm: Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

APPENDIX A (Continued)

Fire Triangle: Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

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

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

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

Firebreak: A natural or constructed barrier used to stop or check fires that may occur or to provide a control line from which to work.

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

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

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

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

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

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

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

Fuel Modification Zone: A strip of land, typically 100 feet wide or more, between an improved property and wildlands, where combustible vegetation has been removed, thinned, or modified and may be partially or totally replaced with approved drought-tolerant, fire-resistant, and/or irrigated plants to provide an acceptable level of risk from vegetation fires. Fuel modification

APPENDIX A (Continued)

reduces radiant and convective heat, thereby reducing the amount of heat exposure on the roadway or structure and providing fire suppression forces a safer area in which to take action.

Fuels: All combustible material within the WUI or intermix, including vegetation and structures.

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

High Value Resource: High Value Resources are natural or man-made resources, including plant and animal species, cultural resources, and residences that form the basis for fire management planning on the Property.

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

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

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

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

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

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

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

Project VESTA (ENSIS October 2007): Southern Australia's most recent and significant study of eucalyptus forest fire behavior. The project was designed to provide new fuel models to estimate the fuel characteristics of different fuel types and identified better fuel parameters to predict the behavior of fire in dry eucalypt forest.

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

APPENDIX A (Continued)

firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

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

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

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

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

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

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

Structure: A habitable structure (as defined by Oakland City Code), historic structure, or other City owned or maintained building (e.g., park maintenance building) or attachment thereto.

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

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

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

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

APPENDIX A (Continued)

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

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

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

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

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

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

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

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

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

Source: www.firewise.org

APPENDIX B
Biological Resources Report

Biological Resources Report

Oakland Vegetation Management Plan

Prepared for: City of Oakland
1 Frank Ogawa Plaza
Oakland, CA 94612

Prepared by: Horizon Water and Environment
266 Grand Ave, Suite 210
Oakland, CA 94610

November 2017

Horizon Water and Environment. *Oakland Vegetation Management Plan. Draft Biological Resources Report.* November 2017. (HWE 16.042) Oakland, CA.

Table of Contents

1.0 Introduction	1
1.1 Objectives of the Report.....	1
2.0 Methods	1
2.1 Background Data Review.....	1
2.2 Field Surveys.....	4
2.3 Habitat Classification and Mapping.....	4
3.0 Habitats in the Plan Area	4
3.1 Terrestrial Habitats.....	5
3.2 Aquatic and Wetland Habitats.....	15
4.0 Biological Resources by Parcel Type and Topography	15
4.1 Urban and Residential Parcels.....	16
4.2 Canyon Areas.....	16
4.3 Ridgetop Areas.....	18
4.4 City Park Lands and Open Space.....	18
4.5 Roadside Clearance Areas.....	19
5.0 Special-Status Species.....	20
5.1 Definitions and Methods of Assessment.....	20
5.2 Special-status Plants.....	22
5.3 Special-status Wildlife.....	40
6.0 Potentially Jurisdictional Wetlands & Waters of the U.S	45
7.0 Sensitive Natural Communities	45
8.0 References	45

List of Appendices

- Appendix A. Special-Status Species Lists
- Appendix B. Species Observed in the Plan Area during Reconnaissance Surveys
- Appendix C. Vegetation Classification Crosswalk
- Appendix D. Photographs of Special-status Species

List of Figures

- Figure 1. Project Location
- Figure 2. Habitats in the Plan Area (Sheets 1-5)
- Figure 3. Plan Area by Parcel Type

- Figure 4. Pre-1970 Special-Status Plant Species Occurrences in the Vicinity of the Plan Area (Sheets 1-4)
Figure 5. Post-1970 Special-Status Plant Species Occurrences in the Vicinity of the Plan Area (Sheets 1-4)
Figure 6. Special-Status Animals in the Vicinity of the Plan Area (Sheets 1-4)
Figure 7. Critical Habitat

List of Tables

- Table 1. Summary of Habitats within the Plan Area.
Table 2. Special-Status Plants with the Potential to Occur in the Plan Area
Table 3. Special-Status Fish and Wildlife with the Potential to Occur in the Plan Area

1.0 Introduction

Oakland, California, contains topographic, vegetation, and climatic conditions which combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires, such as the 1991 Tunnel Fire. As part of a broader, multi-faceted approach to fire hazard reduction, the City of Oakland (City) is developing a Vegetation Management Plan (Plan) to reduce the risk of catastrophic fire in the Very High Fire Hazard Severity Zone (VHFHSZ). Specifically, the Plan Area includes:

- 434 City-owned parcels, ranging in size from >0.1 to 235 acres and totaling 1,948 acres
- Roadside areas along 308 miles of road within the City's VHFHSZ, which includes surface and arterial streets, State Routes 13 and 24, and Interstate 580

An overview of the Plan Area is shown in **Figure 1**, and in more detail in **Figure 2**, Sheets 1-5.

1.1 Objectives of the Report

This purpose of this Biological Resources Report is to document current (existing) biological conditions within the Plan Area at the time of Plan development. This report includes mapping of vegetation and land cover, and identification of potential habitat for special-status species and sensitive natural communities. The findings of this report provide a baseline understanding of existing biological resources in the Plan Area. This report provides a foundation upon which the Plan will be developed to identify and describe vegetation management approaches to reduce fire risk.

2.0 Methods

Developing this report involved several steps including first collecting and reviewing pertinent reference materials, then conducting a series of field surveys of sites in the Plan Area, classifying and mapping vegetation and habitat conditions, and documenting these findings in this report. Vegetation types consist of assemblages of plant species that coexist in an area. These assemblages are influenced by climate, geology, soil, and disturbance, among other factors. Habitat is the natural setting under which organisms normally live, and is defined by both biotic and abiotic features. Broadly, the Plan Area includes both terrestrial and aquatic habitats, which are further divided and defined in Section 3.0.

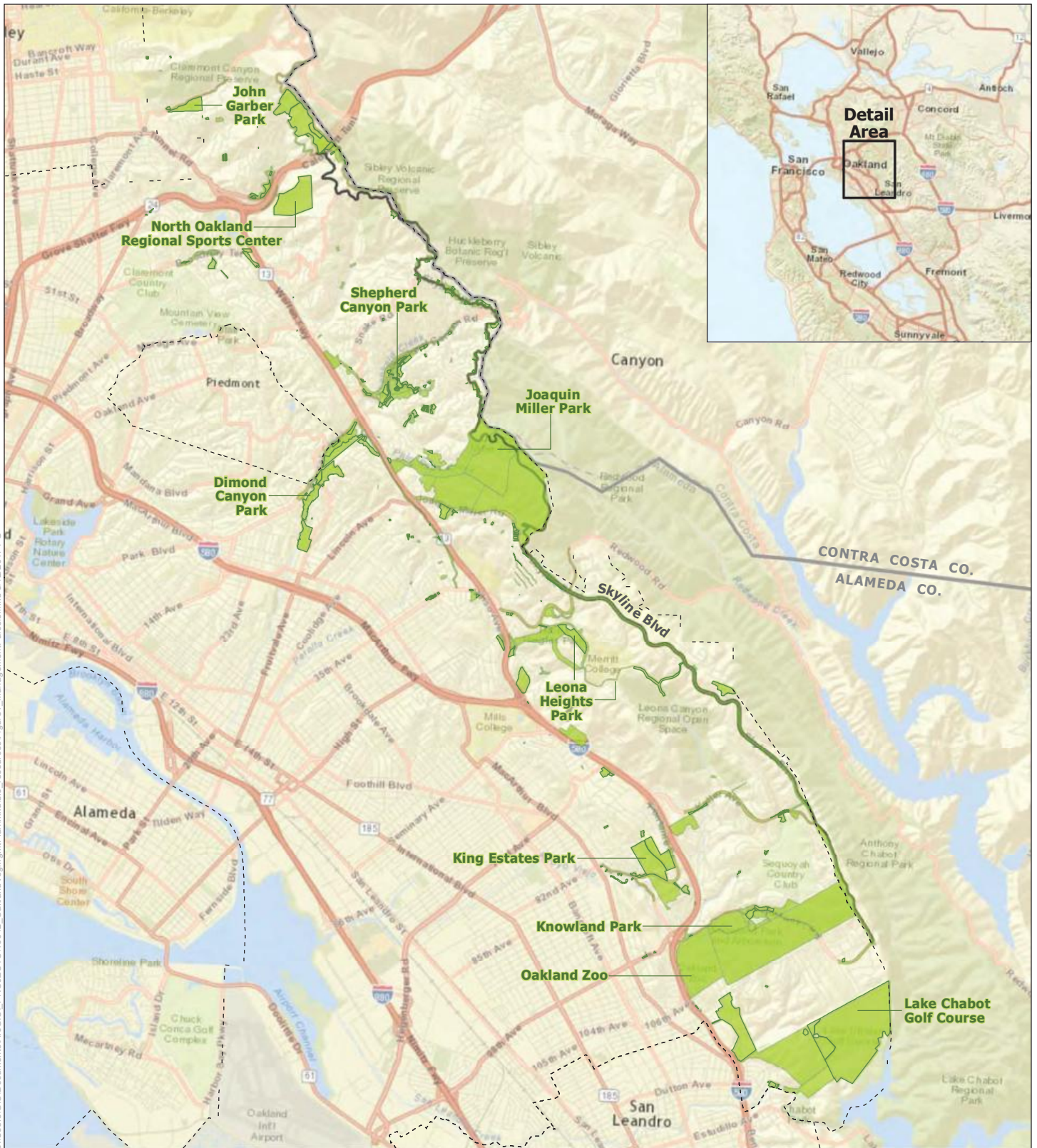
2.1 Background Data Review

Biologists from Horizon Water and Environment (Horizon) collected and reviewed the following materials relevant to biological resources in the Plan Area.

- U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) Report (USFWS 2017, Appendix A).
- California Natural Diversity Database (CNDDDB) (CDFW 2017) and California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants of California (CNPS 2017) queries for the following USGS 7.5 minute quadrangles: Briones Valley,

Hayward, Hunters Point, Las Trampas Ridge, Oakland East, Oakland West, Richmond, San Leandro, and Walnut Creek (Appendix A).

- CNPS East Bay Chapter Rare, Unusual and Significant Plants of Alameda and Contra Costa Counties Database.
- Final Hazardous Fire Risk Reduction Environmental Impact Statement (EIS), (Federal Emergency Management Agency [FEMA] 2014).
- eBird.org records for the Plan Area (eBird 2017).
- East Bay Regional Park District (EBRPD) Draft Wildfire Hazard Reduction and Resource Management Plan (LSA 2009a) and EIR (LSA 2009b)
- Final Sausal Creek Watershed Enhancement Plan (Laurel Marcus and Associates et al. 2010).
- Vegetation Management Implementation Plan: Chabot Space and Science Center (WRA 2013).
- East Bay Watershed Master Plan Update (EBMUD 2016).
- URS Strawberry Canyon Vegetation Mitigation letter (URS 2009).



C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegetationManagement\resources\Figure1_ManagementParcels.mxd 5/12/2017 PG

BaseMap Sources: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 1
Project Area



- Project Area (Parcels and Roadside Treatment Areas)
- City Limits
- County Line

Sources: City of Oakland; County of Alameda



2.2 Field Surveys

Field surveys to map land cover and vegetation and to identify potentially suitable habitat for special-status species within the Plan Area were conducted over several weeks in early 2017, including: on January 25, February 6, February 23, March 7, March 11, March 16, March 28, and April 27. Horizon Water and Environment's Oakland based ecologist/botanist, Robin Hunter, participated in all surveys. Oakland based wildlife biologist Brian Piontek, participated in the March 7 and 28, 2017 surveys. The biologists visited portions of the Plan Area with potentially sensitive biological resources on foot. Some portions of the Plan Area were observed with binoculars. Some parcels which were completely developed were mapped using aerial imagery. Portions of some parcels were mapped using vegetation signatures from aerial imagery. Wildlife species observed or recognized by signs such as scat, tracks, burrows, nests, bird songs, or calls during the survey were identified and recorded. An inventory of plant and wildlife species observed during the 2017 field surveys is provided in Appendix B.

2.3 Habitat Classification and Mapping

Habitats were mapped using the California Wildlife Habitat Relationships (CWHR) System (Mayer Laudenslayer 1988). This classification system was chosen because it is specifically appropriate for California landscapes such as the Oakland Hills, its relevance to wildlife, its accessibility to the public, the fact that it can be input into predictive fire models that will be used for the Vegetation Management Plan, and the flexibility of using this classification for habitat types over the large survey area. The minimum mapping unit was 0.1 acre, except in the instance of linear features, such as roads. Habitat classification types were entered into ArcGIS 10.3 software to create a vegetation and land cover layer covering the entire Plan Area, based on field survey data and interpretation of aerial imagery. Riverine habitat was mapped using data from the National Hydrography Dataset (USGS 2016). A crosswalk to other vegetation classification systems (e.g., Sawyer et. al 2009, CalVeg) is provided in Appendix C. Additionally, plants are designated as invasive if they are rated by the California Invasive Plant Council (Cal-IPC) as moderate or high (Cal-IPC 2006).

3.0 Habitats in the Plan Area

There is substantial variation in topography and land use within the Plan Area. Most of the Plan Area is situated in the hills of eastern Oakland, California. A smaller portion of the Plan Area is located on parcels within urban/residential areas in the vicinity of Highway 13 and I-580. Land uses include residential, transportation corridors, open space and park lands, and vacant lots. Elevations in the Plan Area range from 100 feet above mean sea level (msl) at an urban parcel on Golf Links Road to approximately 1,540 feet above msl at the top of the ridgeline, near Chabot Science Center.

Prior to urbanization, vegetation in the Plan Area was primarily grasslands and shrublands, (Nowak 1993). Only about 2.3 percent of land in Oakland was covered by forests, including coast redwood (*Sequoia sempervirens*) forests, coast live oak (*Quercus agrifolia*) stands, and riparian woodlands (Nowak 1993). Major logging of redwood forests occurred in the mid-1800s (Simon 2014). Between 1880 and 1920 large scale tree planting occurred in the Oakland hills, initially by Joaquin Miller and later by Frank Havens (Nowak 1993). Tree species planted included pines (*Pinus* spp.), acacia (*Acacia* spp.), and eucalyptus (*Eucalyptus*

spp.) (Nowak 1993). Frank Havens planted an estimated 3 million blue gum eucalyptus (*Eucalyptus globulus*) and Monterey pine (*Pinus radiata*) seedlings (Simon 2014).

Fire and vegetated fire hazard management have also shaped vegetation in the Oakland hills. In the last 100 years, 14 significant fires have occurred in the Oakland Hills (City of Oakland 2017). This includes the 1991 Tunnel Fire, which burned 1,700 acres (City of Oakland 2017). Many of the fires burned large areas, restarting succession of vegetation in these areas. Additionally, the City has conducted vegetated fire hazard management activities within the Plan Area since 2003. Activities such as goat grazing, brush and French broom removal, mowing, hand removal of weeds, tree trimming, removal of sapling eucalyptus and Monterey pine trees, removal of dead or dying vegetation, among other vegetation management practices have shaped vegetation in the Oakland hills by removing biomass, and in some cases shifting successional processes.

The following section provides descriptions of habitats present within the Plan Area. Terrestrial habitats are generally described in terms of vegetation present in these habitats. Figure 2 shows the mapped habitats within the Plan Area, and Table 1 summarizes habitat area and percent of the total Plan Area. Each community type is described based both on the habitat descriptions in the CWHR System and specific conditions encountered within the survey area. Section 4 describes the distribution of biological communities across different parcel types. Wildlife typically associated with these biological communities is also described below. Much of the information regarding typical wildlife associated with each habitat type is referenced from the EBRPD Draft Wildfire Hazard Reduction and Resource Management Plan EIR(LSA 2009b).

Table 1. Habitats and Spatial Coverage within the Plan Area

Vegetative Habitat Type	Acres	Percentage
Urban	655.2	29.08%
Coast Oak Woodland	628.7	27.91%
Annual Grassland	259.8	11.53%
Closed-cone Pine-Cypress	192.0	8.52%
Eucalyptus	175.3	7.78%
Coastal Scrub	170.2	7.55%
Redwood	141.4	6.28%
Perennial Grassland	11.6	0.52%
Valley/foothill Riparian	10.5	0.47%
Chamise-redshank Chaparral	8.1	0.36%
Freshwater Emergent Wetland	0.2	0.01%
Total	2253	100.0%

3.1 Terrestrial Habitats

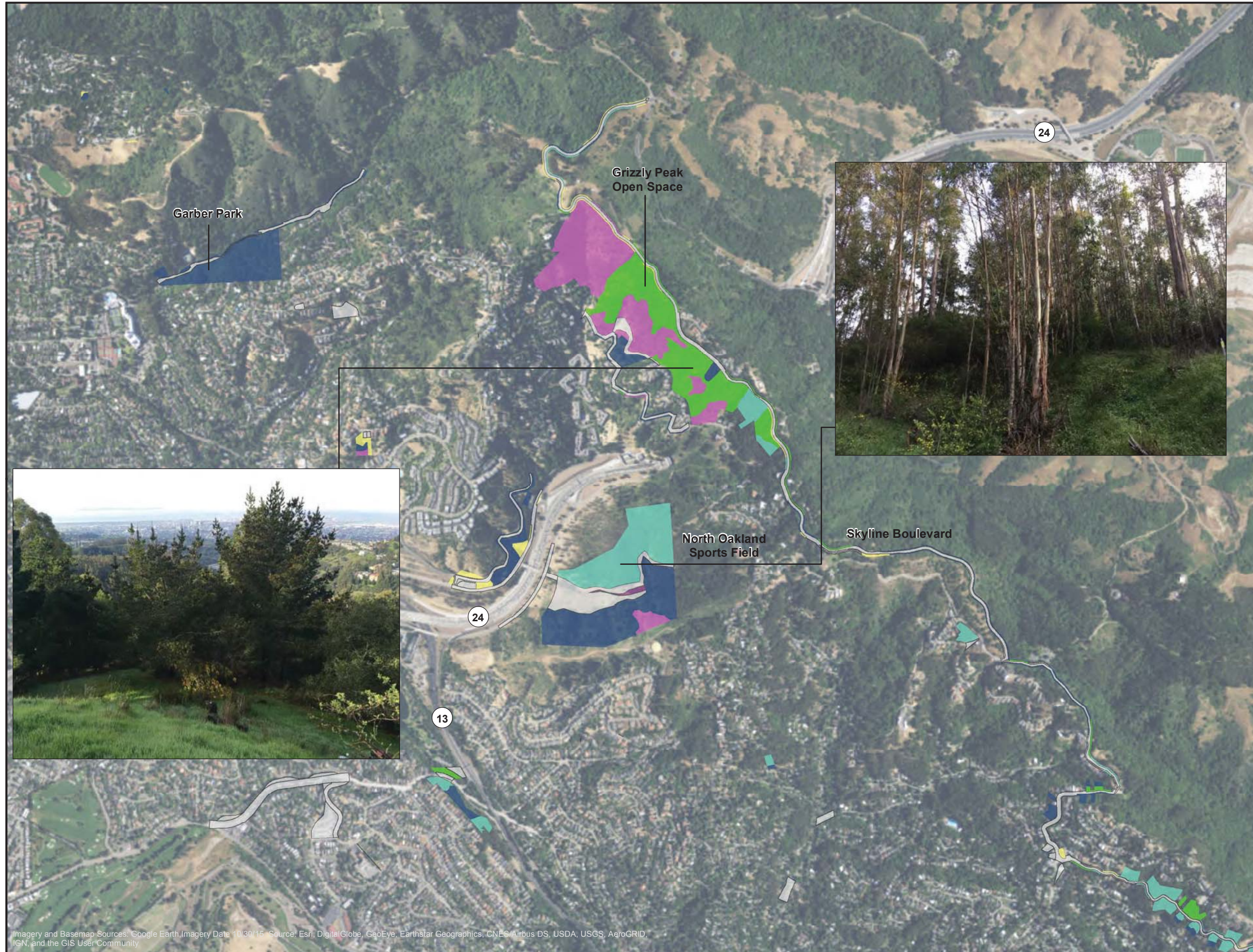
3.1.1 Tree-dominated

Coast Oak Woodland

This habitat is dominated by coast live oak; the canopy may range from open to relatively closed. This habitat is generally found along drainages within the Plan Area, but is also found along hillslopes and upland flats. In areas along drainages, California bay laurel (*Umbellularia californica*) is common, and may be co-dominant with coast live oak. California buckeye (*Aesculus californica*) is occasionally found in this habitat type. The understory is variable in composition and includes species such as native California blackberry (*Rubus ursinus*), poison oak (*Toxicodendron diversilobum*), oso berry (*Oemleria cerasiformis*), ocean spray (*Holodiscus discolor*), woodfern (*Dryopteris arguta*) and swordfern (*Polystichum munitum*), as well as non-native Himalayan blackberry (*R. armeniacus*). Forests dominated by coast live oak are considered to be one of the most fire resistant tree-dominated habitats (Sugihara et al. 2006). The thick bark and small leaves of coast live oak contribute to the fire resistance of this habitat (Sugihara et al. 2006).

On hill slopes and other non-riparian areas, coast live oaks are generally the main canopy species, and may be more widely spaced. In these locations, various grasses are often dominant in the understory, including wild oats (*Avena* spp.) and ripgut brome (*Bromus diandrus*). Purple needlegrass (*Stipa pulchra* [= *Nasella pulchra*]) is occasionally found in the understory in coast oak woodlands with a more open canopy.

Coast oak woodland support a diverse assemblage of wildlife. Amphibians associated with this habitat include ensatina (*Ensatina eschscholtzii*), arboreal salamander (*Aneides lugubris*), and California slender salamander (*Batrachoseps attenuatus*) (LSA 2009). Typical bird species include Nuttall's Woodpecker (*Picoides nuttallii*), Acorn Woodpecker (*Melanerpes formicivorus*), Western Scrub-Jay (*Aphelocoma californica*), Steller's Jay (*Cyanocitta stelleri*), Hutton's Vireo (*Vireo huttoni*), Oak Titmouse (*Baeolophus inornatus*), Violet-green Swallow (*Tachycineta thalassina*), Orange-Crowned Warbler (*Vermivora celata*), Bushtits (*Psaltriparus minimus*), and Dark-Eyed Junco (*Junco hyemalis*). Raptors, including Red-Shouldered Hawk (*Buteo lineatus*) and Cooper's Hawk (*Accipiter cooperii*) may also occur. Amphibians such as California newt (*Taricha torosa*) may be found in this habitat, particularly near streams. Small mammals common to oak woodlands include California mouse (*Peromyscus californicus*), dusky-footed woodrat (*Neotoma fuscipes*), as well as non-native eastern fox squirrel (*Sciurus niger*) (LSA 2009). Larger mammals typically found in this habitat include bobcat (*Lynx rufus*), coyote (*Canis latrans*), and California mule deer (*Odocoileus hemionus californicus*).



- ### Habitat Types
- Annual Grassland
 - Coast Oak Woodland
 - Closed-cone Pine-Cypress
 - Coastal Scrub
 - Eucalyptus
 - Urban
 - Valley/foothill Riparian

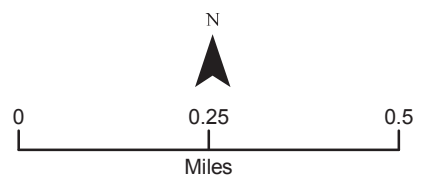
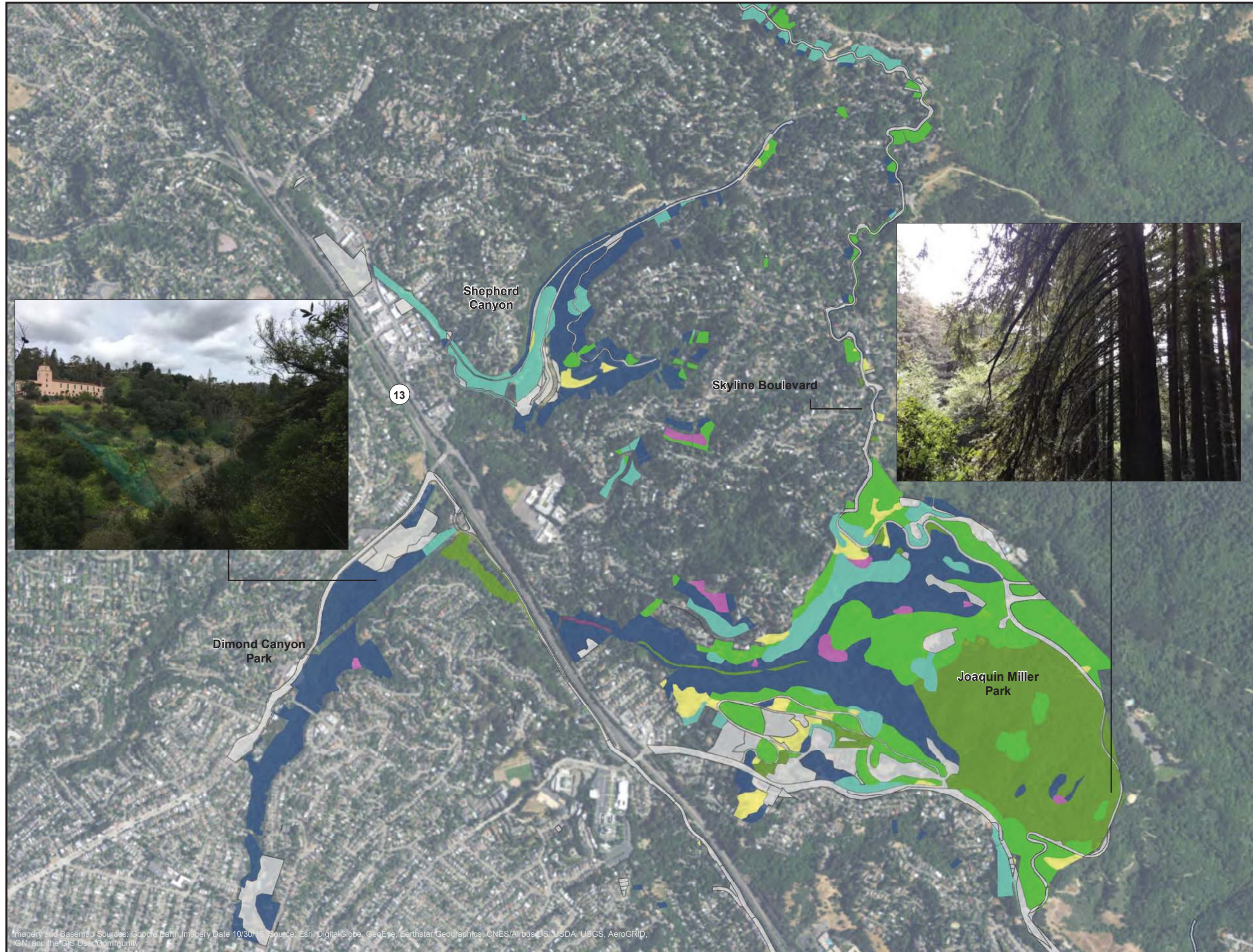


Figure 2
Sheet 1 of 5

Habitats in the Project Area
Oakland Vegetation Management
Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure2_Vegetation.mxd RH 9/28/2017

Imagery and Basemap Sources: Google Earth Imagery Date 10/30/15 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- ### Habitat Types
- Annual Grassland
 - Coast Oak Woodland
 - Closed-cone Pine-Cypress
 - Coastal Scrub
 - Eucalyptus
 - Redwood
 - Urban
 - Valley/foothill Riparin

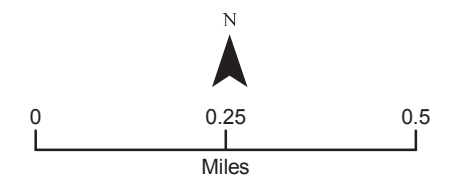


Figure 2
Sheet 2 of 5

Habitats in the Project Area
Oakland Vegetation Management
Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmt\Plan\mxd\bio_resources\Figure2_Vegetation.mxd RH 9/28/2017

Imagery and Basemap Sources: Google Earth Imagery Date 10/30/16 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- ### Habitat Types
- Annual Grassland
 - Coast Oak Woodland
 - Closed-cone Pine-Cypress
 - Coastal Scrub
 - Eucalyptus
 - Redwood
 - Urban

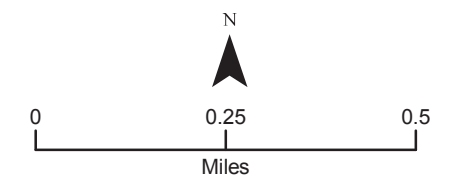


Figure 2
Sheet 3 of 5

Habitats in the Project Area
Oakland Vegetation Management
Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure2_Vegetation.mxd RH 9/28/2017

Imagery and Basemap Sources: Google Earth Imagery Date: 10/30/15 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- ### Habitat Types
- Annual Grassland
 - Coast Oak Woodland
 - Closed-cone Pine-Cypress
 - Chamise-Redshank Chaparral
 - Coastal Scrub
 - Eucalyptus
 - Freshwater Emergent Wetland
 - Perennial Grassland
 - Redwood
 - Urban

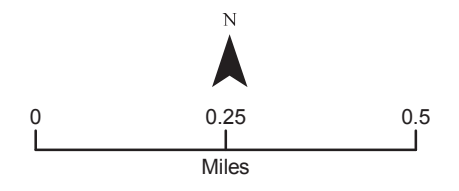


Figure 2
Sheet 4 of 5

Habitats in the Project Area
Oakland Vegetation Management
Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmt\Map\resources\Figure2_Vegetation.mxd RH 9/28/2017

Imagery and Base Map Sources: Google Earth Imagery Date 10/10/15 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Habitat Types

- Annual Grassland
- Coast Oak Woodland
- Closed-cone Pine-Cypress
- Chamise-Redshank Chaparral
- Coastal Scrub
- Eucalyptus
- Freshwater Emergent Wetland
- Perennial Grassland
- Redwood
- Urban

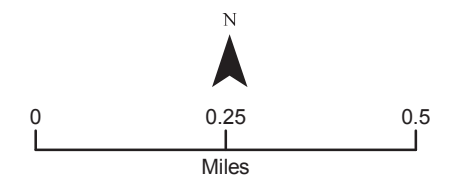


Figure 2
Sheet 5 of 5

Habitats in the Project Area
Oakland Vegetation Management
Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmt\Map\resources\Figure2_Vegetation.mxd RH 9/28/2017

Imagery and Base Map Sources: Google Earth Imagery Date 10/20/15 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Redwood Forest

Redwood forests are found in a few portions of the Plan Area, largely along canyons and drainages within Joaquin Miller Park and Leona Heights Park. Coast redwood (*Sequoia sempervirens*) is the dominant tree in this habitat. Subdominant trees include coast live oak and bay laurel. The understory is dominated by ferns such as western swordfern (*Polystichum munitum*). Other common understory species include wild ginger (*Asarum caudatum*) and huckleberry (*Vaccinium ovatum*).

Redwood forests provide food, cover, or other habitat elements for a wide variety of wildlife species. Many species associated with coast oak woodland habitat may also be found in the redwood forest. Bird species typical of this habitat include Steller's Jay, Brown Creeper (*Certhia americana*), Hairy Woodpecker (*Picoides villosus*), Pacific Wren (*Troglodytes pacificus*), and Pacific-slope Flycatcher (*Empidonax difficilis*).

Valley Foothill Riparian

This habitat is associated with the moderately sized and large drainages within the Plan Area. Dominant species include willows (*Salix* spp.), mainly arroyo willow (*S. lasiolepis*), and white alder (*Alnus rhombifolia*). Bigleaf maple (*Acer macrophyllum*) is found as a subdominant species, and red alder (*Alnus rubra*) is occasionally found.

This habitat may support many breeding birds, including Warbling Vireo (*Vireo gilvus*), Wilson's Warbler (*Cardellina pusilla*), Downy Woodpecker (*Picoides pubescens*), Northern Flicker (*Colaptes auratus*), Chestnut-Backed chickadee (*Poecile rufescens*), Swainson's Thrush (*Catharus ustulatus*), Wilson's Warbler (*Cardellina pusilla*), Black-Headed Grosbeak (*Pheucticus melanocephalus*), Song Sparrow (*Melospiza melodia*), and Pacific-Slope Flycatcher. Many other bird species may use this habitat during migration. Dusky-footed woodrats typically use this habitat, as do raccoons. Riparian habitat provides dispersal corridors for wildlife species. Riparian areas also provide important habitat for amphibians such as Pacific chorus frog (*Pseudacris regilla*) and California newt,

Eucalyptus Forest

Eucalyptus trees (*Eucalyptus* spp.) were introduced to the Oakland Hills from Australia, starting in the late 19th century (Nowak 1993). Blue gum eucalyptus (*Eucalyptus globulus*) is by far the most common eucalyptus species in this habitat. Other trees present as minor components of this community include coast live oak and bay laurel. Understory composition varies and may consist of eucalyptus saplings, shrubs, and non-native grasses such as wild oats, ripgut brome, and panic veldt grass (*Ehrharta erecta*). In some areas, especially in groves with mature eucalyptus trees, the understory is very sparse, in part due to the allelopathic effects of the eucalyptus leaf litter (del Moral and Muller 1970). Thick litter may also have mulching effects. In areas where understory vegetation is present, common shrubs include French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), poison oak, and cotoneaster (*Cotoneaster* spp.).

Monarch butterflies (*Danaus plexippus*) are known to overwinter in specific eucalyptus groves along the California coast from Mendocino County south to Baja California, Mexico. While observations of some Monarchs are known in the Plan Area, substantial or significant monarch butterfly overwintering groves are not present in the Plan Area (CDFW 2017, Western Monarch Count Resource Center 2017).

This habitat type provides roosts, perches, and nest sites for a number of bird species, especially raptors. Bird species commonly observed in eucalyptus forest in the Plan Area include American Crow (*Corvus brachyrhynchos*), Western Scrub-Jay, American Robin (*Turdus migratorius*), Great Horned Owl (*Bubo virginianus*), Red-tailed Hawk, and Red-shouldered Hawk. Eucalyptus litter creates micro-habitats for a number of small vertebrate species that occur in a variety of woodland habitats, including southern alligator lizard, Pacific gopher snake (*Pituophis catenifer catenifer*), and woodrat (Pearson 1988).

Closed-Cone Pine-Cypress

In the Plan Area, this habitat is dominated by Monterey pine (*Pinus radiata*) and Monterey Cypress (*Hesperocyparis macrocarpa*). Large portions of the Oakland hills were planted with these species by Joaquin Miller, Frank Haven, and others (Nowak 1993). Monterey pine is native to San Mateo, Monterey, and San Luis Obispo Counties and Monterey Cypress is native to Monterey County. Both species have been planted in parks and other urban areas throughout coastal California. Subdominant trees include coast live oak and eucalyptus. The understory ranges from sparse to dense, and in some areas resembles the coastal scrub habitat type described below. The understory can include species such as sticky monkey flower (*Mimulus aurantiacus*), coyotebrush (*Baccharis pilularis*), poison oak, and western bracken fern (*Pteridium aquilinum* var. *pubescens*). Blue elderberry (*Sambucus nigra* ssp. *caerulea*) can be found scattered occasionally in this habitat. Other shrubs may include French broom and Scotch broom.

Bird species that use this habitat include Chestnut-Backed Chickadee, Pine Siskin (*Spinus pinus*), Hairy Woodpecker, and Pygmy Nuthatch (*Sitta pygmaea*), Pacific Wren, Western Bluebird (*Sialia mexicana*), as well as a variety of migratory birds that may forage in this habitat. Raptors such as Great Horned Owl, Cooper's Hawk, Red-tailed Hawk, and Red-shouldered Hawk may use closed-cone pine-cypress habitat as nest sites. Small vertebrates may use this habitat, but it does not typically support the diverse wildlife assemblages associated with oak and riparian woodlands (LSA 2009).

3.1.2 Shrub-dominated

Coastal Scrub

Coastal scrub is dominated by shrub species, including California sagebrush (*Artemisia californica*) and coyotebrush. Subdominant shrubs include coffeeberry (*Frangula californica*), sticky monkey flower, western bracken fern, and silver bush lupine (*Lupinus albifrons* var. *albifrons*). Understory species include various annual grasses. Emergent trees may be present at low cover. Some areas mapped as coastal scrub consists of less complex communities dominated by coyotebrush, or a mix of coyotebrush and poison oak. French broom is occasionally a component of this community. These coyotebrush-dominated habitats may have been grassland habitats in the past (McBride and Heady 1968). The coyotebrush-dominated community generally supports fewer wildlife species, possibly due to lower plant diversity and simpler habitat structure (LSA 2009). This habitat is typically found on slopes, and large areas are found in Grizzly Peak Open Space, Joaquin Miller Park, Knowland Park, and Sheffield Village Open Space, with smaller areas in other portions of the Plan Area.

Birds associated with this habitat include California Towhee (*Melospiza crissalis*), California Quail (*Callipepla californica*), Wrentit (*Chamaea fasciata*), Anna's Hummingbird (*Calypte anna*), Allen's Hummingbird (*Selasphorus sasin*), Western Scrub-jay, Bewick's wren (*Thryomanes bewickii*), and Spotted Towhee (*Pipilo maculatus*). Fence lizards and southern alligator lizard (*Elgaria multicarinata*) may also be found in this habitat. Mammals typical of this habitat include deer mouse (*Peromyscus maniculatus*), brush rabbit (*Sylvilagus bachmani*), gray fox (*Urocyon cinereoargenteus*), coyote, and mountain lion (*Puma concolor*) (LSA 2009). Coastal scrub provides suitable habitat for the federally threatened Alameda whipsnake (*Masticophis lateralis euryxanthus*).

Chamise-Redshank Chaparral

In the Plan Area, this habitat is dominated by chamise (*Adenostoma fasciculatum*) and typically found on dry, south-facing slopes in Knowland Park. There is little to no canopy cover in this habitat, and shrubs may be very dense. Other common species in this habitat include sticky monkey flower, coyotebrush, poison oak, and soap plant (*Chlorogalum pomeridianum*). Wildlife use of this habitat is similar to Coastal Scrub, described above. This habitat is highly adapted to fire, and its structure is influenced by fire.

3.1.3 Herbaceous

Annual Grassland

Non-native annual grasses such as barleys (*Hordeum* spp.), bromes (*Bromus* spp.), wild oats, brome fescue (*Festuca bromoides*), and others dominate this community. Non-native perennial grasses in this community include Italian rye grass (*Festuca perennis*). Native grass species such as purple needlegrass are present at low cover in some areas mapped as annual grassland.

This habitat supports a variety of native forbs, including California poppy (*Eschscholzia californica*), blue-eyed grass (*Sisyrinchium bellum*), annual lupine (*Lupinus bicolor*), dwarf owl's clover (*Triphysaria pusilla*), and purple owl's clover (*Castilleja exserta*). Non-native forbs present in this community include field mustard (*Brassica rapa*), wild radish (*Raphanus sativus*), yellow star thistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), filarees (*Erodium* spp.) and milk thistle (*Silybum marianum*).

A variety of wildlife species use annual grasslands for breeding and/or foraging. Reptiles that breed in annual grassland habitats include western fence lizard and common garter snake (Kie 1988). Mammals typical of this habitat include California ground squirrel, Botta's pocket gopher, western harvest mouse, California vole, and coyote (Kie 1988). Annual grasslands provide foraging habitat for raptors, including Barn Owl (*Tyto alba*), Great Horned Owl, Red-tailed Hawk, and American Kestrel (*Falco sparverius*).

Perennial Grassland

This habitat is found scattered within the more common annual grassland community. These relic stands are remnants of the native perennial grasslands that were more prevalent prior to the introduction of non-native annual grasses to California (Stromberg and Griffen 1996). Native perennial grasses such as purple needlegrass, foothill needlegrass (*Stipa lepida*), and blue wildrye (*Elymus glaucus*) are characteristic species in this habitat. Non-native annual

grasses including barleys, bromes, wild oats, and others are also common in this habitat type. The forb and wildlife communities are similar to those described for annual grassland.

This habitat is found in a few locations, such as Knowland Park (EBCNPS 2010).

3.1.4 Developed/Landscaped

Urban/Developed

This habitat includes paved and unpaved roads, buildings, median strips, lawns, yards, and landscaped parks. This habitat type consists of a mosaic of different vegetation types (McBride and Reid 1988). The majority of Urban/Developed habitat within the Plan Area may also be classified as being within the “urban residential zone” or “suburban zone” (McBride and Reid 1988). Species composition and vegetative cover in this habitat varies. A variety of bird species may use this habitat, including Mourning Dove, Anna’s Hummingbird, American Robin (*Turdus migratorius*), Scrub Jay, Northern Mockingbird (*Mimus polyglottos*), House Finch (*Haemorhous mexicanus*), Wrentits, Bushtits, and Oak Titmouse (McBride and Reid 1988). Common wildlife in these areas includes raccoon, opossum, and striped skunk (McBride and Reid 1988). Mule deer may also be found in this habitat.

3.2 Aquatic and Wetland Habitats

3.2.1 Riverine

Riverine habitat in the Plan Area includes perennial, intermittent, and ephemeral streams. Perennial streams flow year round, while intermittent streams dry down seasonally, and ephemeral streams only flow for a short period. These streams provide a water source for wildlife, as well as important habitat for aquatic species including amphibians and fish. California newt occurs in this habitat. Rainbow trout (*Oncorhynchus mykiss*) are known to occur in perennial streams in the Plan Area, including Sausal, Palo Seco, and Shepard Creeks (Laurel Marcus and Associates et al. 2010).

3.2.2 Freshwater Emergent Wetland

A small emergent wetland is located within Joaquin Miller Park in the northeastern portion of the park between the Fern Creek trail and Skyline Boulevard. This wetland is dominated by California blackberry and rushes (*Juncus* spp.). A second small emergent wetland is located within Knowland Park and is dominated by rushes and sedges. Freshwater emergent wetlands provide food, water, and cover for many bird species, and are among the most productive wildlife habitats in California (Kramer 1988).

4.0 Biological Resources by Parcel Type and Topography

The Plan Area encompasses a large area with various types of parcels and topographic features including urban and residential parcels, canyon areas, ridgetops, City parks and open spaces, and roadside clearance areas. While Section 3 summarizes habitat types present throughout the Plan Area, the following section generally describes the types of habitats

present on these various types of parcels. The range of vegetation and habitat types on a parcel reflect many site conditions including the site's position in the watershed, physiographic setting, slope aspect, underlying geology and soil, soil moisture, and past land uses. Figure 3 shows the Plan Area divided into parcel types.

4.1 Urban and Residential Parcels

Urban and residential parcels contain a variety of habitat types (Figure 2). These parcels are generally much smaller than other parcel types, but still may contain valuable plant and animal resources, especially if they are located in proximity to larger undeveloped parcels.

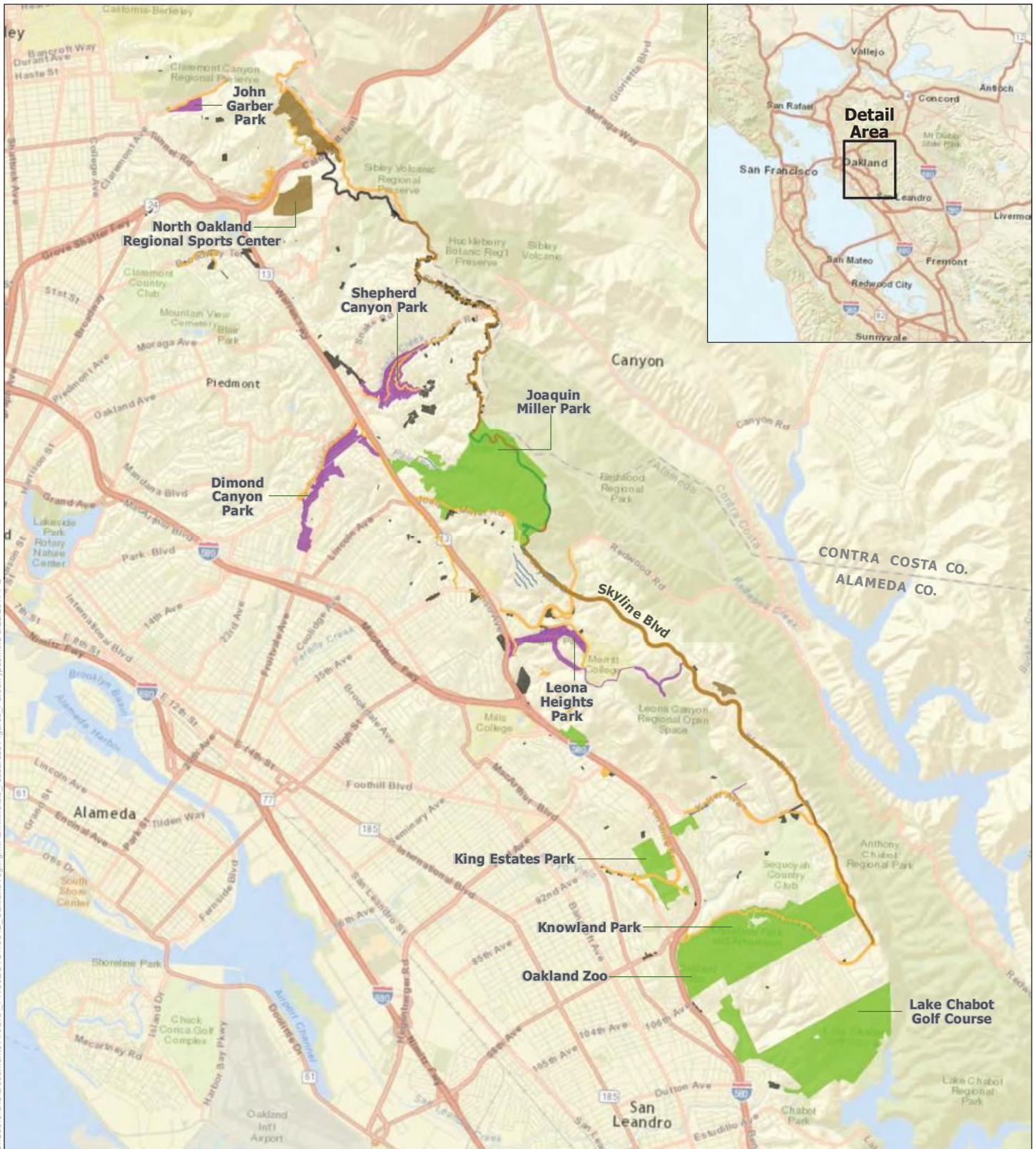
4.2 Canyon Areas

4.2.1 Garber Park

This park is dominated by coast live oak and bay laurel, with big leaf maple and California buckeye subdominant (Figure 2, Sheet 1). The volunteer group Garber Park Stewards has conducted regular restoration activities within the park to remove invasive species and restore native habitat. This park contains a diverse community of native plant species.

4.2.2 Dimond Canyon Park

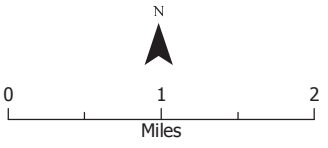
Dimond Canyon Park is dominated by a mix of coast live oak and bay laurel (Figure 2, Sheet 2). A narrow band of riparian habitat follows Sausal Creek in the lower portion of park, but was too narrow to map. At the southern end of Dimond Canyon Park is developed urban habitat, with structures, lawn, oak trees, and a California native plant demonstration garden. The golf course to the north is also characterized as urban habitat. Redwoods become dominant in the portion of the park along Palo Seco Creek. The volunteer group Friends of Sausal Creek has conducted extensive restoration activities within the park since 1996, including channel restoration in Sausal Creek and trail construction and maintenance (Laurel Marcus and Associates et al. 2010).



C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\resources\Figures3_ParcelTypes.mxd 9/28/2017 PG

BaseMap Sources: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

**Figure 3
Parcel Types**



- Urban/Residential
- Median
- Canyon
- Priority Roadside
- Parks/Open Space
- Ridgetop



Sources: City of Oakland; County of Alameda

City of Oakland
Vegetation Management Plan
Biological Resources Report

4.2.3 Shepherd Canyon Park and Montclair Railroad Trail

Shepard Canyon Park contains a developed area with sports fields near Shepard Canyon Road (Figure 2, Sheet 2). Outside of the developed area, the park is dominated by coast oak woodland, with patchy areas of Monterey Pine and Cypress, annual grassland, and eucalyptus. Eucalyptus is dominant in the western portion of the Montclair Railroad Trail, and patches of broom are also common. Coast live oak becomes dominant in the northeastern portion of the trail.

4.2.4 Leona Heights Park

A redwood forest community dominates the portion of Leona Heights Park along the stream. Further upslope, coast live oak becomes dominant. Broom is sporadically common along the trails within the oak-dominated habitat. Coastal scrub and annual grassland characterize the eastern portion of the park on more exposed south-facing slopes.

4.3 Ridgetop Areas

4.3.1 North Oakland Regional Sports Field

The northern portion of the North Oakland Regional Sports Field is dominated by a eucalyptus forest. The understory of this forest is mainly broom, especially in the most northern portion of the site. Scattered coast live oak and bay laurel are present within the eucalyptus forest.

The center of the North Oakland Regional Sports Field consists of urban/developed habitat, including sports fields and a fire road. A small area of riparian habitat is located along a stream. The southern portion of the site consists of coast oak woodland, with a small patch of coastal scrub, both along north-facing slopes.

4.3.2 Grizzly Peak Open Space

Grizzly Peak Open Space is dominated by two habitats. Coastal scrub is the dominant habitat in the northern and central portions of this area mainly on south- and southeastern-facing slopes, while a Monterey pine community is dominant in the southern and central portions of the area, often on northwestern-facing slopes. The Monterey pine community has an open canopy, and the species composition of the understory in this community is similar to the coastal scrub habitat. Dominant shrubs include coyotebush and sticky monkeyflower. Compared to earlier mapping efforts in this area (FEMA 2014), the extent of Monterey pine appears to have expanded. A portion of the southern part of the Grizzly Peak Open Space is characterized by a eucalyptus forest community.

4.3.3 City Stables

Habitat at the City Stables is characterized as urban, with the majority of the site being developed.

4.4 City Park Lands and Open Space

4.4.1 Sheffield Village Open Space

Sheffield Village Open Space is dominated by coast oak woodland and coastal scrub habitats, with patches of annual grassland present on some south- and west-facing slopes. The coastal scrub habitat is dominated by coyote brush in areas adjacent to the Lake Chabot Golf Course, but is generally more diverse in areas towards the center of the open space.

4.4.2 Knowland Park

Knowland Park is the largest of the open space areas in the Plan, covering approximately 470 acres. It contains a diverse assemblage of habitats, and has been identified as a Botanical Protection Priority Area by the East Bay Chapter of the California Native Plant Society (Bartosh et al. 2010). It also contains the developed habitat of the Oakland Zoo, which has recently expanded. Coast oak woodlands dominate the northeastern portions of the park, as well as drainages throughout the park. Both coastal scrub and chamise scrub are present in the park, generally along south-facing slopes but also on some north-facing slopes. Coastal scrub in the eastern portion of the park is generally a simple assemblage of coyote brush and poison oak. This same species assemblage is also found in some of the coastal scrub community mapped south of Golf Links Road. Smaller patches of coastal scrub contain a more diverse mix of shrub species, including California sagebrush and lupines. Annual grasslands dominate the southern and central portions of the park typically on south-facing slopes, with islands of perennial grasslands. Perennial grasslands in the park are dominated by purple needlegrass. Other native grass species present include blue wildrye, California oatgrass, and California brome (*Bromus carinatus*).

4.4.3 Joaquin Miller Park

Redwood forest covers the majority of the eastern portion of Joaquin Miller Park. Coast oak woodland is dominant along drainages in the eastern and northern portions of the park. The southwestern portion of the park is landscaped, and contains buildings and other developed spaces, including Woodminister Amphitheater, the dog play areas, the ranger station, and the community center. Stands of Monterey pine and Monterey cypress are scattered throughout the park, with a large stand west of the Sequoia horse arena. A large stand of eucalyptus is found at the western edge of the park, near Castle Drive. Small areas of coastal scrub can be found, generally on south-facing slopes.

Serpentine soils are located in the southernmost portion of the park, near the intersection of Skyline Boulevard and Joaquin Miller Road. These soils support occurrences of special-status plant species such as the Presidio clarkia (*Clarkia franciscana*) and Tiburon buckwheat (*Eriogonum luteolum* var. *caninum*).

4.4.4 King Estates

King Estates is dominated by annual grassland, with coast oak woodland present in drainages. Coastal scrub dominated by coyotebrush is also present on slopes in some portions of King Estates.

4.5 Roadside Clearance Areas

Roadside clearance areas are located throughout the Plan Area, and contain a variety of habitats described above. These areas generally provide limited habitat for wildlife, due to their proximity to roadways.

5.0 Special-Status Species

5.1 Definitions and Methods of Assessment

Special-status plant and wildlife species refer to those species that meet one or more of the following criteria:

- Species that are listed as threatened or endangered under the federal Endangered Species Act (ESA) (50 CFR 17.12 for listed plants, 50 CFR 17.11 for listed animals);
- Species that are candidates for possible future listing as threatened or endangered under ESA (76 FR 66370);
- Species that are listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (CESA) (14 CCR 670.5);
- Plants listed as rare under the California Native Plant Protection Act of 1977 (Fish & G. Code, § 1900 et seq.);
- California Rare Plant Rank (CRPR) List 1,2, 3, and 4 species;
- Species that meet the definitions of rare or endangered under California Environmental Quality Act (CEQA) (CEQA Guidelines, § 15380), as determined by the City; or
- Animals fully protected in California (Fish & G. Code, § 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]).

These species have been identified as warranting some level of protection from human impacts. The following terms are used by state and federal agencies to designate special-status species:

Federal endangered (FE): species designated as endangered under ESA. A FE species is one that is in danger of extinction throughout all or a significant portion of its range. Under the ESA, it is illegal for any person, private entity, or government agency to take endangered species without federal authorization. Take of most threatened species is similarly prohibited. *Take* is defined to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct. *Harm* is defined to mean an act that actually kills or injures fish or wildlife. Take may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. The incidental take of listed species can be authorized under Section 7 or Section 10 of the ESA.

State endangered (SE): species designated as endangered under CESA. These include native species or subspecies that are in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (CESA § 2062). Take of any state

endangered species is prohibited, except as authorized by the Fish and Game Code. *Take* is defined specifically in the Fish and Game Code to mean "hunt, pursue, catch, capture, or kill," or an attempt to do any such act.

Federal threatened (FT): species designated as threatened under ESA. A FT species is one that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. At the discretion of USFWS or NMFS, incidental take of any individual of an FT species may be prohibited or restricted.

State threatened (ST): species designated as threatened under CESA. These include native species or subspecies that, although not presently threatened with extinction, are likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts (CESA § 2067). Take, as defined by Fish and Game Code Section 86, of any state endangered species is prohibited, except as authorized by the Fish and Game Code.

State Fully protected (SFP): FP species may not be taken at any time unless authorized by CDFW for necessary scientific research, which cannot include actions for project mitigation. While some species included under these statutes are also listed as threatened, endangered or Species of Special Concern, others are not.

State Species of Special Concern (SSC): a species, subspecies, or distinct population of a vertebrate animal native to California that has been determined by CDFW to warrant protection and management intended to reduce the need to give the species formal protection as an SE, or ST species. "Species of special concern" is an administrative designation and carries no formal legal status. Generally, Species of Special Concern should be included in a CEQA environmental analysis if they can be shown to meet the criteria of sensitivity outlined in Section 15380 of the CEQA Guidelines. However, some older lists of Species of Special Concern were not developed using criteria relevant to CEQA and the information used in generating those lists is out of date. Therefore, the current circumstances of each unlisted Species of Special Concern must be considered against those criteria and not automatically assumed to be rare, threatened or endangered.

CRPR 1, 2, 3 and 4 species: CRPR lists are jointly managed by CDFW and the California Native Plant Society (CNPS). Rank 1A plants are presumed extinct in California. Rank 1B plants are considered rare, threatened, or endangered in California and elsewhere. Ranks 2A plants are presumed extirpated in California but common elsewhere. Rank 2B plants are rare, threatened, or endangered in California, but more common elsewhere. Rank 3 plants are plants about which more information is needed. Rank 4 plants have limited distribution and this is considered a watch list. All of the plants constituting CRPR 1-3 meet the definitions of CESA and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA. Some of the plants constituting CRPR 4 meet the definitions of the CESA, and few, if any, are eligible for state listing. However, many of them are significant locally, and CNPS strongly recommends that Rank 4 plants be evaluated in CEQA documents.

Background information on special-status plant and wildlife species with potential to occur in the Plan Area was compiled in the background data review (See Section 2.1).

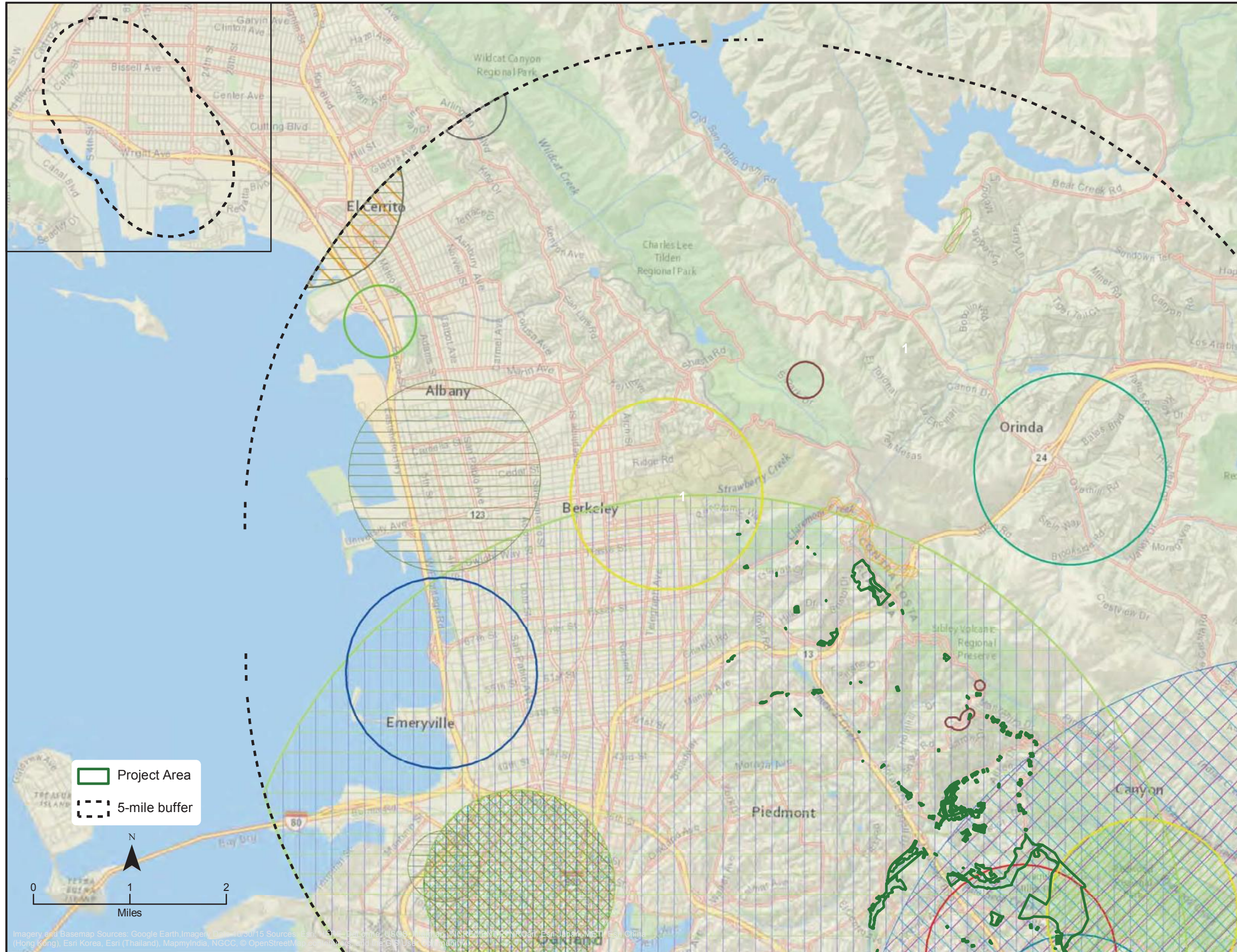
Tables 2 and 3 list the special-status plant and wildlife species with potential to occur in the Plan Area, Appendix D contains photographs of these species, and Figures 4, 5 and 6 show the CNDDDB occurrences of special-status plants and animals within a 5-mile radius of the Plan Area. Special-status plants have been divided into pre-and post-1970 occurrences. Appendix A contains information on special-status species with “none” or “not expected” potentials to occur. Appendix A also contains a list of A-Ranked Unusual Plant Species of Alameda and Contra Costa Counties as defined by the Easy Bay CNPS that are known to occur in the Plan Area. A-ranked plant species occur in five or fewer regions in Alameda and Contra Costa Counties.

The potential for special-status species to occur in the vicinity of the Plan Area was evaluated according to the following criteria:

- **None:** indicates that the area contains a complete lack of suitable habitat, the local range for the species is restricted, and/or the species is extirpated in this region.
- **Not Expected:** indicates situations where suitable habitat or key habitat elements may be present but may be of poor quality or isolated from the nearest extant occurrences. Habitat suitability refers to factors such as elevation, soil chemistry and type, vegetation communities, microhabitats, and degraded/significantly altered habitats.
- **Possible:** indicates the presence of suitable habitat or key habitat elements that potentially support the species.
- **Present:** indicates the species was either observed directly or its presence was confirmed by diagnostic signs during field investigations or in previous studies in the area.

5.2 Special-status Plants

Special-status plants known to occur in the Plan Area include pallid manzanita (*Arctostaphylos pallida*), Oakland star-tulip (*Calochortus umbellatus*), Presidio clarkia (*Clarkia franciscana*), western leatherwood (*Dirca occidentalis*), Tiburon buckwheat (*Eriogonum luteolum* var. *caninum*) and bristly leptosiphon (*Leptosiphon acicularis*). Several other special-status plants have the potential to occur within the Plan Area but have not been documented (Table 2).



- Special-Status Plant Species**
 Source: CNDDDB February 2017 update
- California seablite
 - Choris' popcornflower
 - Diablo helianthella
 - Jepson's coyote-thistle
 - Loma Prieta hoita
 - Marin knotweed
 - San Francisco Bay spineflower
 - San Joaquin spearscale
 - Santa Clara red ribbons
 - Santa Cruz tarplant
 - alkali milk-vetch
 - bent-flowered fiddleneck
 - dark-eyed gilia
 - fragrant fritillary
 - most beautiful jewelflower
 - oval-leaved viburnum
 - round-leaved filaree
 - saline clover
 - western leatherwood
 - woodland woollythreads

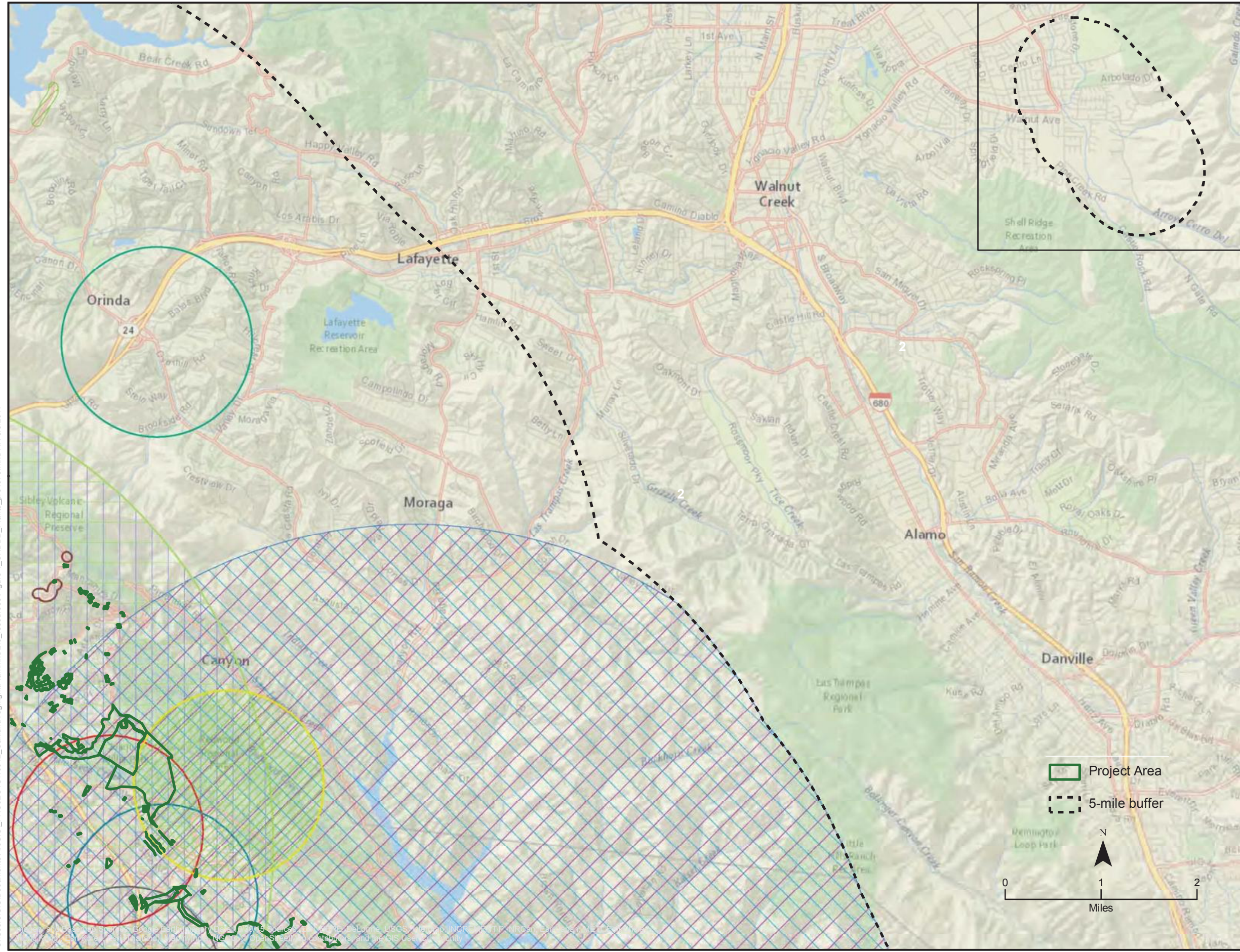
Project Area
 5-mile buffer



Figure 4
Sheet 1 of 4
Pre-1970 Special-status Plant Species Occurrences in the Vicinity of the Plan Area

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\resources\Figure 4_CNDDDB_Plants_pre1970.mxd RH 8/8/2017

Imagery and Basemap Sources: Google Earth Imagery, © 2015 Sources: Esri, DeLorme, USGS, Imagery, NRC, Mapbox, Aero, Esri, Japan, Microsoft, (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



- Special-Status Plant Species**
 Source: CNDDB February 2017 update
- Diablo helianthella
 - Jepson's coyote-thistle
 - Loma Prieta hoita
 - Marin knotweed
 - Santa Clara red ribbons
 - bent-flowered fiddleneck
 - dark-eyed gilia
 - fragrant fritillary
 - round-leaved filaree
 - western leatherwood
 - woodland woollythreads

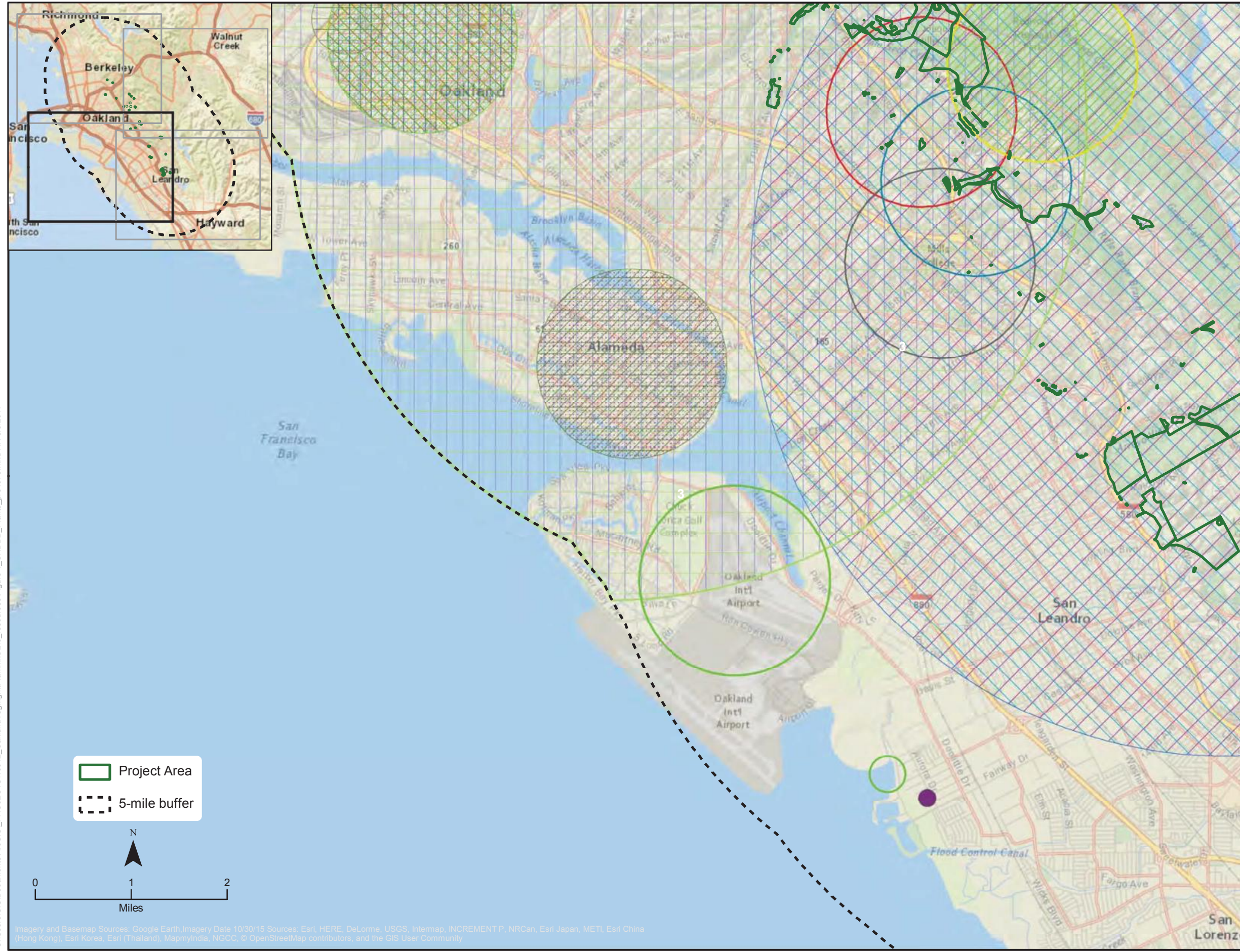
Project Area
 5-mile buffer



Figure 4
Sheet 2 of 4

Pre-1970 Special-status Plant Species Occurrences in the Vicinity of the Plan Area

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 4_CNDDB_Plants_pre1970.mxd RH 8/8/2017



- Special-Status Plant Species**
 Source: CNDDB February 2017 update
- California seablite
 - Choris' popcornflower
 - Congdon's tarplant
 - Diablo helianthella
 - Loma Prieta hoita
 - Marin knotweed
 - San Francisco Bay spineflower
 - San Joaquin spearscale
 - Santa Clara red ribbons
 - adobe sanicle
 - bent-flowered fiddleneck
 - dark-eyed gilia
 - fragrant fritillary
 - oval-leaved viburnum
 - robust spineflower
 - round-leaved filaree
 - saline clover
 - woodland woollythreads

Project Area
 5-mile buffer

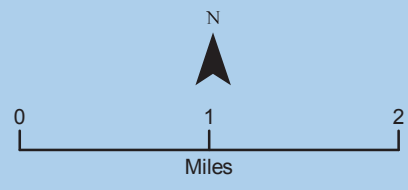


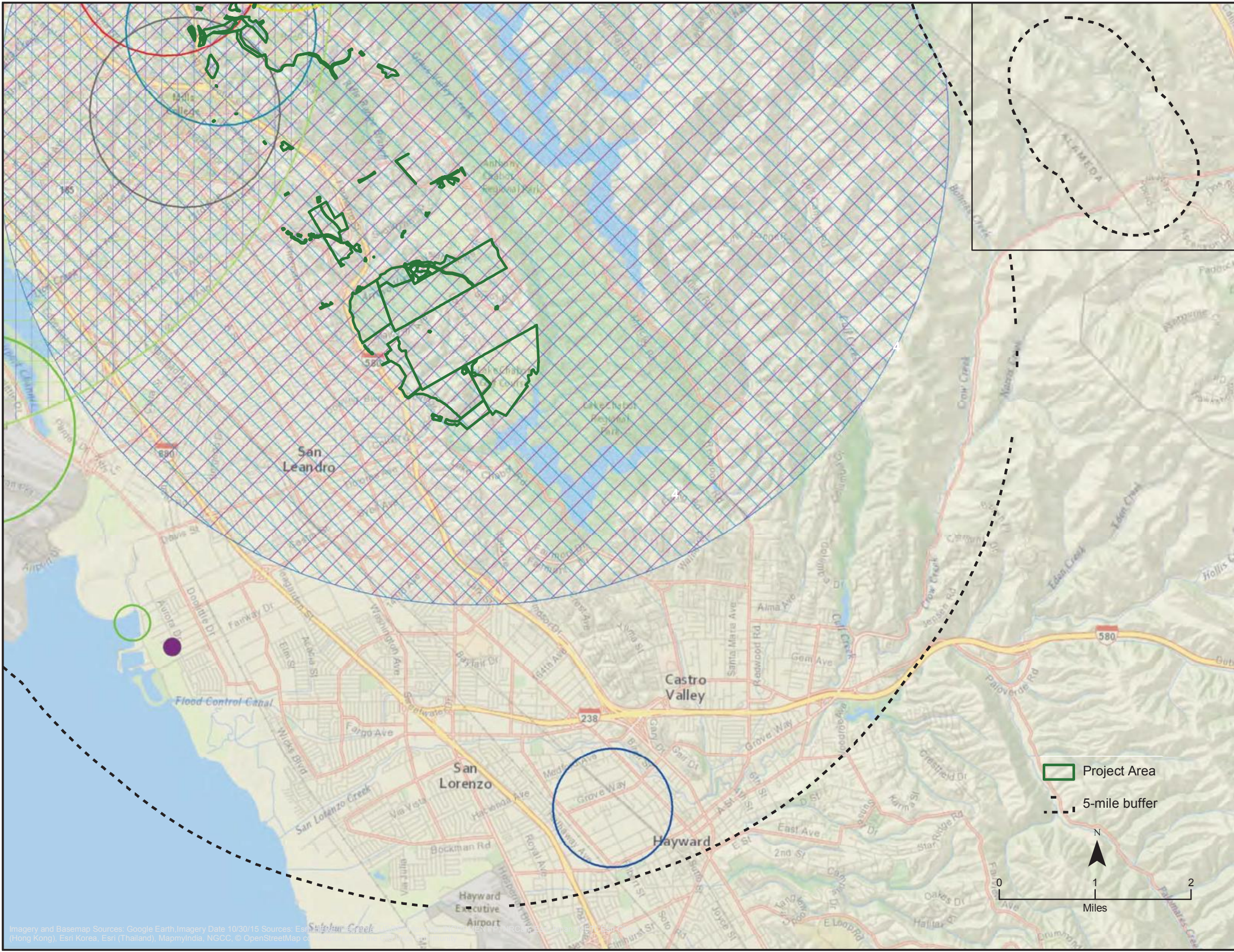
Figure 4
Sheet 3 of 4

Pre-1970 Special-status Plant Species Occurrences in the Vicinity of the Plan Area

City of Oakland
 Vegetation Management Plan
 Biological Resources Report

Imagery and Basemap Sources: Google Earth, Imagery Date 10/30/15 Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 4_CNDDB_Plants_pre1970.mxd RH 8/8/2017



- Special-Status Plant Species**
 Source: CNDDDB February 2017 update
- California seablite
 - Congdon's tarplant
 - Diablo helianthella
 - Loma Prieta hoita
 - Marin knotweed
 - Santa Clara red ribbons
 - Santa Cruz tarplant
 - bent-flowered fiddleneck
 - dark-eyed gilia
 - fragrant fritillary
 - round-leaved filaree
 - woodland woollythreads

Project Area

5-mile buffer

N

0 1 2
Miles

Figure 4
Sheet 4 of 4

Pre-1970 Special-status Plant Species Occurrences in the Vicinity of the Plan Area

C:\Users\GIS\Documents\ArcGIS\PROJECTS\116042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 4_CNDDDB_Plants_pre1970.mxd RH 8/8/2017

Imagery and Basemap Sources: Google Earth, Imagery Date: 10/30/15 Sources: Esri (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors

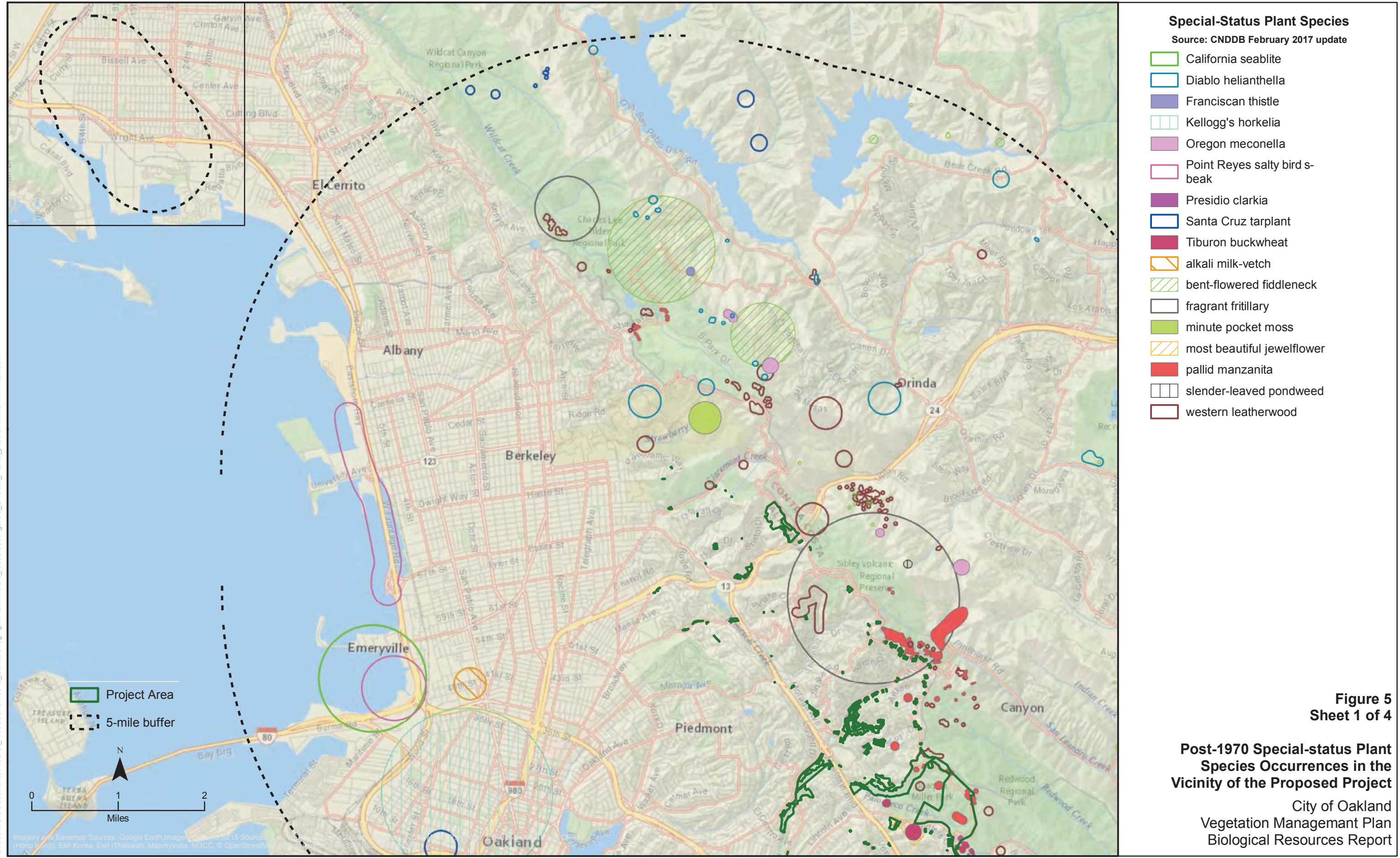


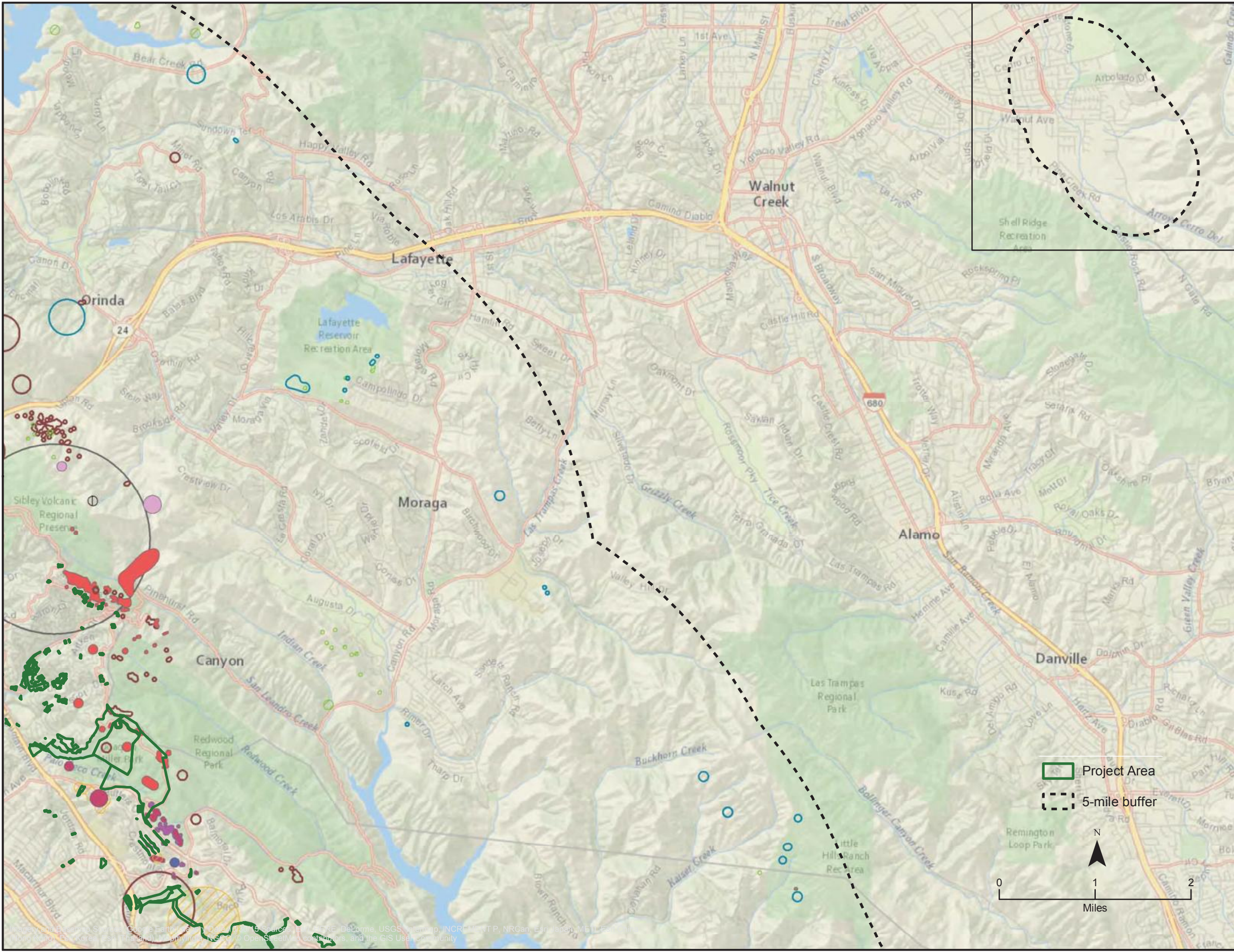
Figure 5
Sheet 1 of 4

Post-1970 Special-status Plant Species Occurrences in the Vicinity of the Proposed Project

City of Oakland
Vegetation Management Plan
Biological Resources Report

C:\Users\GIS\Documents\GIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 5_CNDDDB_Plants_post1970.mxd RH 11/27/2017

Imagery and Basemap Sources: Google Earth, Imagery © 2015 Sources: Esri, DeLorme, USGS, AeroGRID, IGN, Esri, Intel (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



- Special-Status Plant Species**
 Source: CNDDDB February 2017 update
- Diablo helianthella
 - Mt. Diablo fairy-lantern
 - Oregon meconella
 - Presidio clarkia
 - San Francisco popcornflower
 - Tiburon buckwheat
 - bent-flowered fiddleneck
 - fragrant fritillary
 - most beautiful jewelflower
 - pallid manzanita
 - slender-leaved pondweed
 - western leatherwood

Project Area
 5-mile buffer



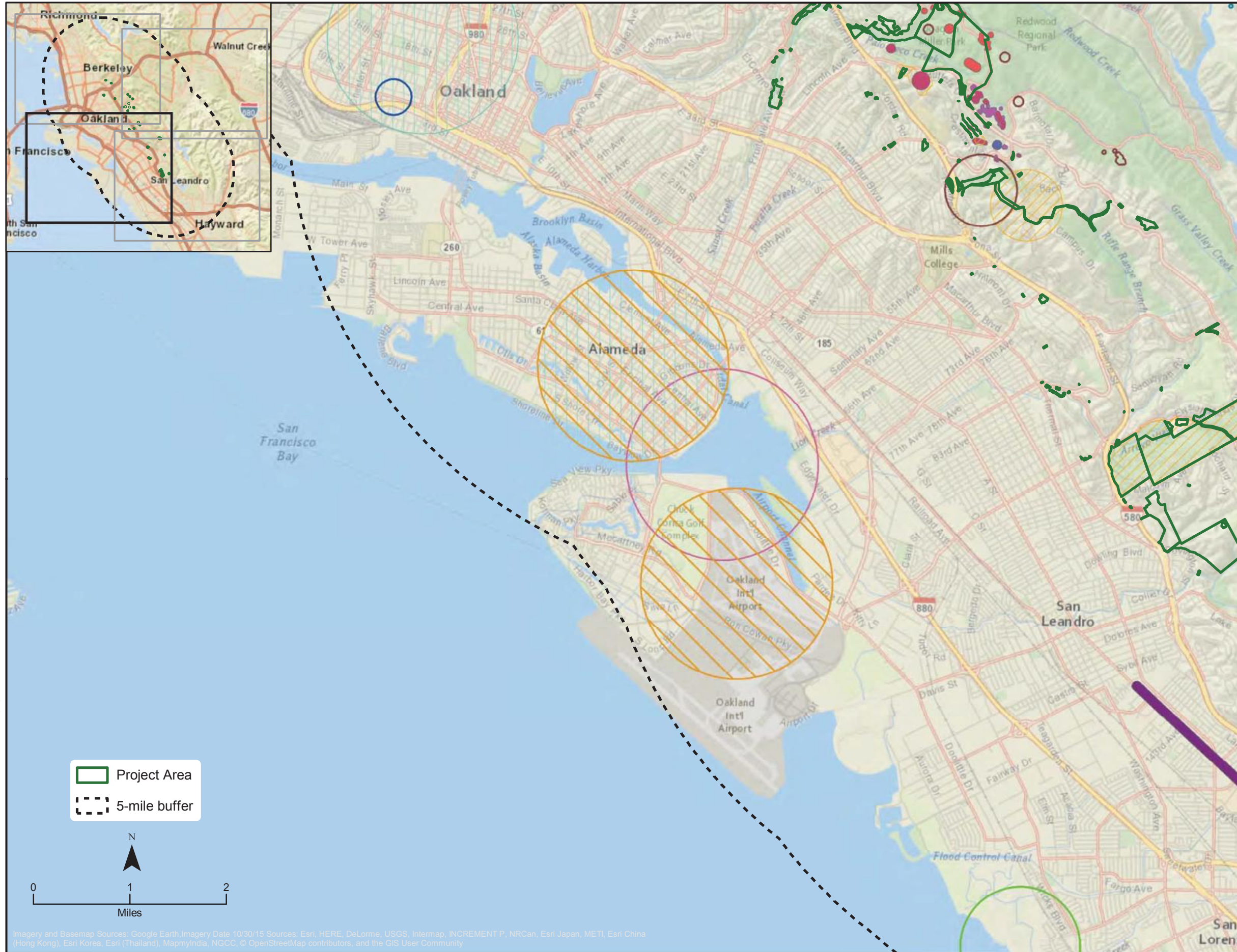
Figure 5
Sheet 2 of 4

Post-1970 Special-status Plant Species Occurrences in the Vicinity of the Proposed Project

City of Oakland
 Vegetation Management Plan
 Biological Resources Report

C:\Users\GISUser\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 5_CNDDDB_Plants_post1970.mxd RH 11/27/2017

Map data and base images from Google Earth, ArcGIS, and other sources. Data provided by CNDDDB, USGS, and other agencies. Map prepared by the City of Oakland.



- Special-Status Plant Species**
 Source: CNDDDB February 2017 update
- California seablite
 - Congdon's tarplant
 - Diablo helianthella
 - Kellogg's horkelia
 - Point Reyes salty bird s-beak
 - Presidio clarkia
 - San Francisco popcornflower
 - Santa Cruz tarplant
 - Tiburon buckwheat
 - alkali milk-vetch
 - big-scale balsamroot
 - most beautiful jewelflower
 - pallid manzanita
 - western leatherwood

Project Area
 5-mile buffer

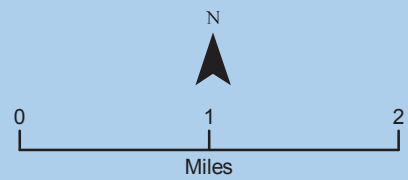
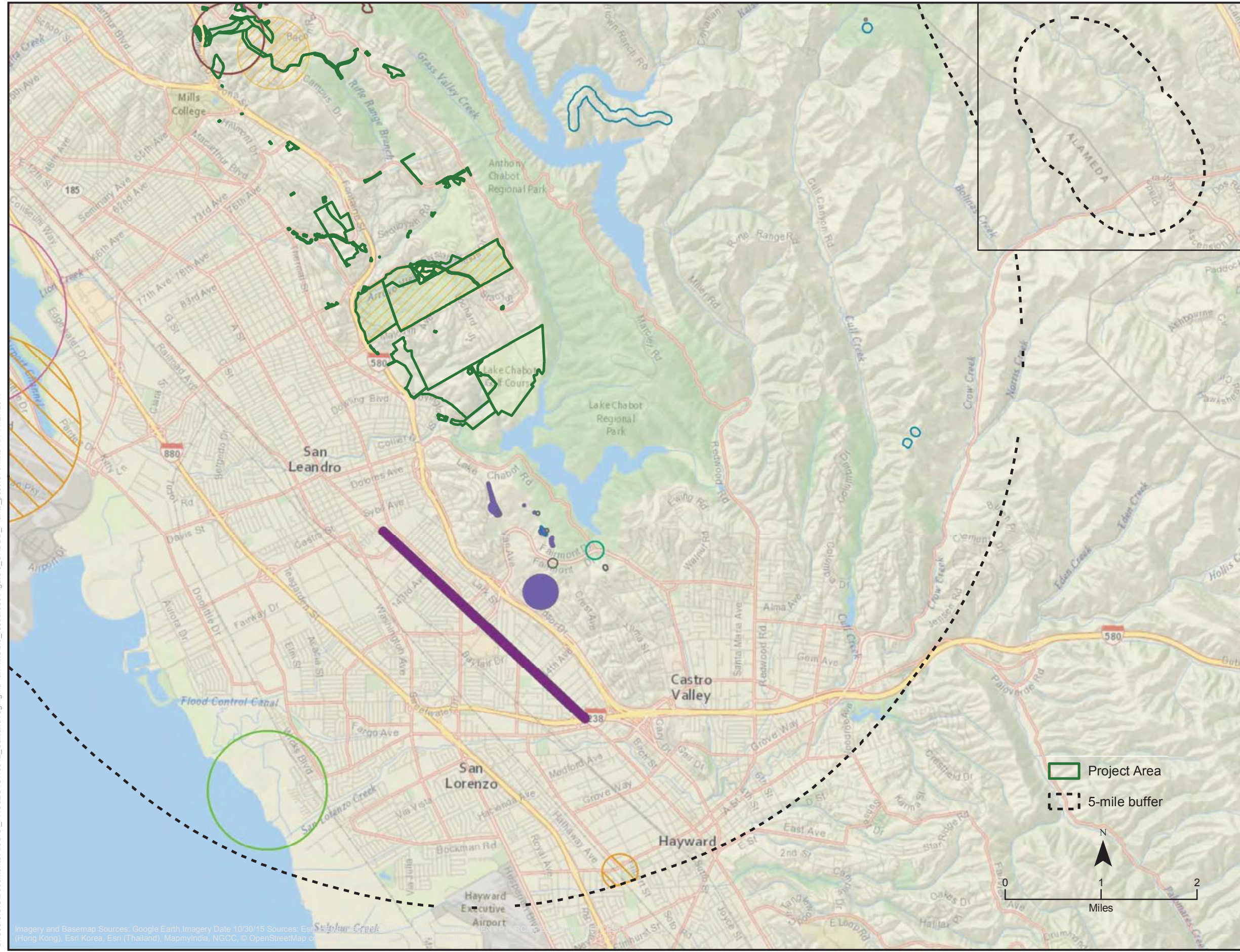


Figure 5
Sheet 3 of 4
Post-1970 Special-status Plant Species Occurrences in the Vicinity of the Proposed Project
 City of Oakland
 Vegetation Management Plan
 Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 5_CNDDDB_Plants_post1970.mxd RH 11/27/2017
 Imagery and Basemap Sources: Google Earth, Imagery Date 10/30/15 Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community



Special-Status Plant Species

Source: CNDDDB February 2017 update

- California seablite
- Congdon's tarplant
- Diablo helianthella
- Jepson's coyote-thistle
- Mt. Diablo fairy-lantern
- Point Reyes salty bird s-beak
- Presidio clarkia
- Tiburon buckwheat
- alkali milk-vetch
- bent-flowered fiddleneck
- big-scale balsamroot
- fragrant fritillary
- most beautiful jewelflower
- western leatherwood

Project Area
 5-mile buffer

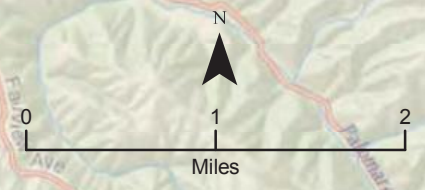
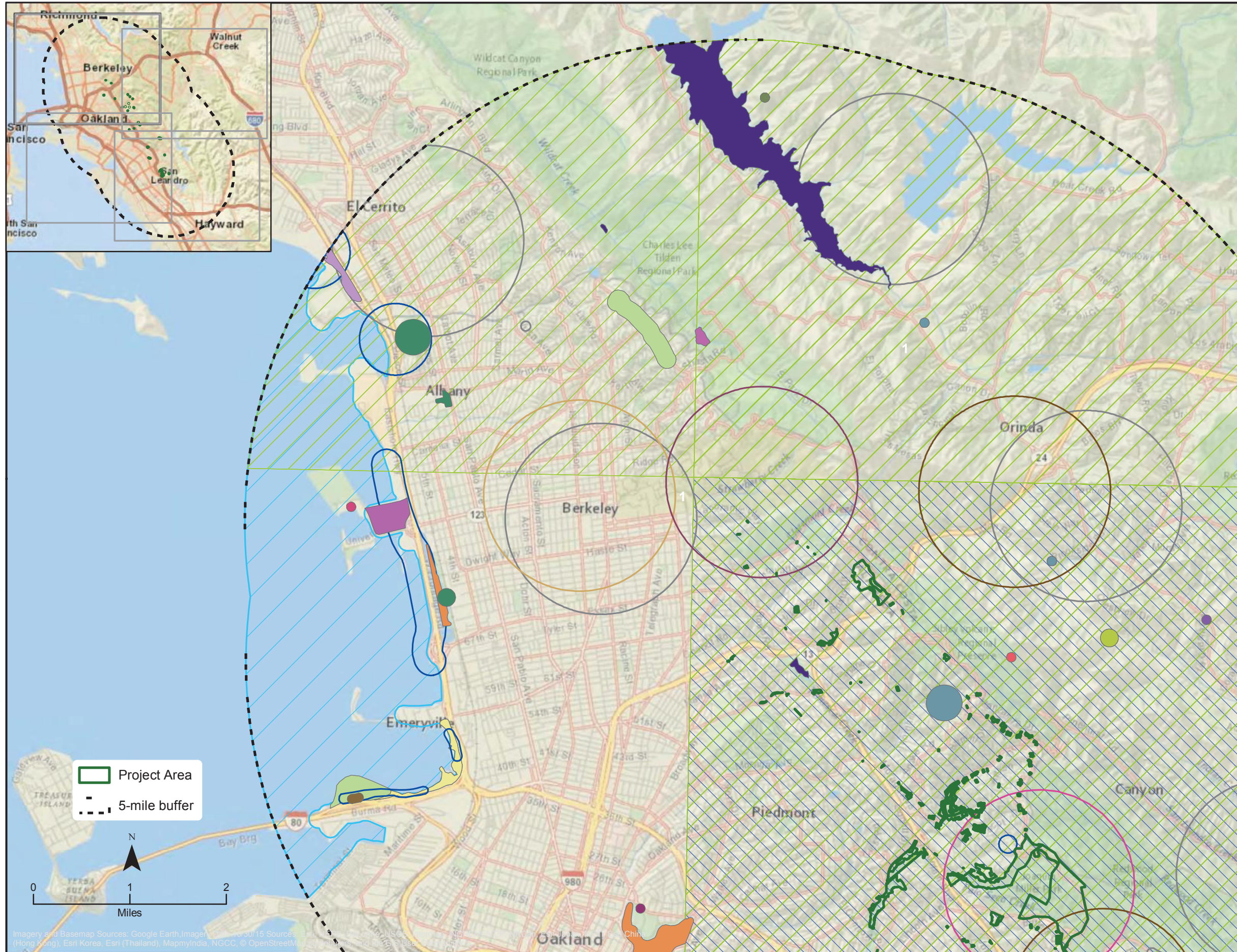


Figure 5
Sheet 4 of 4

Post-1970 Special-status Plant Species Occurrences in the Vicinity of the Proposed Project

City of Oakland
 Vegetation Management Plan
 Biological Resources Report

Imagery and Basemap Sources: Google Earth, Imagery Date 10/30/15 Sources: Esri (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors



Special-Status Animal Species

Source: CNDDDB February 2017 update

- Alameda song sparrow
- Alameda whipsnake
- American badger
- American peregrine falcon
- Bay checkerspot butterfly
- California black rail
- California clapper rail
- California red-legged frog
- Cooper's hawk
- Sacramento perch
- San Francisco dusky-footed woodrat
- Townsend's big-eared bat
- bald eagle
- big free-tailed bat
- foothill yellow-legged frog
- golden eagle
- longfin smelt
- monarch - California overwintering population
- northern harrier
- pallid bat
- salt-marsh harvest mouse
- saltmarsh common yellowthroat
- tidewater goby
- western pond turtle
- white-tailed kite

Note: Alameda whipsnake and American peregrine falcon are shown covering the entire USGS 7.5" quadrangle where the occurrence is located.

Figure 6
Sheet 1 of 4

Special-status Animal Species Occurrences in the Vicinity of the Plan Area
City of Oakland
Vegetation Management Plan
Biological Resources Report

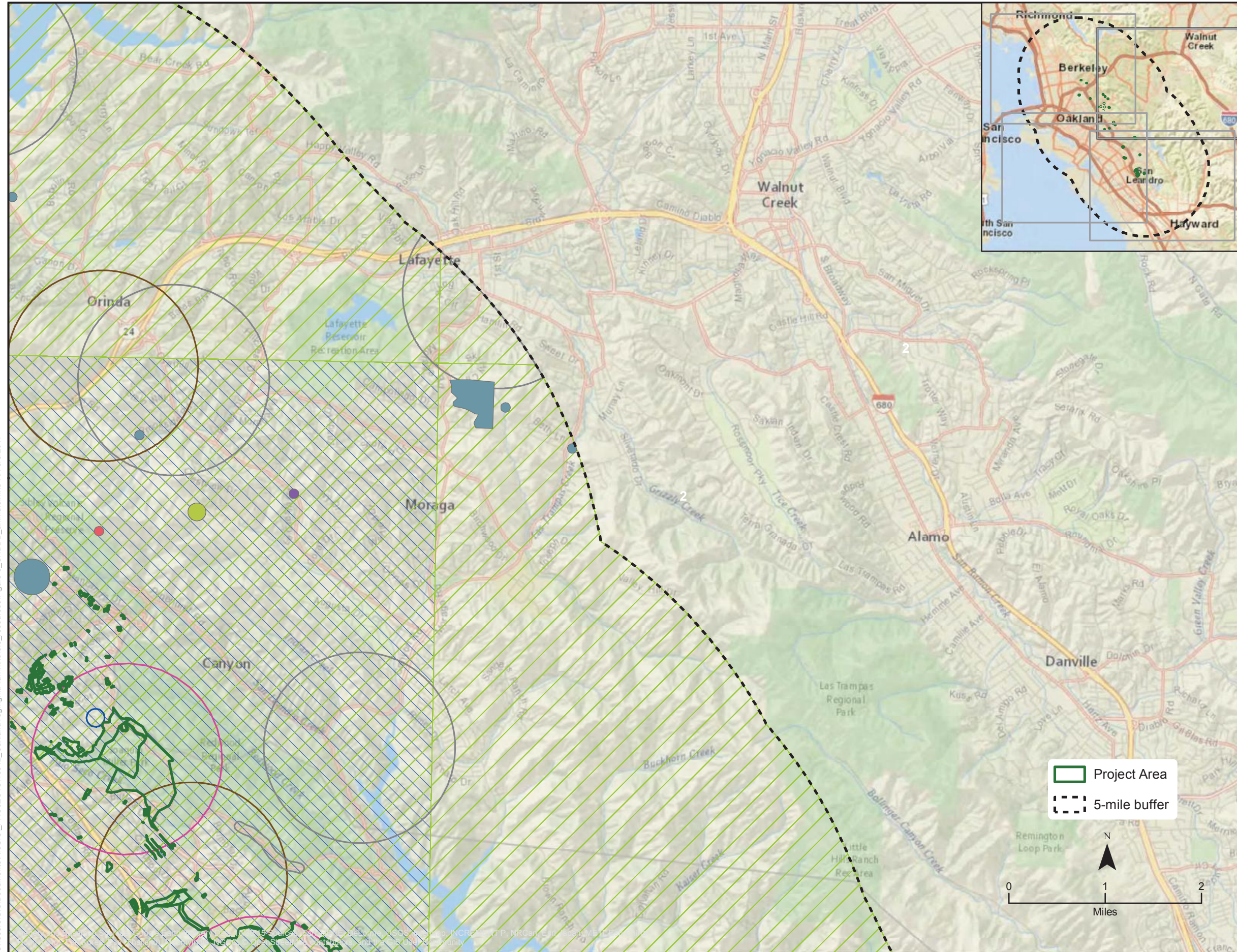
C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\resources\Figure 5_CNDDDB_animals.mxd RH 8/8/2017

Imagery and Basemap Sources: Google Earth Imagery © 2015 Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community











Project Area
 5-mile buffer



C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bio_resources\Figure 5_CNDDDB_animals.mxd RH 8/8/2017



Special-Status Animal Species
Source: CNDDDB February 2017 update

-  Alameda song sparrow
-  Alameda whipsnake
-  American badger
-  American peregrine falcon
-  Bay checkerspot butterfly
-  California red-legged frog
-  San Francisco dusky-footed woodrat
-  foothill yellow-legged frog
-  golden eagle
-  pallid bat

Note: Alameda whipsnake and American peregrine falcon are shown covering the entire USGS 7.5" quadrangle where the occurrence is located.



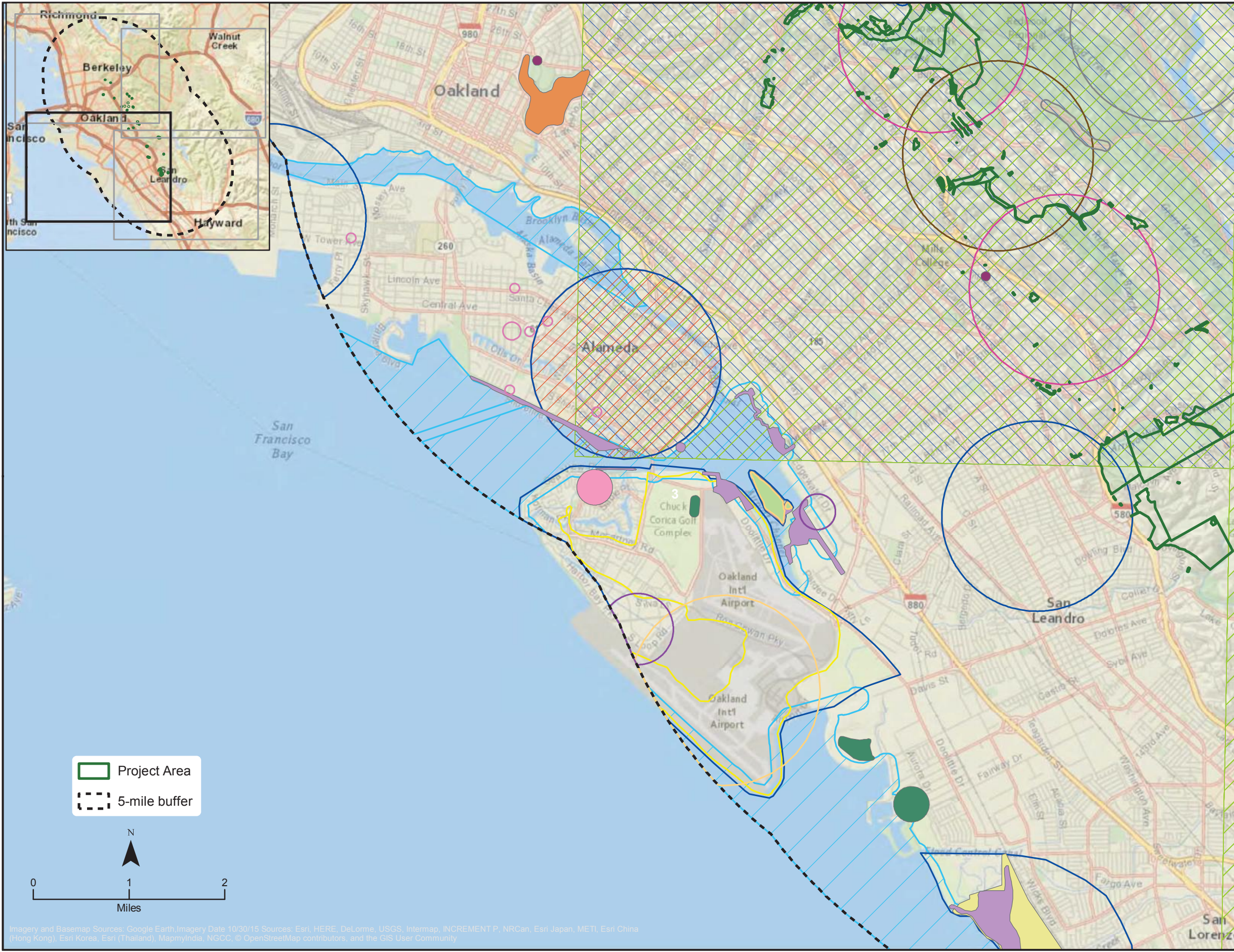
 Project Area
 5-mile buffer



Figure 6
Sheet 2 of 4

Special-status Animal Species Occurrences in the Vicinity of the Plan Area
City of Oakland
Vegetation Management Plan
Biological Resources Report



Special-Status Animal Species

Source: CNDDDB February 2017 update

- Alameda Island mole
- Alameda song sparrow
- Alameda whipsnake
- American badger
- American peregrine falcon
- Bay checkerspot butterfly
- California black rail
- California clapper rail
- California least tern
- California tiger salamander
- Cooper's hawk
- burrowing owl
- longfin smelt
- monarch - California overwintering population
- pallid bat
- salt-marsh harvest mouse
- salt-marsh wandering shrew
- saltmarsh common yellowthroat
- tidewater goby
- western snowy plover

Note: Alameda whipsnake and American peregrine falcon are shown covering the entire USGS 7.5" quadrangle where the occurrence is located.

Project Area
 5-mile buffer

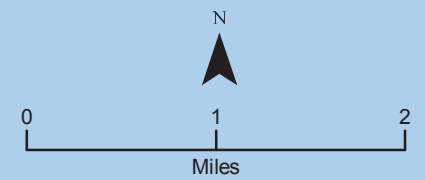
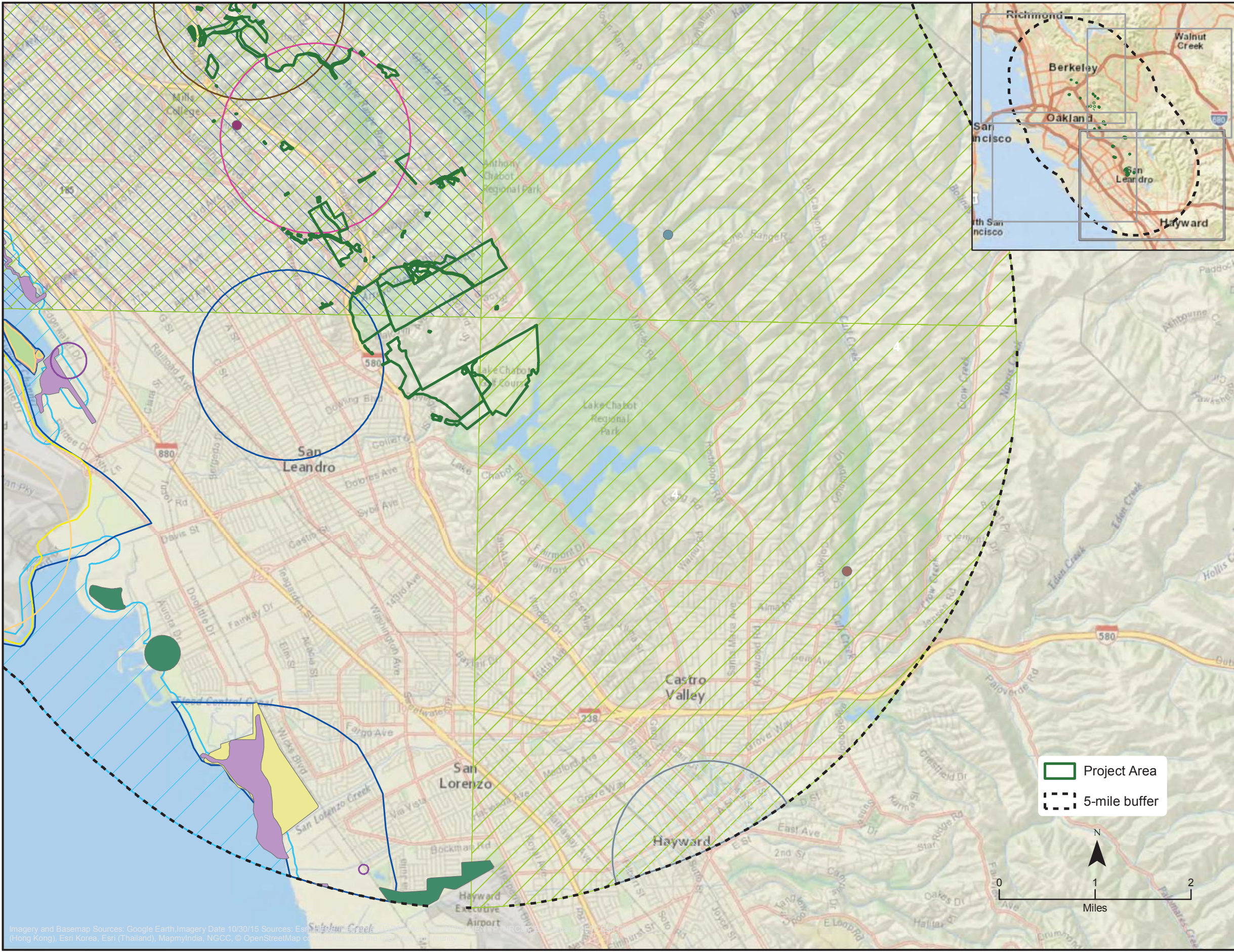


Figure 6
Sheet 3 of 4
Special-status Animal Species Occurrences in the Vicinity of the Plan Area
 City of Oakland
 Vegetation Management Plan
 Biological Resources Report



Special-Status Animal Species

Source: CNDDDB February 2017 update

- Alameda song sparrow
- Alameda whipsnake
- American badger
- American peregrine falcon
- Bay checkerspot butterfly
- California black rail
- California clapper rail
- California red-legged frog
- Cooper's hawk
- burrowing owl
- longfin smelt
- monarch - California overwintering population
- pallid bat
- salt-marsh harvest mouse
- salt-marsh wandering shrew
- saltmarsh common yellowthroat
- western mastiff bat
- western pond turtle
- western snowy plover
- yellow warbler

Note: Alameda whipsnake and American peregrine falcon are shown covering the entire USGS 7.5" quadrangle where the occurrence is located.

Project Area
 5-mile buffer



Figure 6
Sheet 4 of 4

Special-status Animal Species Occurrences in the Vicinity of the Plan Area
 City of Oakland
 Vegetation Management Plan
 Biological Resources Report

C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\resources\Figure 5_CNDDDB_animals.mxd RH 8/8/2017

Imagery and Basemap Sources: Google Earth Imagery Date: 10/30/15 Sources: Esri (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors

Table 2. Special Status Plants

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Amsinckia lunaris</i> bent-flowered fiddleneck	-/-/1B.2	Cismontane woodland, valley and foothill grassland, coastal bluff scrub. 3-795 meters. Blooms March through June.	Possible. Suitable habitat is present in the Plan Area including Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland)
<i>Androsace elongata</i> ssp. <i>acuta</i> California androsace	-/-/4.2	Chaparral, cismontane woodland, coastal sage scrub, valley and foothill grassland, meadows and seeps, pinyon and juniper woodland. Highly localized and often overlooked little plant. 150-1,200 meters. Blooms March through June.	Possible. Suitable habitat is present in the Plan Area, including Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland).
<i>Arctostaphylos pallida</i> pallid manzanita	FT/SE/1B.1	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub. Grows on uplifted marine terraces on siliceous shale or thin chert. May require fire. 180-460 meters. Blooms December through March.	Present. This species is present in Joaquin Miller Park, near Chabot Space and Science Center. Possible in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Kings Estates, Urban and residential parcels (with coast oak woodland or closed-cone pine-cypress habitats)
<i>Balsamorhiza macrolepis</i> big-scale balsamroot	-/-/1B.2	Chaparral, valley and foothill grassland, cismontane woodland. Sometimes on serpentine. 35-1,465 meters. Blooms March through June.	Possible. Suitable habitat is present in the Plan Area In Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or annual grassland)

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Blepharizonia plumosa</i> big tarplant	-/-/1B.1	Valley and foothill grassland. Dry hills and plains in annual grassland. Clay to clay-loam soils; usually on slopes and often in burned areas. 30-505 meters. Blooms July through October.	Possible. Suitable habitat is present in the Plan Area in Sheffield Village Open Space, Knowland Park, Kings Estates, Urban and residential parcels (with annual grassland).
<i>California macrophylla</i> round-leaved filaree	-/-/1B.2	Cismontane woodland, valley and foothill grassland. Clay soils. 15-1,200 meters. Blooms March through May.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or annual grassland).
<i>Calochortus umbellatus</i> Oakland star-tulip	-/-/4.2	Chaparral, lower montane coniferous forest, broadleafed upland forest, valley and foothill grassland, cismontane woodland. Often on serpentine. 100-700 meters. Blooms March through May.	Present. Suitable habitat is present in the Plan Area. Documented in Knowland Park (Placemakers 2011), Joaquin Miller Park, and Leona Heights Park. Possible in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Kings Estates, Urban and residential parcels (with coast oak woodland or annual grassland)
<i>Castilleja ambigua</i> var. <i>ambigua</i> johnny-nip	-/-/4.2	Coastal bluff scrub, coastal scrub, coastal prairie, marshes and swamps, valley and foothill grassland, vernal pool margins. 0-435 meters. Blooms March through August.	Possible. Suitable habitat is present in the Plan Area in Grizzly Peak Open Space, Sheffield Village Open Space, Knowland Park, Kings Estates, Urban and residential parcels (with annual grassland).
<i>Clarkia franciscana</i> Presidio clarkia	FE/SE/1B.1	Coastal scrub, valley and foothill grassland. Serpentine outcrops in grassland or scrub. 20-305 meters. Blooms May through July.	Present. A CNDDDB occurrence is present in the Plan Area in Joaquin Miller Park, and in the median strip between Chadbourne Way and Skyline Boulevard. Possible in adjacent areas.
<i>Dirca occidentalis</i> western leatherwood	-/-/1B.2	Broadleafed upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian forest, riparian woodland. On brushy slopes, mesic sites; mostly in mixed evergreen and foothill woodland	Present. A CNDDDB occurrence is present in the Plan Area in Joaquin Miller Park. Possible in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space,

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
		communities. 25-425 meters. Blooms January through April.	Knowland Park, Kings Estates, Urban and residential parcels (with coast oak woodland).
<i>Eriogonum luteolum</i> var. <i>caninum</i> Tiburon buckwheat	-/-/1B.2	Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Serpentine soils; sandy to gravelly sites. 0-700 meters. Blooms May through September.	Present. This species is present within the Plan Area Present in Joaquin Miller Park. Possible on serpentine soils along roadside clearance areas in the Crestmont neighborhood and in serpentine areas along Skyline Boulevard.
<i>Fissidens pauperculus</i> minute pocket moss	-/-/1B.2	North coast coniferous forest. Moss growing on damp soil along the coast. In dry streambeds and on stream banks. 10-1,024 meters.	Possible. Suitable habitat is present in the Plan Area.
<i>Fritillaria liliacea</i> fragrant fritillary	-/-/1B.2	Coastal scrub, valley and foothill grassland, coastal prairie, cismontane woodland. Often on serpentine; various soils reported though usually on clay, in grassland. 3-400 meters. Blooms February through April.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or grassland).
<i>Helianthella castanea</i> Diablo helianthella	-/-/1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Usually in chaparral/oak woodland interface in rocky, azonal soils. Often in partial shade. 45-1,070 meters. Blooms March through June.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or grassland).
<i>Hemizonia congesta</i> ssp. <i>congesta</i> congested-headed hayfield tarplant	-/-/1B.2	Valley and foothill grassland. Grassy valleys and hills, often in fallow fields; sometimes along roadsides. 20 -560 meters. Blooms April through November.	Present. A documented occurrence is present in the Plan Area (Lake 2017) in Knowland Park. Possible in Sheffield Village Open Space, Kings Estates, Joaquin Miller Park, and urban and residential parcels (with annual grassland).

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Hoita strobilina</i> Loma Prieta hoita	-/-/1B.1	Chaparral, cismontane woodland, riparian woodland. Serpentine; mesic sites. 60-975 meters. Blooms May through October.	Possible. Suitable habitat is present in the Plan Area in mesic serpentine sites in Joaquin Miller Park.
<i>Leptosiphon acicularis</i> bristly leptosiphon	-/-/4.2	Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland. Grassy areas, woodland, chaparral. 55-1,500 meters. Blooms April through July.	Present. Documented in Knowland Park in 2013 (Calflora 2017). Possible in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or grassland).
<i>Meconella oregana</i> Oregon meconella	-/-/1B.1	Coastal prairie, coastal scrub. Open, moist places. 60-640 meters. Blooms March through April.	Possible. Suitable habitat is present in the Plan Area in Grizzly Peak Open Space, Joaquin Miller Park, Leona Heights Park, and Knowland Park.
<i>Micropus amphibolus</i> Mt. Diablo cottonweed	-/-/3.2	Valley and foothill grassland, cismontane woodland, chaparral, broadleafed upland forest. Bare, grassy or rocky slopes. 45-825 meters. Blooms March through May.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or grassland).
<i>Plagiobothrys diffusus</i> San Francisco popcornflower	-/SE/1B.1	Valley and foothill grassland, coastal prairie. Historically from grassy slopes with marine influence. 45-360 meters. Blooms March through June.	Possible. Suitable habitat is present in the Plan Area in Knowland Park, Joaquin Miller Park, Sheffield Village Open Space, Kings Estates, and urban and residential parcels (with annual grassland)..
<i>Polemonium carneum</i> Oregon polemonium	-/-/2B.2	Coastal prairie, coastal scrub, lower montane coniferous forest. 0-1,830 m. Blooms April through September.	Possible. Suitable habitat is present in the Plan Area in Grizzly Peak Open Space, North Oakland Sports Field, Joaquin Miller Park, Leona Heights Park, Kings Estates, Knowland Park, and Sheffield Village Open Space..

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Ranunculus lobbii</i> Lobb's aquatic buttercup	-/-/4.2	Cismontane woodland, valley and foothill grassland, vernal pools, north coast coniferous forest. Mesic sites. Generally occurs in wetlands. 15-470 meters. Blooms February through May.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland or grassland).
<i>Streptanthus albidus</i> <i>ssp. peramoenus</i> (= <i>Streptanthus glandulosus</i> <i>ssp. glandulosus</i>) most beautiful jewelflower	-/-/1B.2	Chaparral, valley and foothill grassland, cismontane woodland. Serpentine outcrops, on ridges and slopes. 95-1,000 meters. March through October.	Present. This species is present in the Plan Area in Joaquin Miller Park (Lake 2017) and Knowland Park (OWLS 2017). Possible on serpentine soils along roadside clearance areas in the Crestmont neighborhood and in serpentine areas along Skyline Boulevard..
<i>Viburnum ellipticum</i> oval-leaved viburnum	-/-/2B.3	Chaparral, cismontane woodland, lower montane coniferous forest. 215-1,400 meters. Blooms May through June.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with coast oak woodland).
<p>* List of Abbreviations for Species Status follow below:</p> <p>FT = Federal threatened FE = Federal endangered SE = State endangered SR = State Rare</p>			

5.3 Special-status Wildlife

A review of existing information, as described in Section 2, identified special-status wildlife species known to occur in the Plan Area vicinity. These species, and their potential to occur in the Plan Area are outlined in Table 3. Special-status wildlife with the potential to be impacted by project activities is discussed below.

5.3.1 Invertebrates

No special-status invertebrate have the potential to occur within the Plan Area.

5.3.2 Fish

Sausal Creek supports resident rainbow trout (*Oncorhynchus mykiss*) (Leidy 2005, Laurel Marcus and Associates et al 2010). The Sausal Creek watershed historically supported steelhead trout, the anadromous form of *O. mykiss*, but there is currently no evidence of anadromy in the *O. mykiss* population there (Leidy 2005). Resident rainbow trout are not a special-status species.

5.3.3 Amphibians and Reptiles

Special-status reptiles with the potential to occur in the Plan Area include western pond turtle (*Emys marmorata*), Alameda whipsnake (*Masticophis lateralis euryxanthus*), and California red-legged frog (*Rana draytonii*) (Table 3). Alameda whipsnake is most likely to occur within coastal scrub and chaparral habitats, but this species may also use adjacent habitats such as grasslands and oak woodlands (USFWS 2011). Portions of the Plan Area are within critical habitat for this species, particularly the Grizzly Peak Open Space (**Figure 7**).

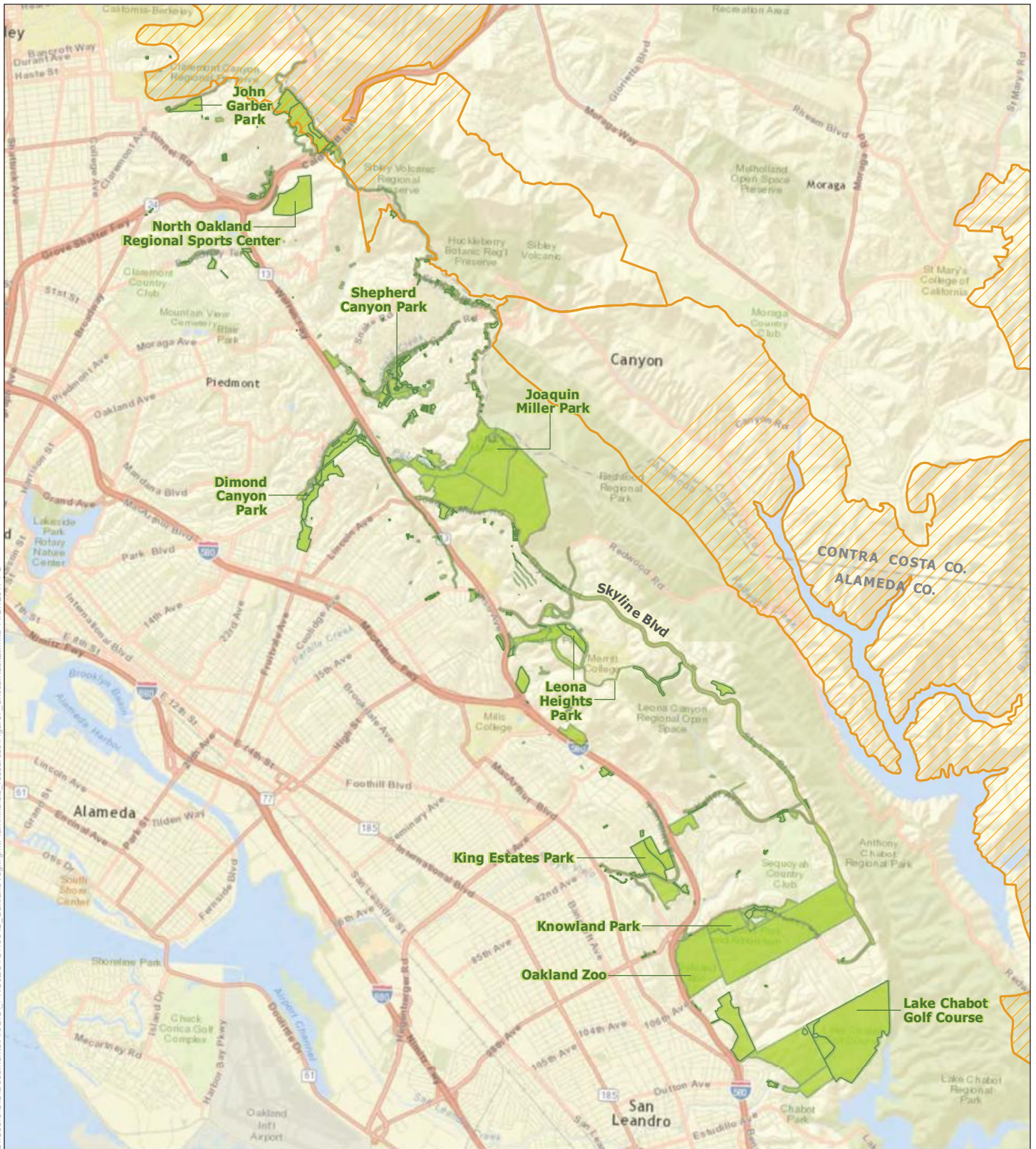
Western pond turtles have the potential to occur within the Plan Area within aquatic habitat such a perennial streams.

5.3.4 Birds

Special-status birds with the potential to occur in the Plan Area include White-tailed Kite (*Elanus leucurus*), Golden Eagle (*Aquila chrysaetos*), and Yellow Warbler (*Setophaga petechial*).

5.3.5 Mammals

Special-status mammals with the potential to occur in the Plan Area include western red bat (*Lasiurus blossevillii*), pallid bat (*Antrozous pallidus*), western mastiff bat (*Eumops perotis californicus*), and San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*). Western red bats and western mastiff bats may roost in trees in the Plan Area. San Francisco dusky-footed woodrat stick houses were observed in many locations within the Plan Area, and were most often encountered in oak woodlands and riparian areas. These structures should be avoided if possible during vegetation management activities.



C:\Users\GIS\Documents\ArcGIS\PROJECTS\16042_OaklandVegMgmtPlan\mxd\bb_resources\Figure7_CriticalHabitat.mxd 11/27/2017 PG

BaseMap Sources: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure 7
Critical Habitat



- Project Area
- Alameda whipsnake critical habitat



Table 3. Special-status Wildlife

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
<i>Amphibians and Reptiles</i>			
<i>Emys marmorata</i> western pond turtle	-/SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6,000 ft elevation. Need basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying.	Possible. Suitable habitat is present in the Plan Area including aquatic portions of Garber Park, North Oakland Sports Field, Dimond Park, Joaquin Miller Park, Leona Heights Park, Knowland Park, and Sheffield Village Open Space.
<i>Masticophis lateralis euryxanthus</i> Alameda whipsnake	FT/ST	Typically found in chaparral and scrub habitats but will also use adjacent grassland, oak savanna and woodland habitats. Mostly south-facing slopes and ravines, with rock outcrops, deep crevices or abundant rodent burrows, where shrubs form a vegetative mosaic with oak trees and grasses.	Present. Present in Knowland Park (Placemakers 2011). Possible in Grizzly Peak Open Space (critical habitat for this species), North Oakland Sports Field, Joaquin Miller Park, and Sheffield Village Open Space.
<i>Rana draytonii</i> California red-legged frog	FT/SSC	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat.	Possible. Suitable habitat is present in the Plan Area in North Oakland Sports Field, Dimond Canyon Park, Joaquin Miller Park, Leona Heights Park, Knowland Park, and Sheffield Village Open Space.
<i>Birds</i>			
<i>Aquila chrysaetos</i> Golden Eagle	-/SFP	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	Possible (Foraging only). Species may use grasslands for foraging, but nesting is not expected. Possible foraging in Kings Estates, Knowland Park, and Sheffield Village Open Space.
<i>Elanus leucurus</i> White-tailed Kite	-/SFP	Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland. Open	Possible. Suitable habitat is present in the Plan Area Possible in Kings Estates, Knowland Park, and Sheffield Village Open Space.

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
		grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	
<i>Setophaga petechia</i> Yellow Warbler	-/SSC	Riparian plant associations in close proximity to water. Also nests in montane shrubbery in open conifer forests in Cascades and Sierra Nevada. Frequently found nesting and foraging in willow shrubs and thickets, and in other riparian plants including cottonwoods, sycamores, ash, and alders.	Possible. Suitable habitat is present in the Plan Area in riparian areas within North Oakland Sports Field, Dimond Canyon Park, Joaquin Miller Park, Leona Heights Park, Kowland Park, and Sheffield Village Open Space.
Mammals			
<i>Antrozous pallidus</i> pallid bat	-/SSC	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with forested or grassland habitats).
<i>Eumops perotis californicus</i> western mastiff bat	-/SSC	Many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc. Roosts in crevices in cliff faces, high buildings, trees and tunnels.	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park, Kings Estates, Urban and residential parcels (with forested or grassland habitats).
<i>Lasiurus blossevillii</i> western red bat	-/SSC	Roosts primarily in trees, 2-40 ft above ground, from sea level up through mixed conifer forests. Prefers habitat edges & mosaics with trees that are protected from above & open below with open areas for foraging	Possible. Suitable habitat is present in the Plan Area in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space, Knowland Park, Joaquin Miller Park,

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
			Kings Estates, Urban and residential parcels (with forested or grassland habitats).
<p><i>Neotoma fuscipes annectens</i> San Francisco dusky-footed woodrat</p>	<p>-/SSC</p>	<p>Forest habitats of moderate canopy and moderate to dense understory. May prefer chaparral and redwood habitats. Constructs nests of shredded grass, leaves and other material. May be limited by availability of nest-building materials.</p>	<p>Present. This species is present in both tree-dominated and shrub-dominated communities in the Plan Area. Present in Joaquin Miller Park and Knowland Park. Possible in Garber Park, Dimond Canyon Park, Shepherd Canyon Park, Leona Heights Park, North Oakland Regional Sports Field, Grizzly Peak Open Space, Sheffield Village Open Space, and Kings Estates.</p>
<p>* List of Abbreviations for Species Status follow below: FT = Federal threatened FE = Federal endangered FC = Federal candidate FD = Federal delisted ST = State threatened SE = State endangered SSC = Species of special concern SFP = State fully protected</p>			

6.0 Potentially Jurisdictional Wetlands & Waters of the U.S

A delineation of wetlands and waters has not been conducted for the Plan Area. . Several of the aquatic habitats described in Section 3.2 of this report are likely to be regulated by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) under section 404 the Clean Water Act.

7.0 Sensitive Natural Communities

Portions of the Plan Area contain sensitive natural communities as identified by California Department of Fish and Wildlife (CDFG 2010). Sensitive natural communities in the Plan Area include:

- *Sequoia sempervirens* (Redwood forest) Alliance (Alliance code 86.100.00): Joaquin Miller Park, Leona Canyon, Diamond Canyon Park.
- *Nassella pulchra* (Purple needle grass grassland) Alliance (Alliance code 41.150.00): Knowland Park, Sheffield Village Open Space.
- *Umbellularia californica* (California bay forest) Alliance (Alliance code 74.100.00): Dimond Canyon Park, Knowland Park, Sheffield Village Open Space.

8.0 References

- Bartosh, H., L. Naumovich, and L. Baker. 2010. A Guidebook to Botanical Priority Protection Areas of the East Bay. East Bay Chapter of the California Native Plant Society.
- California Department of Fish and Game (CDFG). 2010. Sensitive Natural Communities List. Available at: http://www.dfg.ca.gov/biogeodata/vegcamp/natural_communities.asp.
- California Department of Fish and Wildlife (CDFW). 2017. California Natural Diversity Data Base. Biogeographic Data Branch. Sacramento, California. August 2017.
- Calflora. 2014. Calflora Plant Search [web application]. Berkeley, California. Accessed on May Feb 28, 2017 at: <http://www.calflora.org/>.
- California Native Plant Society (CNPS). 2017. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Accessed on Feb 28, 2017 at: <http://www.rareplants.cnps.org>.
- City of Oakland. 2017. History of Fires in the Oakland Hills. Accessed March 2017. <http://www2.oaklandnet.com/oakca1/groups/fire/documents/webcontent/oak042168.pdf>
- eBird. 2017. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: <http://www.ebird.org>. Accessed May 3, 2017.

- Federal Emergency Management Agency (FEMA). 2014. Final Hazardous Fire Risk Reduction Environmental Impact Statement.
- Kie, J.G. 1988. Urban. *In A Guide to Wildlife Habitats of California*. 1988. Mayer, K.E. and W.F. Laudenslayer, eds. State of California, Resources Agency, Department of Fish and Game Sacramento, CA. Updated by CWHR staff, April 2005.
- Kramer, G. 1988. Urban. *In A Guide to Wildlife Habitats of California*. 1988. Mayer, K.E. and W.F. Laudenslayer, eds. State of California, Resources Agency, Department of Fish and Game Sacramento, CA.
- Lake, D. 2017. Rare, Unusual and Significant Plants of Alameda and Contra Costa Counties [web application]. East Bay Chapter of the California Native Plant Society.
- Laurel Marcus and Associates, NewFields River Basin Services, and Hydrologic Systems Inc. 2010. Final Sausal Creek Watershed Enhancement Plan. Prepared for Friends of Sausal Creek. March.
- LSA Associates, Inc. 2009a. East Bay Regional Park District Draft Wildfire Hazard Reduction and Resource Management Plan. July.
- LSA Associates, Inc. 2009b. East Bay Regional Park District Wildfire Hazard Reduction and Resource Management Plan Environmental Impact Report. July.
- Mayer, K.E. and W.F. Laudenslayer, eds. *A Guide to Wildlife Habitats of California*. 1988. State of California, Resources Agency, Department of Fish and Game Sacramento, CA. Updated descriptions available at: <https://www.wildlife.ca.gov/Data/CWHR/Wildlife-Habitats>.
- McBride, J.R. and H.F. Heady. 1968. Invasion of grassland by *Baccharis pilularis*. DC. *Journal of Range Management*, 21(2), pp.106-108.
- McBride, J.R. and C. Reid. 1988. Urban. *In A Guide to Wildlife Habitats of California*. 1988. Mayer, K.E. and W.F. Laudenslayer, eds. State of California, Resources Agency, Department of Fish and Game Sacramento, CA.
- Nowak, D.L. 1993. Historical Vegetation Change in Oakland and Its Implications for Urban Forest Management. *Journal of Arboriculture* 19(5).
- Oakland Wildland Stewards (OWLS). 2017. Native Plants of the Oakland Hills City Parks.
- Pearson, D.C. 1988. Eucalyptus. *In A Guide to Wildlife Habitats of California*. 1988. Mayer, K.E. and W.F. Laudenslayer, eds. State of California, Resources Agency, Department of Fish and Game Sacramento, CA.
- Placemakers. 2011. Amendment to Oakland Zoo Masters Plan: Subsequent Mitigated Negative Declaration/Addendum. Prepared for the City of Oakland. February.
- Sanders, A.C., M.A. Elvin, and M.S. Brunell. 2017. *Monardella villosa* subsp. *villosa*, in Jepson Flora Project (eds.) Jepson eFlora.

http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=51631, accessed on June 06, 2017.

- Sawyer, J.O., T. Keeler-Wolf, and J. Evens. 2009. A Manual of California Vegetation. Second edition. California Native Plant Society Press.
- Simon, G.L. Vulnerability-in-Production: A Spatial History of Nature, Affluence, and Fire in Oakland, California *Annals of the Association of American Geographers*, 104(6).
- Stromberg, M.R. and J.R. Griffen. 1996. Long-Term Patterns in Coastal California Grasslands in Relation to Cultivation, Gophers, and Grazing. *Ecological Applications*, 6(4).
- Sugihara, N.G., J. W. Van Wagendonk, K. E. Shaffer, J. Fites-Kaufman and A. Thode, eds. 2006. Fire in California's Ecosystems. Chapter 14. University of California Press. Berkeley and Los Angeles, California.
- URS. 2009. Strawberry Canyon Vegetation Mitigation letter. May 27.
- U.S. Fish and Wildlife Service (USFWS). 2009. Bay checkerspot butterfly (*Euphydryas editha bayensis*) 5-Year Review: Summary and Evaluation. August.
- U.S. Fish and Wildlife Service (USFWS). 2010. *Chorizanthe robusta* var. *robusta* (Robust Spineflower) 5-Year Review: Summary and Evaluation. February.
- U.S. Fish and Wildlife Service (USFWS). 2011. Alameda Whipsnake (*Masticophis lateralis euryxanthus*) 5-Year Review: Summary and Evaluation. September.
- U.S. Fish and Wildlife Service (USFWS). 2012. Programmatic Biological Opinion for U.S. Army Corps of Engineers (Corps) Permitted Projects Utilizing the East Alameda County Conservation Strategy that May Affect Federally Listed Species in East Alameda County, California (Corps File Number 2011-00230S). May.
- U.S. Fish and Wildlife Service USFWS. 2014. *Holocarpha macradenia* (Santa Cruz tarplant) 5-Year Review: Summary and Evaluation.
- U.S. Geological Survey, 2016, USGS National Hydrography Dataset (NHD) Downloadable Data Collection - National Geospatial Data Asset (NGDA) National Hydrography Dataset (NHD): USGS - National Geospatial Technical Operations Center (NGTOC): Rolla, MO and Denver, CO
- Western Monarch Count Resource Center. 2017. Find an Overwintering Site Near You. Available: <https://www.westernmonarchcount.org/find-an-overwintering-site-near-you/>. Accessed September 28, 2017.
- Whittemore, A.T. 2017. *Juglans californica*, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/cgi-bin/get_IJM.pl?tid=29566, accessed on February 28, 2017.
- WRA, Inc. 2013. Vegetation Management Implementation Plan: Chabot Space and Science Center. Prepared for City of Oakland. November.

Page Intentionally Left Blank

Appendix A

Special-Status Species Lists



Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database



Query Criteria: Quad (Hayward (3712261) OR Briones Valley (3712282) OR Hunters Point (3712263) OR Las Trampas Ridge (3712271) OR Oakland East (3712272) OR Oakland West (3712273) OR Richmond (3712283) OR San Leandro (3712262) OR Walnut Creek (3712281))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Accipiter cooperii</i> Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
<i>Accipiter striatus</i> sharp-shinned hawk	ABNKC12020	None	None	G5	S4	WL
<i>Ambystoma californiense</i> California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
<i>Amsinckia lunaris</i> bent-flowered fiddleneck	PDBOR01070	None	None	G2G3	S2S3	1B.2
<i>Anniella pulchra</i> northern California legless lizard	ARACC01020	None	None	G3	S3	SSC
<i>Anomobryum julaceum</i> slender silver moss	NBMUS80010	None	None	G5?	S2	4.2
<i>Antrozous pallidus</i> pallid bat	AMACC10010	None	None	G5	S3	SSC
<i>Aquila chrysaetos</i> golden eagle	ABNKC22010	None	None	G5	S3	FP
<i>Archoplites interruptus</i> Sacramento perch	AFCQB07010	None	None	G2G3	S1	SSC
<i>Arctostaphylos pallida</i> pallid manzanita	PDERI04110	Threatened	Endangered	G1	S1	1B.1
<i>Ardea herodias</i> great blue heron	ABNGA04010	None	None	G5	S4	
<i>Astragalus tener var. tener</i> alkali milk-vetch	PDFAB0F8R1	None	None	G2T2	S2	1B.2
<i>Athene cunicularia</i> burrowing owl	ABNSB10010	None	None	G4	S3	SSC
<i>Balsamorhiza macrolepis</i> big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
<i>Blepharizonia plumosa</i> big tarplant	PDAST1C011	None	None	G2	S2	1B.1
<i>Bombus caliginosus</i> obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	
<i>Bombus crotchii</i> Crotch bumble bee	IIHYM24480	None	None	G3G4	S1S2	
<i>Bombus occidentalis</i> western bumble bee	IIHYM24250	None	None	G2G3	S1	



Selected Elements by Scientific Name
 California Department of Fish and Wildlife
 California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Branta hutchinsii leucopareia</i> cackling (=Aleutian Canada) goose	ABNJB05035	Delisted	None	G5T3	S3	
<i>California macrophylla</i> round-leaved filaree	PDGER01070	None	None	G4	S4	1B.2
<i>Calochortus pulchellus</i> Mt. Diablo fairy-lantern	PMLIL0D160	None	None	G2	S2	1B.2
<i>Calystegia purpurata ssp. saxicola</i> coastal bluff morning-glory	PDCON040D2	None	None	G4T2T3	S2S3	1B.2
<i>Carex comosa</i> bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
<i>Centromadia parryi ssp. congdonii</i> Congdon's tarplant	PDAST4R0P1	None	None	G3T2	S2	1B.1
<i>Charadrius alexandrinus nivosus</i> western snowy plover	ABNNB03031	Threatened	None	G3T3	S2S3	SSC
<i>Chloropyron maritimum ssp. palustre</i> Point Reyes salty bird's-beak	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
<i>Chorizanthe cuspidata var. cuspidata</i> San Francisco Bay spineflower	PDPGN04081	None	None	G2T1	S1	1B.2
<i>Chorizanthe robusta var. robusta</i> robust spineflower	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1
<i>Cicindela hirticollis gravida</i> sandy beach tiger beetle	IICOL02101	None	None	G5T2	S2	
<i>Cicuta maculata var. bolanderi</i> Bolander's water-hemlock	PDAP10M051	None	None	G5T4	S2	2B.1
<i>Circus cyaneus</i> northern harrier	ABNKC11010	None	None	G5	S3	SSC
<i>Cirsium andrewsii</i> Franciscan thistle	PDAST2E050	None	None	G3	S3	1B.2
<i>Clarkia concinna ssp. automixa</i> Santa Clara red ribbons	PDONA050A1	None	None	G5?T3	S3	4.3
<i>Clarkia franciscana</i> Presidio clarkia	PDONA050H0	Endangered	Endangered	G1	S1	1B.1
<i>Corynorhinus townsendii</i> Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
<i>Coturnicops noveboracensis</i> yellow rail	ABNME01010	None	None	G4	S1S2	SSC
<i>Danaus plexippus pop. 1</i> monarch - California overwintering population	IILEPP2012	None	None	G4T2T3	S2S3	
<i>Dipodomys heermanni berkeleyensis</i> Berkeley kangaroo rat	AMAFD03061	None	None	G3G4T1	S1	
<i>Dirca occidentalis</i> western leatherwood	PDTHY03010	None	None	G2	S2	1B.2



Selected Elements by Scientific Name
California Department of Fish and Wildlife
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Efferia antiochi</i> Antioch efferian robberfly	IIDIP07010	None	None	G1G2	S1S2	
<i>Egretta thula</i> snowy egret	ABNGA06030	None	None	G5	S4	
<i>Elanus leucurus</i> white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
<i>Emys marmorata</i> western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
<i>Eriogonum luteolum var. caninum</i> Tiburon buckwheat	PDPGN083S1	None	None	G5T2	S2	1B.2
<i>Eryngium jepsonii</i> Jepson's coyote-thistle	PDAP10Z130	None	None	G2	S2	1B.2
<i>Eucyclogobius newberryi</i> tidewater goby	AFCQN04010	Endangered	None	G3	S3	SSC
<i>Eumops perotis californicus</i> western mastiff bat	AMACD02011	None	None	G5T4	S3S4	SSC
<i>Euphydryas editha bayensis</i> Bay checkerspot butterfly	IILEPK4055	Threatened	None	G5T1	S1	
<i>Extriplex joaquinana</i> San Joaquin spearscale	PDCHE041F3	None	None	G2	S2	1B.2
<i>Falco peregrinus anatum</i> American peregrine falcon	ABNKD06071	Delisted	Delisted	G4T4	S3S4	FP
<i>Fissidens pauperculus</i> minute pocket moss	NBMUS2W0U0	None	None	G3?	S2	1B.2
<i>Fritillaria liliacea</i> fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
<i>Geothlypis trichas sinuosa</i> saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
<i>Gilia capitata ssp. chamissonis</i> blue coast gilia	PDPLM040B3	None	None	G5T2	S2	1B.1
<i>Gilia millefoliata</i> dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
<i>Haliaeetus leucocephalus</i> bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
<i>Helianthella castanea</i> Diablo helianthella	PDAST4M020	None	None	G2	S2	1B.2
<i>Helminthoglypta nickliniana bridgesi</i> Bridges' coast range shoulderband	IMGASC2362	None	None	G3T1	S1S2	
<i>Hemizonia congesta ssp. congesta</i> congested-headed hayfield tarplant	PDAST4R065	None	None	G5T1T2	S1S2	1B.2
<i>Heteranthera dubia</i> water star-grass	PMPON03010	None	None	G5	S2	2B.2



Selected Elements by Scientific Name
 California Department of Fish and Wildlife
 California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Hoita strobilina</i> Loma Prieta hoita	PDFAB5Z030	None	None	G2	S2	1B.1
<i>Holocarpha macradenia</i> Santa Cruz tarplant	PDAST4X020	Threatened	Endangered	G1	S1	1B.1
<i>Horkelia cuneata var. sericea</i> Kellogg's horkelia	PDROS0W043	None	None	G4T1?	S1?	1B.1
<i>Hydroprogne caspia</i> Caspian tern	ABNNM08020	None	None	G5	S4	
<i>Isocoma arguta</i> Carquinez goldenbush	PDAST57050	None	None	G1	S1	1B.1
<i>Juglans hindsii</i> Northern California black walnut	PDJUG02040	None	None	G1	S1	1B.1
<i>Lasionycteris noctivagans</i> silver-haired bat	AMACC02010	None	None	G5	S3S4	
<i>Lasiurus cinereus</i> hoary bat	AMACC05030	None	None	G5	S4	
<i>Lasthenia conjugens</i> Contra Costa goldfields	PDAST5L040	Endangered	None	G1	S1	1B.1
<i>Laterallus jamaicensis coturniculus</i> California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
<i>Layia carnosa</i> beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
<i>Leptosiphon rosaceus</i> rose leptosiphon	PDPLM09180	None	None	G1	S1	1B.1
<i>Malacothamnus hallii</i> Hall's bush-mallow	PDMAL0Q0F0	None	None	G2	S2	1B.2
<i>Masticophis lateralis euryxanthus</i> Alameda whipsnake	ARADB21031	Threatened	Threatened	G4T2	S2	
<i>Meconella oregana</i> Oregon meconella	PDPAP0G030	None	None	G2G3	S2	1B.1
<i>Melospiza melodia maxillaris</i> Suisun song sparrow	ABPBXA301K	None	None	G5T3	S3	SSC
<i>Melospiza melodia pusillula</i> Alameda song sparrow	ABPBXA301S	None	None	G5T2?	S2S3	SSC
<i>Melospiza melodia samuelis</i> San Pablo song sparrow	ABPBXA301W	None	None	G5T2	S2	SSC
<i>Microcina leei</i> Lee's micro-blind harvestman	ILARA47040	None	None	G1	S1	
<i>Microcina lumi</i> Lum's micro-blind harvestman	ILARA47050	None	None	G1	S1	
<i>Microtus californicus sanpabloensis</i> San Pablo vole	AMAFF11034	None	None	G5T1T2	S1S2	SSC



Selected Elements by Scientific Name
California Department of Fish and Wildlife
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Monolopia gracilens</i> woodland woollythreads	PDAST6G010	None	None	G3	S3	1B.2
<i>Neotoma fuscipes annectens</i> San Francisco dusky-footed woodrat	AMAFF08082	None	None	G5T2T3	S2S3	SSC
<i>Northern Coastal Salt Marsh</i> Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
<i>Northern Maritime Chaparral</i> Northern Maritime Chaparral	CTT37C10CA	None	None	G1	S1.2	
<i>Nycticorax nycticorax</i> black-crowned night heron	ABNGA11010	None	None	G5	S4	
<i>Nyctinomops macrotis</i> big free-tailed bat	AMACD04020	None	None	G5	S3	SSC
<i>Oenothera deltooides ssp. howellii</i> Antioch Dunes evening-primrose	PDONA0C0B4	Endangered	Endangered	G5T1	S1	1B.1
<i>Phalacrocorax auritus</i> double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
<i>Plagiobothrys chorisianus var. chorisianus</i> Choris' popcornflower	PDBOR0V061	None	None	G3T2Q	S2	1B.2
<i>Plagiobothrys diffusus</i> San Francisco popcornflower	PDBOR0V080	None	Endangered	G1Q	S1	1B.1
<i>Plagiobothrys glaber</i> hairless popcornflower	PDBOR0V0B0	None	None	GH	SH	1A
<i>Polygonum marinense</i> Marin knotweed	PDPGN0L1C0	None	None	G2Q	S2	3.1
<i>Rallus obsoletus obsoletus</i> California Ridgway's rail	ABNME05016	Endangered	Endangered	G5T1	S1	FP
<i>Rana boylei</i> foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
<i>Rana draytonii</i> California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
<i>Reithrodontomys raviventris</i> salt-marsh harvest mouse	AMAFF02040	Endangered	Endangered	G1G2	S1S2	FP
<i>Rynchops niger</i> black skimmer	ABNNM14010	None	None	G5	S2	SSC
<i>Sanicula maritima</i> adobe sanicle	PDAPI1Z0D0	None	Rare	G2	S2	1B.1
<i>Scapanus latimanus parvus</i> Alameda Island mole	AMABB02031	None	None	G5THQ	SH	SSC
<i>Serpentine Bunchgrass</i> Serpentine Bunchgrass	CTT42130CA	None	None	G2	S2.2	
<i>Setophaga petechia</i> yellow warbler	ABPBX03010	None	None	G5	S3S4	SSC



Selected Elements by Scientific Name
California Department of Fish and Wildlife
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Sorex vagrans halicoetes</i> salt-marsh wandering shrew	AMABA01071	None	None	G5T1	S1	SSC
<i>Spirinchus thaleichthys</i> longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC
<i>Sternula antillarum browni</i> California least tern	ABNNM08103	Endangered	Endangered	G4T2T3Q	S2	FP
<i>Streptanthus albidus ssp. peramoenus</i> most beautiful jewelflower	PDBRA2G012	None	None	G2T2	S2	1B.2
<i>Stuckenia filiformis ssp. alpina</i> slender-leaved pondweed	PMPOT03091	None	None	G5T5	S3	2B.2
<i>Suaeda californica</i> California seablite	PDCHE0P020	Endangered	None	G1	S1	1B.1
<i>Taxidea taxus</i> American badger	AMAJF04010	None	None	G5	S3	SSC
<i>Trachusa gummifera</i> San Francisco Bay Area leaf-cutter bee	IIHYM80010	None	None	G1	S1	
<i>Trifolium hydrophilum</i> saline clover	PDFAB400R5	None	None	G2	S2	1B.2
<i>Triphysaria floribunda</i> San Francisco owl's-clover	PDSCR2T010	None	None	G2?	S2?	1B.2
<i>Tryonia imitator</i> mimic tryonia (=California brackishwater snail)	IMGASJ7040	None	None	G2	S2	
Valley Needlegrass Grassland Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
<i>Viburnum ellipticum</i> oval-leaved viburnum	PDCPR07080	None	None	G4G5	S3?	2B.3
<i>Xanthocephalus xanthocephalus</i> yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 116

Plant List

54 matches found. Click on scientific name for details

Search Criteria

Found in 9 Quads around 37122G2

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
<u>Amsinckia lunaris</u>	bent-flowered fiddleneck	Boraginaceae	annual herb	1B.2	S2S3	G2G3
<u>Androsace elongata ssp. acuta</u>	California androsace	Primulaceae	annual herb	4.2	S3S4	G5?T3T4
<u>Arctostaphylos pallida</u>	pallid manzanita	Ericaceae	perennial evergreen shrub	1B.1	S1	G1
<u>Astragalus tener var. tener</u>	alkali milk-vetch	Fabaceae	annual herb	1B.2	S2	G2T2
<u>Balsamorhiza macrolepis</u>	big-scale balsamroot	Asteraceae	perennial herb	1B.2	S2	G2
<u>Blepharizonia plumosa</u>	big tarplant	Asteraceae	annual herb	1B.1	S2	G2
<u>California macrophylla</u>	round-leaved filaree	Geraniaceae	annual herb	1B.2	S3?	G3?
<u>Calochortus pulchellus</u>	Mt. Diablo fairy-lantern	Liliaceae	perennial bulbiferous herb	1B.2	S2	G2
<u>Calochortus umbellatus</u>	Oakland star-tulip	Liliaceae	perennial bulbiferous herb	4.2	S4	G4
<u>Calystegia purpurata ssp. saxicola</u>	coastal bluff morning-glory	Convolvulaceae	perennial herb	1B.2	S2S3	G4T2T3
<u>Castilleja ambigua var. ambigua</u>	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	4.2	S4	G4T5
<u>Centromadia parryi ssp. congdonii</u>	Congdon's tarplant	Asteraceae	annual herb	1B.1	S2	G3T2
<u>Chloropyron maritimum ssp. palustre</u>	Point Reyes bird s-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.2	S2	G4?T2
<u>Chorizanthe cuspidata var. cuspidata</u>	San Francisco Bay spineflower	Polygonaceae	annual herb	1B.2	S1	G2T1
<u>Chorizanthe robusta var. robusta</u>	robust spineflower	Polygonaceae	annual herb	1B.1	S1	G2T1
<u>Cirsium andrewsii</u>	Franciscan thistle	Asteraceae	perennial herb	1B.2	S3	G3
<u>Clarkia concinna ssp. automixa</u>	Santa Clara red ribbons	Onagraceae	annual herb	4.3	S3	G5?T3
<u>Clarkia franciscana</u>	Presidio clarkia	Onagraceae	annual herb	1B.1	S1	G1
<u>Dirca occidentalis</u>	western leatherwood	Thymelaeaceae	perennial deciduous shrub	1B.2	S2	G2
<u>Eriogonum luteolum var. caninum</u>	Tiburon buckwheat	Polygonaceae	annual herb	1B.2	S2	G5T2
<u>Eryngium jepsonii</u>	Jepson's coyote thistle	Apiaceae	perennial herb	1B.2	S1	G1
<u>Extriplex joaquinana</u>	San Joaquin spearscale	Chenopodiaceae	annual herb	1B.2	S2	G2
<u>Fissidens pauperculus</u>	minute pocket moss	Fissidentaceae	moss	1B.2	S2	G3?
<u>Fritillaria liliacea</u>	fragrant fritillary	Liliaceae	perennial bulbiferous herb	1B.2	S2	G2
<u>Gilia capitata ssp. chamissonis</u>	blue coast gilia	Polemoniaceae	annual herb	1B.1	S2	G5T2

Gilia millefoliata	dark-eyed gilia	Polemoniaceae	annual herb	1B.2	S2	G2
Helianthella castanea	Diablo helianthella	Asteraceae	perennial herb	1B.2	S2	G2
Hoita strobilina	Loma Prieta hoita	Fabaceae	perennial herb	1B.1	S2	G2
Holocarpha macradenia	Santa Cruz tarplant	Asteraceae	annual herb	1B.1	S1	G1
Horkelia cuneata var. sericea	Kellogg's horkelia	Rosaceae	perennial herb	1B.1	S1?	G4T1?
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	4.2	S3	G3
Juglans californica	Southern California black walnut	Juglandaceae	perennial deciduous tree	4.2	S3	G3
Juglans hindsii	Northern California black walnut	Juglandaceae	perennial deciduous tree	1B.1	S1	G1
Lasthenia conjugens	Contra Costa goldfields	Asteraceae	annual herb	1B.1	S1	G1
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2	G5T2
Leptosiphon acicularis	bristly leptosiphon	Polemoniaceae	annual herb	4.2	S3	G3
Meconella oregana	Oregon meconella	Papaveraceae	annual herb	1B.1	S2	G2G3
Micropus amphibolus	Mt. Diablo cottonweed	Asteraceae	annual herb	3.2	S3S4	G3G4
Monardella antonina ssp. antonina	San Antonio Hills monardella	Lamiaceae	perennial rhizomatous herb	3	S1S3	G4T1T3Q
Monolopia gracilens	woodland woolythreads	Asteraceae	annual herb	1B.2	S3	G3
Navarretia gowenii	Lime Ridge navarretia	Polemoniaceae	annual herb	1B.1	S1	G1
Piperia michaelii	Michael's rein orchid	Orchidaceae	perennial herb	4.2	S3	G3
Plagiobothrys chorisianus var. chorisianus	Choris popcornflower	Boraginaceae	annual herb	1B.2	S2	G3T2Q
Plagiobothrys diffusus	San Francisco popcornflower	Boraginaceae	annual herb	1B.1	S1	G1Q
Plagiobothrys glaber	hairless popcornflower	Boraginaceae	annual herb	1A	SH	GH
Polygonum marinense	Marin knotweed	Polygonaceae	annual herb	3.1	S2	G2Q
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb	4.2	S3	G4
Sanicula maritima	adobe sanicle	Apiaceae	perennial herb	1B.1	S2	G2
Streptanthus albidus ssp. peramoenus	most beautiful jewelflower	Brassicaceae	annual herb	1B.2	S2	G2T2
Stuckenia filiformis ssp. alpina	slender-leaved pondweed	Potamogetonaceae	perennial rhizomatous herb	2B.2	S3	G5T5
Suaeda californica	California seablite	Chenopodiaceae	perennial evergreen shrub	1B.1	S1	G1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	1B.2	S2	G2
Triphysaria floribunda	San Francisco owl's- clover	Orobanchaceae	annual herb	1B.2	S2?	G2?
Viburnum ellipticum	oval-leaved viburnum	Adoxaceae	perennial deciduous shrub	2B.3	S3?	G4G5

Suggested Citation

CNPS, Rare Plant Program. 2017. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website <http://www.rareplants.cnps.org> [accessed 22 February 2017].

Search the Inventory
[Simple Search](#)
[Advanced Search](#)

Information
[About the Inventory](#)
[About the Rare Plant Program](#)

Contributors
[The Calflora Database](#)
[The California Lichen Society](#)

[Glossary](#)

[CNPS Home Page](#)

[About CNPS](#)

[Join CNPS](#)

© Copyright 2010-2014 California Native Plant Society. All rights reserved.

A-Ranked Native Plants of the Oakland Hills City Parks
Compiled by the Oakland Wildland Stewards (OWLS)

Scientific Name	Common Name	Lifeform	Beacons field	Butters Canyon	Dimond Canyon	Garber	Joaquin Miller	Knowland	Leona	Marge Saunders	Shepherd Canyon + MRRT	EBCNPS Rank	How many parks?
<i>Agrostis hallii</i>	Hall's bentgrass	PG						yes				A2	1
<i>Alnus rubra</i>	red alder	T				yes			yes			A2	2
<i>Arctostaphylos pallida</i>	pallid manzanita	S					yes				yes	*A1	2
<i>Asarum caudatum</i>	wild ginger	P			yes		yes					A2	2
<i>Brodiaea terrestris subsp. terrestris</i>	dwarf brodiaea	P						yes				A2	1
<i>Calochortus umbellatus</i>	Oakland star-tulip	P					yes	yes	yes			*A2	3
<i>Carex densa</i>	dense sedge	GL						yes				A2	1
<i>Carex globosa</i>	round-fruit sedge	P					yes					A1	1
<i>Carex leptopoda</i>	short-scale sedge	P	yes				yes					A1	2
<i>Carex multicostata</i>	multi-ribbed sedge	GL						yes				A2	1
<i>Castilleja subinclusa subsp. franciscana</i>	paintbrush	P						yes				A1	1
<i>Chrysolepis chrysophylla var.</i>	golden chinquapin	S					yes					A2	1
<i>Corallorhiza maculata var. maculata</i>	spotted coralroot	P				yes	yes	yes				A2	3
<i>Cyperus niger</i>	black flatsedge	GL							yes			A2	1
<i>Deinandra corymbosa</i>	coastal tarweed	A						yes				A2	1
<i>Dicentra formosa</i>	western bleeding hearts	P								yes		A2	1
<i>Dichondra donelliana</i>	California ponysfoot	P					yes					A1	1
<i>Dirca occidentalis</i>	western leatherwood	S					yes					*A2	1
<i>Eriogonum luteolum var. caninum</i>	Tiburon buckwheat	A					yes					*A1	1
<i>Gaultheria shallon</i>	salal	S					yes					A1	1
<i>Hosackia stipularis var. stipularis</i>	balsam bird's-foot trefoil	P					yes					A1	1
<i>Iris douglasiana</i>	Douglas' iris	P	yes		yes	yes	yes	yes		yes		A2	6
<i>Leptosiphon acicularis</i>	bristly leptosiphon	A						yes				*A1	1
<i>Oxalis oregana</i>	redwood sorrel	P			yes		yes					A1	2

Scientific Name	Common Name	Lifeform	Beacons field	Butters Canyon	Dimond Canyon	Garber	Joaquin Miller	Knowland	Leona	Marge Saunders	Shepherd Canyon + MRRT	EBCNPS Rank	How many parks?
<i>Phyla nodiflora</i>	turkey tangle frogfruit	P							yes			A1	1
<i>Pinus coulteri</i>	big-cone pine	T						yes				A2	1
<i>Piperia elongata</i>	dense flower rein orchid	P					yes					A2	1
<i>Pseudognaphalium biolettii</i>	cudweed	P					yes					A2	1
<i>Quercus chrysolepis</i>	canyon live oak	T					yes	yes				A2	2
<i>Sambucus racemosa var. racemosa</i>	red elderberry	S	yes				yes					A1	2
<i>Sanicula laciniata</i>	coastal blacksnakeroot	P					yes	yes				A2	2
<i>Setaria parviflora</i>	marsh bristlegrass	PG					yes					A2	1
<i>Streptanthus albidus subsp. peramoenus</i>	most beautiful jewelflower	A						yes				*A2	1
<i>Stylocline gnaphaloides</i>	everlasting nest straw	A					yes					A2	1
<i>Trillium ovatum subsp. ovatum</i>	white trillium	P					yes					A2	1
<i>Viola adunca subsp. adunca</i>	western dog violet	P					yes					A1	1
<i>Viola glabella</i>	stream violet	P					yes					A2	1
<i>Viola sempervirens</i>	evergreen violet	P			yes		yes					A1	2
Found in the park			97	21	123	76	252	204	64	28		85	
Planted in the park			0	0	0	0	0	0	0	0		0	
Total natives found or planted			97	21	123	76	252	204	64	28		85	
Presumed extirpated							2						

Key		
Lifeform:	Location Symbols:	
A - Annual	yes	identified in park
B - Biennial	yes?	ID tentative
F - Fern	x?	extirpated?

Scientific Name	Common Name	Lifeform	Beacons field	Butters Canyon	Dimond Canyon	Garber	Joaquin Miller	Knowland	Leona	Marge Saunders	Shepherd Canyon + MRRT	EBCNPS Rank	How many parks?
	G, GL - Grass, Grasslike												
	P - Perennial												
	S - Shrub												
	T - Tree												
	V - Vine												

Notes:

- * Some of the data was collected on a "watershed" basis, and includes vegetation outside the park boundaries.
- * Dimond Canyon includes Dimond Park, but excludes the native plant demonstration garden there
- * Shepherd Canyon includes Montclair RR Trail & Montclair Park

List compiled by Karen Paulsell, with information from stewards of many Oakland Parks, who have come together in an informal group called the OWLS. Comments to: kpaulsell@pacbell.net

IPaC resource list

Project information

NAME

Oakland Vegetation Management

LOCATION

Alameda and Contra Costa counties, California



Local office

Sacramento Fish And Wildlife Office

☎ (916) 414-6600

📠 (916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and should not be used for planning or analyzing project level impacts.

[Section 7](#) of the Endangered Species Act **requires** Federal agencies to “request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action” for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Review section in IPaC or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by creating a project and making a request from the Regulatory Review section.

Listed species¹ are managed by the [Endangered Species Program](#) of the U.S. Fish and Wildlife Service.

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information.

The following species are potentially affected by activities in this location:

Amphibians

NAME

STATUS

California Red-legged Frog *Rana draytonii* Threatened
There is a **final critical habitat** designated for this species. Your location is outside the designated critical habitat.
<http://ecos.fws.gov/ecp/species/2891>

California Tiger Salamander *Ambystoma californiense* Threatened
There is a **final critical habitat** designated for this species. Your location is outside the designated critical habitat.
<http://ecos.fws.gov/ecp/species/2076>

Birds

NAME	STATUS
California Clapper Rail <i>Rallus longirostris obsoletus</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/4240	Endangered
California Least Tern <i>Sterna antillarum browni</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/8104	Endangered
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo <i>Coccyzus americanus</i> There is a proposed critical habitat for this species. Your location is outside the proposed critical habitat. http://ecos.fws.gov/ecp/species/3911	Threatened

Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/498	Threatened

Fishes

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/321	Threatened
Steelhead <i>Oncorhynchus (=Salmo) mykiss</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/1007	Threatened
Tidewater Goby <i>Eucyclogobius newberryi</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/57	Endangered

Flowering Plants

NAME	STATUS
California Seablite <i>Suaeda californica</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/6310	Endangered

Contra Costa Goldfields <i>Lasthenia conjugens</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/7058	Endangered
Pallid Manzanita <i>Arctostaphylos pallida</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/8292	Threatened
Presidio Clarkia <i>Clarkia franciscana</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/3890	Endangered
Robust Spineflower <i>Chorizanthe robusta</i> var. <i>robusta</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/9287	Endangered
Santa Cruz Tarplant <i>Holocarpha macradenia</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/6832	Threatened

Insects

NAME	STATUS
Bay Checkerspot Butterfly <i>Euphydryas editha bayensis</i> There is a final critical habitat designated for this species. Your location is outside the designated critical habitat. http://ecos.fws.gov/ecp/species/2320	Threatened
Callippe Silverspot Butterfly <i>Speyeria callippe callippe</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/3779	Endangered
San Bruno Elfin Butterfly <i>Callophrys mossii bayensis</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/3394	Endangered

Mammals

NAME	STATUS
Salt Marsh Harvest Mouse <i>Reithrodontomys raviventris</i> No critical habitat has been designated for this species. http://ecos.fws.gov/ecp/species/613	Endangered

Reptiles

NAME	STATUS
Alameda Whipsnake (=striped Racer) <i>Masticophis lateralis euryxanthus</i> There is a final critical habitat designated for this species. Your location overlaps the designated critical habitat. http://ecos.fws.gov/ecp/species/5524	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Alameda Whipsnake (=striped Racer) <i>Masticophis lateralis euryxanthus</i> http://ecos.fws.gov/ecp/species/5524#crithab	Final designated

Migratory birds

Birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service³. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Conservation measures for birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Year-round bird occurrence data <http://www.birdscanada.org/birdmon/default/datasummaries.jsp>

The migratory birds species listed below are species of particular conservation concern (e.g. [Birds of Conservation Concern](#)) that may be potentially affected by activities in this location, not a list of every bird species you may find in this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the [AKN Histogram Tools](#) and [Other Bird Data Resources](#).

NAME	SEASON(S)
Allen's Hummingbird <i>Selasphorus sasin</i> http://ecos.fws.gov/ecp/species/9637	Breeding
Bald Eagle <i>Haliaeetus leucocephalus</i> http://ecos.fws.gov/ecp/species/1626	Year-round
Bell's Sparrow <i>Amphispiza belli</i> http://ecos.fws.gov/ecp/species/9303	Year-round
Black Oystercatcher <i>Haematopus bachmani</i> http://ecos.fws.gov/ecp/species/9591	Year-round
Black Rail <i>Laterallus jamaicensis</i> http://ecos.fws.gov/ecp/species/7717	Breeding
Black Skimmer <i>Rynchops niger</i> http://ecos.fws.gov/ecp/species/5234	Breeding
Black-chinned Sparrow <i>Spizella atrogularis</i> http://ecos.fws.gov/ecp/species/9447	Breeding
Burrowing Owl <i>Athene cunicularia</i> http://ecos.fws.gov/ecp/species/9737	Year-round
Costa's Hummingbird <i>Calypte costae</i> http://ecos.fws.gov/ecp/species/9470	Breeding
Fox Sparrow <i>Passerella iliaca</i>	Wintering
Lawrence's Goldfinch <i>Carduelis lawrencei</i> http://ecos.fws.gov/ecp/species/9464	Breeding

Least Bittern <i>Ixobrychus exilis</i> http://ecos.fws.gov/ecp/species/6175	Breeding
Lesser Yellowlegs <i>Tringa flavipes</i> http://ecos.fws.gov/ecp/species/9679	Wintering
Lewis's Woodpecker <i>Melanerpes lewis</i> http://ecos.fws.gov/ecp/species/9408	Wintering
Long-billed Curlew <i>Numenius americanus</i> http://ecos.fws.gov/ecp/species/5511	Wintering
Marbled Godwit <i>Limosa fedoa</i> http://ecos.fws.gov/ecp/species/9481	Wintering
Nuttall's Woodpecker <i>Picoides nuttallii</i> http://ecos.fws.gov/ecp/species/9410	Year-round
Oak Titmouse <i>Baeolophus inornatus</i> http://ecos.fws.gov/ecp/species/9656	Year-round
Olive-sided Flycatcher <i>Contopus cooperi</i> http://ecos.fws.gov/ecp/species/3914	Breeding
Peregrine Falcon <i>Falco peregrinus</i> http://ecos.fws.gov/ecp/species/8831	Year-round
Red Knot <i>Calidris canutus</i> ssp. <i>roselaari</i> http://ecos.fws.gov/ecp/species/8880	Wintering
Rufous-crowned Sparrow <i>Aimophila ruficeps</i> http://ecos.fws.gov/ecp/species/9718	Year-round
Short-billed Dowitcher <i>Limnodromus griseus</i> http://ecos.fws.gov/ecp/species/9480	Wintering
Short-eared Owl <i>Asio flammeus</i> http://ecos.fws.gov/ecp/species/9295	Wintering
Snowy Plover <i>Charadrius alexandrinus</i>	Breeding
Tricolored Blackbird <i>Agelaius tricolor</i> http://ecos.fws.gov/ecp/species/3910	Year-round
Western Grebe <i>Aechmophorus occidentalis</i> http://ecos.fws.gov/ecp/species/6743	Year-round
Whimbrel <i>Numenius phaeopus</i> http://ecos.fws.gov/ecp/species/9483	Wintering
Yellow Rail <i>Coturnicops noveboracensis</i> http://ecos.fws.gov/ecp/species/9476	Wintering

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range

information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAAANCCOS models: the models were developed as part of the NOAAANCCOS project: [Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#). The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the [Northeast Ocean Data Portal](#), which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The [Avian Knowledge Network \(AKN\)](#) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest, survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the [Migratory Bird Programs AKN Histogram Tools](#) webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAAANCCOS [Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project](#) webpage.

Facilities

Wildlife refuges

Any activity proposed on [National Wildlife Refuge](#) lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the [NWI map](#) to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Table A-1
Special-Status Wildlife and Plant Species Not Expected to Occur in the Plan Area

Table A-1. Special Status Plants

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Anomobryum julaceum</i> slender silver moss	-/-/4.2	Broadleafed upland forest, lower montane coniferous forest, north coast coniferous forest. Moss which grows on damp rocks and soil; acidic substrates. Usually seen on roadcuts. 100-1,000 meters.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Arabis blepharophylla</i> coast rockcress	-/-/4.3	Broadleafed upland forest, coastal prairie, coastal scrub, coastal bluff scrub. Rocky sites. 3-1,100 meters. Blooms February through May.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Arctostaphylos auriculata</i> Mt. Diablo manzanita	-/-/1B.3	Chaparral, cismontane woodland. In canyons and on slopes. On sandstone. 180 -565 meters. Blooms January through March.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Arctostaphylos manzanita</i> ssp. <i>laevigata</i> Contra Costa manzanita	-/-/1B.2	Chaparral. Rocky slopes. 150-610 meters. Blooms January through March.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Astragalus tener</i> var. <i>tener</i> alkali milk-vetch	-/-/1B.2	Alkali playa, valley and foothill grassland, vernal pools. Low ground, alkali flats, and flooded lands; in annual grassland or in playas or vernal pools. 0-168 meters. Blooms March through June.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Calandrinia breweri</i> Brewer's calandrinia	-/-/4.2	Chaparral, coastal scrub. Sandy or loamy soils. Disturbed sites, burns. 10-1,200 meters. Blooms	Not expected. Not known from Alameda County (CNPS 2017).

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
		March through June.	
<i>Calochortus pulchellus</i> Mt. Diablo fairy-lantern	-/-/1B.2	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland. On wooded and brushy slopes. 30-915 meters. Blooms April through June.	Not expected. This species is generally known from east of the Oakland hills.
<i>Calystegia purpurata</i> ssp. <i>saxicola</i> coastal bluff morning-glory	-/-/1B.2	Coastal dunes, coastal scrub, coastal bluff scrub, north coast coniferous forest. 10-105 meters. Blooms March through September.	Not expected. Marginally suitable habitat is present in the Plan Area, not known from Alameda County (CNPS 2017)
<i>Campanula exigua</i> chaparral harebell	-/-/1B.2	Chaparral. Rocky sites, usually on serpentine in chaparral. 275-1,250 meters. Blooms May through June.	Not expected. Suitable habitat is present in the Plan Area, but the closest occurrences are on Mt. Diablo. Not known from the Oakland Hills (CNPS 2017)
<i>Carex comosa</i> bristly sedge	-/-/2B.1	Marshes and swamps, coastal prairie, valley and foothill grassland. Lake margins, wet places; site below sea level is on a Delta island. -5-1,620 meters. Blooms May through September.	Not expected. Marginally suitable habitat is present in the Plan Area. Not known from Alameda County (CNPS 2017).
<i>Centromadia parryi</i> ssp. <i>congdonii</i> Congdon's tarplant	-/-/1B.1	Valley and foothill grassland. Alkaline soils, sometimes described as heavy white clay. 0-230 meters. Blooms May through November.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Chloropyron maritimum</i> ssp. <i>palustre</i> Point Reyes salty bird's-beak	-/-/1B.2	Coastal salt marsh. Usually in coastal salt marsh with <i>Salicornia</i> , <i>Distichlis</i> , <i>Jaumea</i> , <i>Spartina</i> , etc. 0-115 meters. Blooms June through October.	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Chorizanthe cuspidata</i> var. <i>cuspidata</i> San Francisco Bay spineflower	-/-/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub. Closely related to <i>C. pungens</i> . Sandy soil on terraces and slopes. 3-215 meters. Blooms April through August.	Not expected. Marginally suitable habitat is present in the Plan Area and this species is considered extirpated from Alameda County (CNPS 2017).
<i>Chorizanthe robusta</i> var. <i>robusta</i> robust spineflower	FE/-/1B.1	Cismontane woodland, coastal dunes, coastal scrub, chaparral. Sandy terraces and bluffs or in loose sand. 9-245 meters. Blooms April through September.	None. Currently known populations of this species are restricted to Santa Cruz County (USFWS 2010).
<i>Cicuta maculata</i> var. <i>bolanderi</i> Bolander's water-hemlock	-/-/2B.1	Marshes and swamps, fresh or brackish water. 0-200 meters. Blooms July through September.	None. Suitable habitat is not present in the Plan Area.
<i>Cirsium andrewsii</i> Franciscan thistle	-/-/1B.2	Coastal bluff scrub, broadleaved upland forest, coastal scrub, coastal prairie. Sometimes serpentine seeps. 0-150 meters. Blooms March through July.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Clarkia concinna</i> ssp. <i>automixa</i> Santa Clara red ribbons	-/-/4.3	Cismontane woodland, chaparral. On slopes and near drainages. 90-1,500 meters. Blooms April through July.	Not expected. Suitable habitat is present in the Plan Area, but the closest occurrences are in the vicinity of Pleasonton (approximately 12 miles southeast of the Plan Area).
<i>Collomia diversifolia</i> serpentine collomia	-/-/4.3	Chaparral, cismontane woodland. On ultramafic soils, rocky or gravelly sites. 300-600 meters. Blooms May through June.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Cordylanthus nidularius</i> Mt. Diablo bird's-	-/SR/1B.1	Chaparral. Grassy or rocky areas within serpentine chaparral. 485-735 meters. Blooms July through August.	Not expected. Known from only one occurrence on Mt. Diablo (CNPS 2017).

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
beak			
<i>Delphinium californicum</i> ssp. <i>interius</i> Hospital Canyon larkspur	-/-/1B.2	Cismontane woodland, chaparral, coastal scrub. In wet, boggy meadows, openings in chaparral and in canyons. 195-1,095 meters. Blooms April through June.	Not expected. This species is not known from the Oakland hills (CNPS 2017).
<i>Eriastrum erterae</i> Lime Ridge eriastrum	-/-/1B.1	Chaparral. Openings or edges; alkaline or semi-alkaline, sandy. 200-290 meters. Blooms June through July.	Not expected. Marginally suitable habitat is present in the Plan Area. Known only from the Lime Ridge area in Walnut Creek (CNPS 2017).
<i>Eriogonum truncatum</i> Mt. Diablo buckwheat	-/-/1B.1	Chaparral, coastal scrub, valley and foothill grassland. Dry, exposed clay or sandy substrates. 105-350 meters. Blooms April through December.	Not expected. Only known extant population is located in Mount Diablo State Park (CNPS 2017).
<i>Eriophyllum jepsonii</i> Jepson's woolly sunflower	-/-/4.3	Coastal scrub, chaparral, cismontane woodland. Sometimes on serpentine. 200-1,025 meters. Blooms April through June.	Not expected. This species is not known from the Oakland hills (CNPS 2017).
<i>Eryngium jepsonii</i> Jepson's coyote-thistle	-/-/1B.2	Vernal pools, valley and foothill grassland. Clay. 3-300 meters. Blooms April through August.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Extriplex joaquinana</i> San Joaquin spearscale	-/-/1B.2	Chenopod scrub, alkali meadow, playas, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with <i>Distichlis spicata</i> , <i>Frankenia</i> , etc. 1-835 meters. Blooms April through October.	None. Suitable habitat is not present in the Plan Area.
<i>Gilia capitata</i> ssp. <i>chamissonis</i>	-/-/1B.1	Coastal dunes, coastal scrub. 3-200 meters. Blooms April through July.	Not expected. Marginally suitable habitat is present in the Plan Area and this species is not known from the

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
blue coast gilia			Oakland hills (CNPS 2017).
<i>Gilia millefoliata</i> dark-eyed gilia	-/-/1B.2	Coastal dunes. 1-60 meters. Blooms April through July.	None. Suitable habitat is not present in the Plan Area.
<i>Grimmia torenii</i> Toren's grimmia	-/-/1B.3	Cismontane woodland, lower montane coniferous forest, chaparral. Openings, rocky, boulder and rock walls, carbonate, volcanic. 325-1,160 meters.	Not expected. Not known from Alameda County. The Contra Costa County occurrence is in the vicinity of Mount Diablo (CNPS 2017).
<i>Hesperolinon breweri</i> Brewer's western flax	-/-/1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Often in rocky serpentine soil in serpentine chaparral and serpentine grassland. 195-885 meters. Blooms May through July.	Not expected. Not known from Alameda County and Contra Costa County occurrences are in the vicinity of Mount Diablo (CNPS 2017).
<i>Heteranthera dubia</i> water star-grass	-/-/2B.2	Marshes and swamps. Alkaline, still or slow-moving water. Requires a pH of 7 or higher, usually in slightly eutrophic waters. 15-1,510 meters. Blooms July through October.	None. Suitable habitat is not present in the Plan Area.
<i>Holocarpha macradenia</i> Santa Cruz tarplant	FT/SE/1B.1	Coastal prairie, coastal scrub, valley and foothill grassland. Light, sandy soil or sandy clay; often with nonnatives. 10-220 meters. Blooms June through October.	Not expected. This species is considered extirpated from Alameda County (USFWS 2014).
<i>Horkelia cuneata</i> var. <i>sericea</i> Kellogg's horkelia	-/-/1B.1	Closed-cone coniferous forest, coastal scrub, coastal dunes, chaparral. Old dunes, coastal sandhills; openings. 5-215 meters. Blooms April through September.	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Iris longipetala</i> coast iris	-/-/4.2	Coastal prairie, lower montane coniferous forest, meadows and seeps. Mesic sites, heavy soils. 0-600 meters.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Isocoma arguta</i> Carquinez goldenbush	-/-/1B.1	Valley and foothill grassland. Alkaline soils, flats, lower hills. On low benches near drainages and on tops and sides of mounds in swale habitat. 1-50 meters. Blooms August through December.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Juglans californica</i> southern California black walnut	-/-/4.2	Chaparral, coastal scrub, cismontane woodland. Slopes, canyons, alluvial habitats. 50-900 meters. Blooms March through August.	Not expected. Bioregional distribution described as Outer South Coast Ranges and Southwestern California (Whittemore 2017).
<i>Juglans hindsii</i> Northern California black walnut	-/-/1B.1	Riparian forest, riparian woodland. Few extant native stands remain; widely naturalized. Deep alluvial soil, associated with a creek or stream. 0-640 meters. Blooms April through May.	None. No native stands within the Plan Area, although naturalized stands may occur.
<i>Lasthenia conjugens</i> Contra Costa goldfields	FE/-/1B.1	Valley and foothill grassland, vernal pools, alkaline playas, cismontane woodland. Vernal pools, swales, low depressions, in open grassy areas. 1-450 meters. Blooms March through June.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Lathyrus jepsonii</i> var. <i>jepsonii</i> Delta tule pea	-/-/1B.2	Freshwater and brackish marshes. Often found with <i>Typha</i> , <i>Aster lentus</i> , <i>Rosa californica</i> , <i>Juncus</i> spp., <i>Scirpus</i> , etc. Usually on marsh and slough edges. 0-5 meters. Blooms May through July.	None. Suitable habitat is not present in the Plan Area.
<i>Layia carnosa</i> beach layia	FE/SE/1B.1	Coastal dunes, coastal scrub. On sparsely vegetated, semi-stabilized dunes, usually behind foredunes. 0-30 meters. Blooms March through July.	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Leptosiphon rosaceus</i> rose leptosiphon	-/-/1B.1	Coastal bluff scrub. 10-140 meters. Blooms April through July.	None. Suitable habitat is not present in the Plan Area.
<i>Malacothamnus hallii</i> Hall's bush-mallow	-/-/1B.2	Chaparral, coastal scrub. Some populations on serpentine. 10-730 meters. Blooms May through October.	Not expected. This species is not known from Alameda County (CNPS 2017).
<i>Monardella antonina</i> ssp. <i>antonina</i> San Antonio Hills monardella	-/-/3	Cismontane woodland, chaparral. 320-1,000 meters. Blooms June through August.	None. This taxon is now considered to be synonymous with <i>Monardella villosa</i> ssp. <i>villosa</i> , a common species (Sanders et al. 2017).
<i>Monolopia gracilens</i> woodland woollythreads	-/-/1B.2	Chaparral, valley and foothill grassland, cismontane woodland, broadleafed upland forest, north coast coniferous forest. Grassy sites, in openings; sandy to rocky soils. Often seen on serpentine after burns but may have only weak affinity to serpentine. 100-1,200 meters. Blooms February through July.	Not expected. Suitable habitat is present in the Plan Area, but this species has not been observed in the Oakland Hills since 1888.
<i>Navarretia gowenii</i> Lime Ridge navarretia	-/-/1B.1	Chaparral. On calcium carbonate-rich soil with high clay content. 180-305 meters. Blooms May through June.	Not expected. Marginally suitable habitat is present in the Plan Area. Known only from 4 occurrences, none of which are in Alameda County (CNPS 2017).
<i>Navarretia nigelliformis</i> ssp. <i>radians</i> shining navarretia	-/-/1B.2	Cismontane woodland, valley and foothill grassland, vernal pools. Apparently in grassland, and not necessarily in vernal pools. 60-975 meters. Blooms March through July.	Not expected. Suitable habitat is present in the Plan Area, but this species is not known from the Oakland Hills (CNPS 2017).
<i>Oenothera deltoides</i> ssp. <i>howellii</i> Antioch Dunes	FE/SE/1B.1	Interior dunes. Remnant river bluffs and sand dunes east of Antioch. 0-30 meters. Blooms March through September.	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
evening-primrose			
<i>Phacelia phacelioides</i> Mt. Diablo phacelia	-/-/1B.2	Chaparral, cismontane woodland. Adjacent to trails, on rock outcrops and talus slopes; sometimes on serpentine. 605-1,345 meters. Blooms April through May.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Piperia michaelii</i> Michael's rein orchid	-/-/4.2	Coastal bluff scrub, coastal scrub, cismontane woodland, chaparral, closed-cone coniferous forest, lower montane coniferous forest. Mudstone and humus, generally dry sites. 3-915 meters. Blooms April through August.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Plagiobothrys chorisianus</i> var. <i>chorisianus</i> Choris' popcornflower	-/-/1B.2	Chaparral, coastal scrub, coastal prairie. Mesic sites. 15-160 meters. Blooms March through June.	Not expected. Known population in Alameda county is considered extirpated (CNPS 2017).
<i>Plagiobothrys glaber</i> hairless popcornflower	-/-/1A	Meadows and seeps, marshes and swamps. Coastal salt marshes and alkaline meadows. 5-180 meters. Blooms March through May.	None. Suitable habitat is not present in the Plan Area. This species is also presumed extinct.
<i>Polygonum marinense</i> Marin knotweed	-/-/3.1	Marshes and swamps. Coastal salt marshes and brackish marshes. 0-10 meters. Blooms April through October.	None. Suitable habitat is not present in the Plan Area.
<i>Sanicula maritima</i> adobe sanicle	-/SR/1B.1	Meadows and seeps, valley and foothill grassland, chaparral, coastal prairie. Moist clay or ultramafic soils. 30-240 meters. Blooms February through May.	Not expected. Presumed extirpated from Alameda County (CNPS 2017).

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Sanicula saxatilis</i> rock sanicle	-/SR/1B.2	Broadleaved upland forest, chaparral, valley and foothill grassland. Bedrock outcrops and talus slopes in chaparral or oak woodland habitat. 670-1250 meters. Blooms April through May.	None. The Plan Area is not within the elevation range for this species.
<i>Senecio aphanactis</i> chaparral ragwort	-/-/2B.2	Chaparral, cismontane woodland, coastal scrub. Drying alkaline flats. 20-855 meters. Blooms January through May.	None. Suitable habitat is not present in the Plan Area.
<i>Streptanthus hispidus</i> Mt. Diablo jewelflower	-/-/1B.3	Valley and foothill grassland, chaparral. Talus or rocky outcrops. 245-975 meters. Blooms March through June.	Not expected. Known only from Contra Costa County (CNPS 2017).
<i>Stuckenia filiformis</i> ssp. <i>alpina</i> slender-leaved pondweed	-/-/2B.2	Marshes and swamps. Shallow, clear water of lakes and drainage channels. 300-2,150 meters. Blooms May through July.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Suaeda californica</i> California seablite	FE/-/1B.1	Marshes and swamps. Margins of coastal salt marshes. 0-5 meters. Blooms July through October.	None. Suitable habitat is not present in the Plan Area.
<i>Trifolium hydrophilum</i> saline clover	-/-/1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 meters. Blooms April through June.	None. Suitable habitat is not present in the Plan Area.
<i>Triphysaria floribunda</i> San Francisco owl's- clover	-/-/1B.2	Coastal prairie, coastal scrub, valley and foothill grassland. On serpentine and non-serpentine substrate (such as at Pt. Reyes). 1-150 meters. Blooms April through June.	Not expected. Not known from Alameda County (CNPS 2017).
<i>Triquetrella californica</i> coastal triquetrella	-/-/1B.2	Coastal bluff scrub, coastal scrub. Grows within 30m from the coast in coastal scrub, grasslands and in open gravels on roadsides, hillsides, rocky	Not expected. Not known from Alameda County (CNPS 2017).

Name	Listing status* (Federal/ State/CRPR)	Habitat and Flowering Period	Potential to Occur in the Plan Area
		slopes, and fields. On gravel or thin soil over outcrops. 10-100 meters.	
<i>Tropidocarpum capparideum</i> caper-fruited tropidocarpum	-/-/1B.1	Valley and foothill grassland. Alkaline clay. 0-360 meters. Blooms March through April.	Not expected. Marginally suitable habitat is present in the Plan Area. Presumed extirpated from Alameda County (CNPS 2017).
<p>* List of Abbreviations for Species Status follow below:</p> <p>FT = Federal threatened FE = Federal endangered SE = State endangered SR = State Rare</p>			

Table A-2. Special-status Wildlife

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
Amphibians and Reptiles			
<i>Ambystoma californiense</i> California tiger salamander	FT/ST	Central Valley DPS federally listed as threatened. Santa Barbara and Sonoma counties DPS federally listed as endangered. Need underground refuges, especially ground squirrel burrows, and vernal pools or other seasonal water sources for breeding.	Not expected. Marginally suitable habitat is present in the Plan Area. Only one CNDDDB occurrence (listed as extirpated) is located within the USGS quadrangles containing the Plan Area.
<i>Rana boylei</i> foothill yellow-legged frog	-/SSC	Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg-laying. Need at least 15 weeks to attain metamorphosis.	Not expected. Marginally suitable habitat is present in Plan Area streams. A CNDDDB occurrence is located approximately 1.2 miles northeast of the Plan Area in Contra Costa County, but there are no occurrences in Oakland.
Invertebrates			
<i>Branchinecta lynchi</i> vernal pool fairy shrimp	FT/-	Endemic to the grasslands of the Central Valley, Central Coast mountains, and South Coast mountains, in astatic rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	None. Suitable habitat is not present in the Plan Area.
<i>Euphydryas editha bayensis</i> Bay checkerspot butterfly	FT/-	Restricted to native grasslands on outcrops of serpentine soil in the vicinity of San Francisco Bay. <i>Plantago erecta</i> is the primary host plant; <i>Orthocarpus densiflorus</i> and <i>O. purpurascens</i> are the secondary host plants.	None. The current range of this species is restricted to Santa Clara County (USFWS 2009).
Birds			
<i>Athene cunicularia</i>	-/SSC	Open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation. Subterranean nester,	Not Expected. Preferred habitat is not present, but species could occur in open areas and

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
Burrowing Owl		dependent upon burrowing mammals, most notably, the California ground squirrel.	possibly urban habitats.
<i>Charadrius alexandrinus nivosus</i> Western Snowy Plover	FT/SSC	Sandy beaches, salt pond levees and shores of large alkali lakes. Needs sandy, gravelly or friable soils for nesting.	None. Suitable habitat is not present in the Plan Area.
<i>Circus cyaneus</i> Northern Harrier	-/SSC	Coastal salt and fresh-water marsh. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	Not expected. Marginally suitable habitat is present in the Project Area.
<i>Falco peregrinus anatum</i> American Peregrine Falcon	FD/SD, SFP	Near wetlands, lakes, rivers, or other water; on cliffs, banks, dunes, mounds; also, human-made structures. Nest consists of a scrape or a depression or ledge in an open site.	Not expected. Marginally suitable habitat is present in the Plan Area. Suitable nesting habitat is not anticipated.
<i>Geothlypis trichas sinuosa</i> Saltmarsh Common Yellowthroat	-/SSC	Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting.	None. No breeding habitat in the project area for this subspecies. This species inhabits coastal lowlands, brackish marshes. Other subspecies of Common Yellowthroat, which are not special-status species may frequent the project area.
<i>Haliaeetus leucocephalus</i> Bald Eagle	FD/SE	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mi of water. Nests in large, old-growth, or dominant live tree w/open branches, especially ponderosa pine. Roosts communally in winter.	None. Suitable habitat is not present in the Project Area
<i>Laterallus jamaicensis coturniculus</i>	-/ST	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year and dense	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
California Black Rail		vegetation for nesting habitat.	
<i>Melospiza melodia maxillaris</i> Suisun Song Sparrow	-/SSC	Resident of brackish-water marshes surrounding Suisun Bay. Inhabits cattails, tules and other sedges, and Salicornia; also known to frequent tangles bordering sloughs.	None. Suitable habitat is not present in the Plan Area.
<i>Melospiza melodia pusillula</i> Alameda Song Sparrow	-/SSC	Resident of salt marshes bordering south arm of San Francisco Bay. Inhabits Salicornia marshes; nests low in Grindelia bushes (high enough to escape high tides) and in Salicornia.	None. Suitable habitat is not present in the Plan Area.
<i>Melospiza melodia samuelis</i> San Pablo Song Sparrow	-/SSC	Resident of salt marshes along the north side of San Francisco and San Pablo bays. Inhabits tidal sloughs in the Salicornia marshes; nests in Grindelia bordering slough channels.	None. Suitable habitat is not present in the Plan Area.
<i>Rallus longirostris obsoletus</i> California Clapper Rail	FE/SE, SFP	Salt-water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs.	None. Suitable habitat is not present in the Plan Area.
<i>Rynchops niger</i> Black Skimmer	-/SSC	Nests on gravel bars, low islets, and sandy beaches, in unvegetated sites. Nesting colonies usually less than 200 pairs.	None. Suitable habitat is not present in the Plan Area.
<i>Sternula antillarum browni</i> California Least Tern	FE/SE	Nests along the coast from San Francisco Bay south to northern Baja California. Colonial breeder on bare or sparsely vegetated, flat substrates: sand beaches, alkali flats, land fills, or paved areas.	None. Suitable habitat is not present in the Plan Area.
<i>Xanthocephalus xanthocephalus</i>	-/SSC	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where	None. Suitable habitat is not present in the Plan Area.

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
Yellow-headed Blackbird		large insects such as <i>Odonata</i> are abundant, nesting timed with maximum emergence of aquatic insects.	
Fish			
<i>Archoplites interruptus</i> Sacramento perch	-/SSC	Historically found in the sloughs, slow-moving rivers, and lakes of the Central Valley. Prefers warm water. Aquatic vegetation is essential for young. Tolerates wide range of physio-chemical water conditions.	None. Suitable habitat is not present in the Plan Area.
<i>Eucyclogobius newberryi</i> tidewater goby	FE/SSC	Brackish water habitats along the Calif coast from Agua Hedionda Lagoon, San Diego Co. to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	None. Suitable habitat is not present in the Plan Area.
<i>Spirinchus thaleichthys</i> longfin smelt	FC/ST, SSC	Euryhaline, nektonic and anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater.	None. Suitable habitat is not present in the Plan Area.
Mammals			
<i>Corynorhinus townsendii</i> Townsend's big-eared bat	-/SSC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	Not expected. Marginally suitable habitat is present in the Plan Area.
<i>Microtus californicus sanpabloensis</i> San Pablo vole	-/SSC	Saltmarshes of San Pablo Creek, on the south shore of San Pablo Bay. Constructs burrow in soft soil. Feeds on grasses, sedges and herbs. Forms a network of runways leading from the burrow	None. Suitable habitat is not present in the Plan Area.
<p>* List of Abbreviations for Species Status follow below: FT = Federal threatened</p>			

Name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
<p>FE = Federal endangered FC = Federal candidate FD = Federal delisted ST = State threatened SE = State endangered SSC = Species of special concern SFP = State fully protected</p>			

Appendix B

Species Observed in the Plan Area during
Reconnaissance Surveys

Plants

Scientific Name	Common name
<i>Acacia dealbata</i>	silver wattle
<i>Acer macrophyllum</i>	bigleaf maple
<i>Achillea millefolium</i>	yarrow
<i>Adiantum jordanii</i>	California maidenhair fern
<i>Aesculus californica</i>	California buckeye
<i>Alnus rhombifolia</i>	white alder
<i>Arbutus menziesii</i>	madrone
<i>Arctostaphylos pallida</i>	pallid manzanita
<i>Artemisia californica</i>	California sagebrush
<i>Asarum caudatum</i>	wild ginger
<i>Avena barbata</i>	slender wild oat
<i>Avena fatua</i>	wild oat
<i>Baccharis pilularis</i>	coyotbrush
<i>Bellardia trixago</i>	mediterranean lineseed
<i>Briza maxima</i>	large rattlesnake grass
<i>Bromus carinatus</i>	California brome
<i>Bromus diandrus</i>	ripgut brome
<i>Bromus hordeaceus</i>	soft brome
<i>Bromus madritensis</i> ssp. <i>rubens</i>	foxtail brome
<i>Cardamine californica</i>	milk maids
<i>Carduus pycnocephalus</i>	Italian thistle
<i>Carex</i> spp.	sedges
<i>Castilleja exserta</i>	purple owl's clover
<i>Chasmanthe floribunda</i>	chasmanthe
<i>Chlorogalum pomeridianum</i> var. <i>pomeridianum</i>	soap plant
<i>Cirsium vulgare</i>	bull thistle
<i>Claytonia perfoliata</i>	miner's lettuce
<i>Conium maculatum</i>	poison hemlock
<i>Cortaderia jubata</i>	pampas grass
<i>Corylus cornuta</i> var. <i>californica</i>	California hazelnut
<i>Cotoneaster</i> spp.	cotoneaster
<i>Cynara cardunculus</i>	artichoke thistle
<i>Cynoglossum grande</i>	western houndstongue
<i>Cynosurus echinatus</i>	dogtail grass
<i>Cyperus eragrostis</i>	tall flatsedge
<i>Cytisus scoparius</i>	scotch broom
<i>Danthonia californica</i>	California oatgrass
<i>Delairea odorata</i>	cape ivy
<i>Dichelostemma capitatum</i> ssp. <i>capitatum</i>	bluedicks
<i>Dryopteris arguta</i>	California wood fern
<i>Duchesnea indica</i>	mock strawberry
<i>Ehrharta erecta</i>	veldt grass
<i>Elymus glaucus</i>	blue wildrye
<i>Equisetum telmateia</i> ssp. <i>braunii</i>	giant horsetail
<i>Erodium botrys</i>	broad leaf filaree

<i>Erodium cicutarium</i>	red stemmed filaree
<i>Eschscholzia californica</i>	California poppy
<i>Eucalyptus globulus</i>	blue gum eucalyptus
<i>Euphorbia peplus</i>	petty spurge
<i>Festuca bromoides</i>	brome fescue
<i>Festuca microstachys</i>	small fescue
<i>Festuca perennis</i>	Italian rye grass
<i>Fragaria vesca</i>	wood strawberry
<i>Galium aparine</i>	common bedstraw
<i>Galium porrigens</i> var. <i>porrigens</i>	Climbing bedstraw
<i>Galium triflorum</i>	sweet-scented bedstraw
<i>Genista monspessulana</i>	French broom
<i>Geranium dissectum</i>	cutleaf geranium
<i>Hedera helix</i>	English ivy
<i>Heracleum maximum</i>	cowparsnip
<i>Hesperocyparis macrocarpa</i>	Monterey cypress
<i>Holcus lanatus</i>	purple velvet grass
<i>Holodiscus discolor</i>	ocean spray
<i>Hordeum murinum</i>	foxtail barley
<i>Hypochaeris glabra</i>	Smooth cat's ear
<i>Hypochaeris radicata</i>	hairy cat's-ear
<i>Ilex aquifolium</i>	English holly
<i>Juncus effusus</i> var. <i>pacificus</i>	Pacific rush
<i>Juncus patens</i>	spreading rush
<i>Lactuca serriola</i>	prickly lettuce
<i>Lathyrus vestitus</i>	Pacific pea
<i>Lathyrus vestitus</i>	Bolander's pea
<i>Lonicera hispidula</i>	pink honeysuckle
<i>Lupinus bicolor</i>	annual lupine
<i>Lupinus succulentus</i>	arroyo lupine
<i>Lysimachia arvensis</i>	scarlet pimpernel
<i>Maianthemum racemosum</i>	false solomon's seal
<i>Marah fabaceus</i>	California man-root
<i>Marah oregana</i>	coast man-root
<i>Melica</i> sp.	melic
<i>Mimulus aurantiacus</i>	bush monkeyflower
<i>Myosotis latifolia</i>	forget-me-not
<i>Oemleria cerasiformis</i>	oso berry
<i>Olea europaea</i>	olive
<i>Oxalis oregana</i>	redwood sorrel
<i>Oxalis pes-caprae</i>	Bermuda buttercup
<i>Pentagramma triangularis</i>	goldenback fern
<i>Phalaris</i> sp.	canarygrass
<i>Pinus radiata</i>	Monterey pine
<i>Plagiobothrys</i>	popcorn flower
<i>Poa annua</i>	annual bluegrass
<i>Polypodium calirhiza</i>	acid fern

<i>Polystichum munitum</i>	western sword fern
<i>Populus fremontii</i>	Fremont cottonwood
<i>Populus trichocarpa</i>	black cottonwood
<i>Pseudotsuga menziesii</i>	Douglas fir
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	western bracken fern
<i>Quercus agrifolia</i>	coast live oak
<i>Raphanus sativus</i>	wild radish
<i>Rhamnus californica</i>	coffeeberry
<i>Ribes californicum</i>	California gooseberry
<i>Ribes menziesii</i>	canyon gooseberry
<i>Ribes sanguineum</i>	red flowering current
<i>Rosa gymnocarpa</i>	wood rose
<i>Rubus armeniacus</i>	Himalayan blackberry
<i>Rubus parviflorus</i>	thimbleberry
<i>Rubus ulmifolius</i> var. <i>inermis</i>	thornless blackberry
<i>Rubus ursinus</i>	California blackberry
<i>Rumex acetosella</i>	sheep sorrel
<i>Rumex crispus</i>	curly dock
<i>Salix lasiolepis</i>	arroyo willow
<i>Sambucus nigra</i> ssp. <i>caerulea</i>	blue elderberry
<i>Sanicula bipinnatifida</i>	purple sanicle
<i>Sanicula crassicaulis</i>	Pacific sanicle
<i>Scrophularia californica</i>	California bee plant
<i>Sequoia sempervirens</i>	coast redwood
<i>Sisyrinchium bellum</i>	blue-eyed grass
<i>Sonchus oleraceus</i>	common sow thistle
<i>Stachys ajugoides</i>	hedge nettle
<i>Stipa lepida</i>	foothill needlegrass
<i>Stipa pulchra</i>	purple needle grass
<i>Symphoricarpos albus</i>	common snowberry
<i>Taraxacum officinale</i>	common dandelion
<i>Taraxia ovata</i> (= <i>Camissonia o.</i>)	sun cup
<i>Toxicodendron diversilobum</i>	poison oak
<i>Toxicoscordion fremontii</i>	Fremont's star lily
<i>Tradescantia fluminensis</i>	spiderwort
<i>Tradescantia fluminensis</i>	spiderwort
<i>Trifolium hirtum</i>	rose clover
<i>Trifolium pratense</i>	red clover
<i>Trifolium pratense</i>	red clover
<i>Trillium chloropetalum</i>	giant trillium
<i>Triphysaria pusilla</i>	dwarf owl's clover
<i>Typha latifolia</i>	common cattail
<i>Ulex europaeus</i>	gorse
<i>Ulmus</i> sp.	elm
<i>Umbellularia californica</i>	California bay laurel
<i>Vaccinium ovatum</i>	California huckleberry
<i>Vicia sativa</i>	spring vetch

Vinca major

periwinkle

Birds

Scientific Name	Common Name
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Anas platyrhynchos</i>	Mallard
<i>Aphelocoma californica</i>	Western Scrub-Jay
<i>Buteo jamaicensis</i>	Red-tailed Hawk
<i>Calypte anna</i>	Anna's Hummingbird
<i>Cathartes aura</i>	Turkey Vulture
<i>Certhia americana</i>	Brown Creeper
<i>Chamaea fasciata</i>	Wrentit
<i>Colaptes auratus</i>	Northern Flicker
<i>Corvus brachyrhynchos</i>	American Crow
<i>Corvus corax</i>	Common Raven
<i>Cyanocitta stelleri</i>	Steller's Jay
<i>Haemorhous mexicanus</i>	House Finch
<i>Junco hyemalis</i>	Dark-eyed Junco
<i>Melanerpes formicivorus</i>	Acorn Woodpecker
<i>Meleagris gallopavo</i>	Wild Turkey
<i>Melospiza melodia</i>	Song Sparrow
<i>Melospiza crissalis</i>	California Towhee
<i>Mimus polyglottos</i>	Northern Mockingbird
<i>Passer domesticus</i>	House Sparrow
<i>Passerella iliaca</i>	Fox Sparrow
<i>Patagioenas fasciata</i>	Band-tailed Pigeon
<i>Picoides pubescens</i>	Downy Woodpecker
<i>Pipilo maculatus</i>	Spotted Towhee
<i>Poecile rufescens</i>	Chestnut-backed Chickadee
<i>Psaltriparus minimus</i>	Bushtit
<i>Sayornis nigricans</i>	Black Phoebe
<i>Setophaga coronata</i>	Yellow-rumped Warbler
<i>Sialia mexicana</i>	Western Bluebird
<i>Spinus psaltria</i>	Lesser Goldfinch
<i>Streptopelia decaocto</i>	Eurasian Collard Dove
<i>Thryomanes bewickii</i>	Bewick's Wren
<i>Troglodytes aedon</i>	House Wren
<i>Turdus migratorius</i>	American Robin
<i>Vireo huttoni</i>	Hutton's Vireo
<i>Zonotrichia atricapilla</i>	Golden-crowned Sparrow
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow

Other Wildlife

Scientific Name	Common Name
<i>Canis latrans</i>	coyote
<i>Mephitis mephitis</i>	striped skunk
<i>Odocoileus hemionus</i>	mule deer
<i>Pseudacris sierra</i>	Sierran tree frog
<i>Sceloporus occidentalis</i>	western fence lizard
<i>Sylvilagus bachmani</i>	brush rabbit
<i>Thomomys</i> sp.	pocket gopher

Appendix C

Vegetation Classification Crosswalk

California Wildlife Habitat Relationship System Categories									
Annual Grassland	Perennial Grassland	Coast Oak Woodland	Redwood	Coastal Scrub	Closed-Cone Pine-Cypress	Eucalyptus	Valley Foothill Riparian	Freshwater Emergent Wetlands	Chamise-Redshank chaparral
Sawyer et al. 2009									
Annual brome grasslands	Purple needle grass grassland	Coast live oak woodland	redwood forest	Coyote brush scrub	Monterey pine forest	Eucalyptus groves	arroyo willow thickets	Baltic and Mexican rush marshes	chamise chaparral
Wild oats grasslands		California bay forest		Bush monkeyflower scrub	Monterey cypress stands		red alder forest	cattail marshes	
Red brome or Mediterranean grass grasslands		California buckeye groves		Poison oak scrub			white alder groves		
Upland mustards									
Poison hemlock or fennel patches									
CalVeg									
Annual Grasses and Forbs	Perennial Herbs	California Bay	Redwood	California Sagebrush	Monterey Pine	Eucalyptus	Riparian Mixed Hardwood	Tule - Cattail	Chamise
Non-Native/Ornamental Grass		California Buckeye		Coyote Brush	Monterey Cypress		White Alder	Wet Meadows	
Perennial Herbs		Coast Live Oak		North Coastal Scrub			Willow - Alder		

Appendix D



Photographs of Special-status Species

Table of Contents

Plants.....	2
Amphibians and Reptiles	15
Birds	18
Mammals	21

Plants

**Appendix D. Special-status
Species Photographs**

<p>Photo No. 1</p>	 <p>©2010 Vernon Smith</p>
<p>Species: <i>Amsinckia lunaris</i> bent-flowered fiddleneck</p>	
<p>Photo No. 2</p>	 <p>© Keir Morse - keiriosity.com</p>
<p>Species: <i>Androsace elongata</i> ssp. <i>acuta</i> California androsace</p>	
<p>Photo No. 3</p>	

**Appendix D. Special-status
Species Photographs**



Species:
*Arctostaphylos
pallida*
pallid manzanita



©2004 Steve Matson

Photo No. 4

Species:
*Balsamorhiza
macrolepis*
big-scale balsamroot



©2011 Barry Breckling

**Appendix D. Special-status
Species Photographs**

Photo No. 5

Species:
*Blepharizonia
plumosa*
big tarplant



©2002 John Game

Photo No. 6

Species:
*California
macrophylla*
round-leaved filaree



©2009 Barry Rice

**Appendix D. Special-status
Species Photographs**

Photo No. 7

Species:
Calochortus
umbellatus
Oakland star-tulip



©2005 Mike Ireland

Photo No. 8

Species:
Castilleja
ambigua
var. *ambigua*
johnny-nip



©2011 Vernon Smith

**Appendix D. Special-status
Species Photographs**



Photo No. 9

Species:
Clarkia franciscana
Presidio clarkia



©2011 Thomas Reyes

Photo No. 10

Species:
Dirca occidentalis
western
leatherwood



©2017 Steve Matson

**Appendix D. Special-status
Species Photographs**



Photo No. 11

Species:
Eriogonum luteolum
var. *caninum*
Tiburon buckwheat



©2001 Bart and Susan Eisenberg

Photo No. 12

Species:
Fissidens
pauperculus
minute pocket moss



© René J. Belland

©Rene J. Belland

**Appendix D. Special-status
Species Photographs**



Photo No. 13

Species:

Fritillaria liliacea
fragrant fritillary



©2016 Vernon Smith

Photo No. 14

Species:

*Helianthella
castanea*
Diablo helianthella



©2016 Vernon Smith

**Appendix D. Special-status
Species Photographs**



Photo No. 15

Species:
Hemizonia congesta
ssp. *congesta*
congested-headed
hayfield tarplant



©2015 Vernon Smith

Photo No. 16

Species:
Hoita strobilina
Loma Prieta hoita



©2009 James Gaither

**Appendix D. Special-status
Species Photographs**



Photo No. 17

Species:
*Leptosiphon
acicularis*
bristly leptosiphon



©2013 Vernon Smith

Photo No. 18

Species:
Meconella oregana
Oregon meconella



©2013 Scot Loring

**Appendix D. Special-status
Species Photographs**



Photo No. 19

Species:
*Micropus
amphibolus*
Mt. Diablo
cottonweed



©Russell Huddleston

Photo No. 20

Species:
*Plagiobothrys
diffusus*
San Francisco
popcornflower



© Brett Bell

**Appendix D. Special-status
Species Photographs**

Photo No. 21

Species:
*Polemonium
carneum*
Oregon polemonium



©2000 Dianne Fristrom

Photo No. 22

Species:
Ranunculus lobbii
Lobb's aquatic
buttercup



©2008 Jorg Fleige

**Appendix D. Special-status
Species Photographs**

Photo No. 23

Species:

Streptanthus albidus
ssp. *peramoenus*
(=*Streptanthus*
glandulosus ssp.
glandulosus)
most beautiful
jewelflower



© 2017 Adam Chasey

Photo No. 24

Species:

Viburnum ellipticum
oval-leaved
viburnum



©2013 John Rusk

Amphibians and Reptiles

**Appendix D. Special-status
Species Photographs**

Photo No. 25

Species:
Emys marmorata
western pond turtle



©2015 William Flaxington

Photo No. 26

Species:
Masticophis lateralis euryxanthus
Alameda whipsnake



©Gary Nafis

**Appendix D. Special-status
Species Photographs**



Photo No. 27

Species:
Rana draytonii
California red-legged
frog



©2007 William Flaxington

Birds

**Appendix D. Special-status
Species Photographs**



Photo No. 28

Species:
Aquila chrysaetos
Golden Eagle



©2009 NPS/Kent Miller

Photo No. 29

Species:
Elanus leucurus
White-tailed Kite



©2012 Jason Crotty

**Appendix D. Special-status
Species Photographs**



Photo No. 30



Species:
Setophaga petechia
Yellow Warbler



©2017 Simon J. Tonge

Mammals

**Appendix D. Special-status
Species Photographs**

<p>Photo No. 31</p>	 <p>©2011 devra</p>
<p>Photo No. 32</p>	 <p>© J. Scott Altenbach</p>

**Appendix D. Special-status
Species Photographs**



Photo No. 33

Species:
Lasiurus blossevillii
western red bat



©2012 Mike Simpson

APPENDIX C

Parcel Attribute Table

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	No	No	Yes	3	Eucalyptus	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	No	Yes	No	3	Coast Oak Woodland	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	No	Yes	No	3	Eucalyptus	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	No	Yes	Yes	3	Coast Oak Woodland	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	Yes	No	Yes	2	Eucalyptus	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	Yes	Yes	No	2	Coast Oak Woodland	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.01	No	Yes	Yes	No	2	Eucalyptus	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.00	No	Yes	Yes	Yes	2	Coast Oak Woodland	
Canyon	Shepherd Canyon	048E 7350 009 00		Shepherd Canyon Rd	City of Oakland	PWA	Maintenance	Corp Yard Bldgs	CCD4	Oakland	94611		0.07	No	Yes	Yes	Yes	2	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	No		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.67	No	No		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.61	No	No		0	Urban	
Canyon	Shepherd Canyon	48E-7348-67											0	0.77	No	No		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.02	No	No		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	1.21	No	Yes		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.18	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.67	No	Yes		0	Urban	
Canyon	Shepherd Canyon	48E-7348-67											0	0.08	No	Yes		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.08	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.09	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.14	No	Yes		0	Urban	
Canyon	Shepherd Canyon	48E-7348-67											0	0.20	No	Yes		0	Annual Grassland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.56	Yes	Yes		1	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7348-67											0	0.09	Yes	Yes		1	Urban	
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	Yes	Yes		1	Urban	
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	No	No	Yes	3	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	No	Yes	No	3	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.08	No	No	Yes	Yes	3	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	No	Yes	2	Coast Oak Woodland
Canyon	Shepherd Canyon	48E-7348-67											0	0.13	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.02	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	No	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Eucalyptus		2	Eucalyptus	
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes	No	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes	No	Yes	2	Annual Grassland
Canyon	Shepherd Canyon	48E-7348-67											0	0.07	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.03	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	No	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes	Yes	No	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.37	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.20	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7348-67											0	0.01	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.54	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	Yes	2	Annual Grassland
Canyon	Shepherd Canyon	48E-7348-67											0	0.04	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.09	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.12	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.05	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	Yes	Yes	No	Yes	1	Coast Oak Woodland
Canyon	Shepherd Canyon	48E-7348-67											0	0.00	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Canyon	Shepherd Canyon	48E-7348-81											0	0.13	No	Yes		0	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7349-32											0	0.46	Yes	Yes		1	Coast Oak Woodland	
Canyon	Shepherd Canyon	48E-7349-32											0	0.01	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes		0	Eucalyptus	
Canyon	Shepherd Canyon	48E-7349-32											0	0.07	No	Yes		0	Urban	
Canyon	Shepherd Canyon	48E-7349-32											0	0.01	Yes	Yes		1	Eucalyptus	
Canyon	Shepherd Canyon	48E-7349-32											0	0.04	Yes	Yes		1	Eucalyptus	
Canyon	Shepherd Canyon	48E-7349-32											0	0.17	Yes	Yes		1	Urban	
Canyon	Shepherd Canyon	48E-7349-32											0	0.03	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.01	No	Yes	No	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	No	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.01	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	No	2	Urban
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	No	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	No	2	Urban
Canyon	Shepherd Canyon	48E-7349-32											0	0.28	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.06	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7349-32											0	0.40	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.01	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7349-32											0	0.02	Yes	Yes	No	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.08	Yes	Yes	No	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32											0	0.02	Yes	Yes	No	Yes	1	Urban

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type
Canyon	Shepherd Canyon	48E-7349-32									0		0.01	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.01	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.00	Yes	Yes	Yes	No	1	Urban
Canyon	Shepherd Canyon	48E-7349-32									0		0.00	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.00	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.23	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.46	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.01	Yes	Yes	Yes	Yes	1	Urban
Canyon	Shepherd Canyon	48E-7349-32									0		0.11	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.32	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7349-32									0		0.01	Yes	Yes	Yes	Yes	1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	No	Yes			0	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	No	Yes			0	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.08	Yes	Yes			1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	Yes	Yes			1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.05	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	No	Yes	No	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	No	Yes	No	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	No	Yes	Yes	No	2	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.19	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.10	No	Yes	Yes	Yes	2	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	No	Yes	Yes	Yes	2	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	No	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	Yes	Yes	No	Yes	1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.13	Yes	Yes	No	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	Yes	No	1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	Yes	No	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.00	Yes	Yes	Yes	Yes	1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.03	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.02	Yes	Yes	Yes	Yes	1	Eucalyptus
Canyon	Shepherd Canyon	48E-7350-10									0		0.01	Yes	Yes	Yes	Yes	1	Urban
Canyon	Shepherd Canyon	48E-7350-10									0		0.11	Yes	Yes	Yes	Yes	1	Eucalyptus
Median	Median	029 1062 031 05		Monterey Bl	City of Oakland	PWA	Maintenance	Traffic Island	CCD4	Oakland	94602		0.09	No	Yes			1	Urban
Median	Median	029 1062 031 05		Monterey Bl	City of Oakland	PWA	Maintenance	Traffic Island	CCD4	Oakland	94602		0.07	Yes	Yes			1	Urban
Median	Median	029 1151 062 00	36XX	Butters Dr	City of Oakland	LEA	OPR	Butters Roadside	CCD4	Oakland	94602		0.00	Yes	Yes			1	Urban
Median	Median	029 1151 063 00		Skyline Bl	City of Oakland	LEA	OPR	Skyline Median	CCD4	Oakland	94602		0.01	No	Yes			1	Eucalyptus
Median	Median	029 1151 064 00		Kimberlin Heights Dr	City of Oakland	LEA	OPR	Skyline Median	CCD4	Oakland	0		0.00	No	Yes			1	Urban
Median	Median	029 1151 064 00		Kimberlin Heights Dr	City of Oakland	LEA	OPR	Skyline Median	CCD4	Oakland	0		0.02	Yes	Yes			1	Urban
Median	Median	037A 3146 063 00		Vandervee Wy	City of Oakland	LEA	OPR	Open Space, Grass	CCD4	Oakland	94619		0.00	Yes	Yes			1	Urban
Median	Median	037A 3147 070 00		Colgett Dr	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.04	Yes	Yes			1	Urban
Median	Median	037A 3147 071 00		Crestmont Dr	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.03	Yes	Yes			1	Urban
Median	Median	037A 3147 072 02		Creighton Wy	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.01	Yes	Yes			1	Urban
Median	Median	037A 3148 023 03		Crestmont Dr	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.00	Yes	Yes			1	Urban
Median	Median	037A 3149 025 00		Skyline Bl	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.00	Yes	Yes			1	Urban
Median	Median	037A 3149 026 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.26	No	Yes			1	Annual Grassland
Median	Median	037A 3149 026 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.53	Yes	Yes			1	Annual Grassland
Median	Median	037A 3149 027 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.03	No	Yes			1	Annual Grassland
Median	Median	037A 3149 027 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.11	Yes	Yes			1	Annual Grassland
Median	Median	037A 3149 028 00		Skyline Bl	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.00	Yes	Yes			1	Urban
Median	Median	037A 3149 029 00		Skyline Bl	City of Oakland	PWA	Maintenance	Chabot Space & Science Ce	CCD4	Oakland	94619		0.02	No	Yes			1	Urban
Median	Median	037A 3149 029 00		Skyline Bl	City of Oakland	PWA	Maintenance	Chabot Space & Science Ce	CCD4	Oakland	94619		0.62	Yes	Yes			1	Urban
Median	Median	037A 3150 005 00		Skyline Bl	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94602		0.00	No	Yes			1	Eucalyptus
Median	Median	037A 3150 005 00		Skyline Bl	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94602		0.01	Yes	Yes			1	Eucalyptus
Median	Median	037A 3150 006 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.05	No	Yes			1	Urban
Median	Median	037A 3150 006 00		Skyline Bl	City of Oakland	PWA	Maintenance	island	CCD4	Oakland	94619		0.50	Yes	Yes			1	Urban
Median	Median	037A 3150 041 00		Kimberlin Hts Dr	City of Oakland	PWA	Maintenance	1' strip	CCD4	Oakland	94619		0.03	Yes	Yes			1	Urban
Median	Median	037A 3152 008 00		Keller Av	City of Oakland	PWA	Maintenance	1' strip	CCD7	Oakland	94605		0.35	No	Yes			1	Coast Oak Woodland
Median	Median	043A 4660 003 00		Keller Av	City of Oakland	PWA	Maintenance	1' strip	CCD6	Oakland	94605		0.00	No	Yes			1	Urban
Median	Median	043A 4660 003 00		Keller Av	City of Oakland	PWA	Maintenance	1' strip	CCD6	Oakland	94605		0.00	Yes	Yes			1	Urban
Median	Median	043A 4663 024 00		Keller Av	City of Oakland	PWA	Public Works	Street		Oakland	0		0.05	No	Yes			1	Urban
Median	Median	043A 4663 024 00		Keller Av	City of Oakland	PWA	Public Works	Street		Oakland	0		0.21	Yes	Yes			1	Urban
Median	Median	043A 4663 038 02		Keller Av	City of Oakland	LEA	OPR	Street Remnant	CCD6	Oakland	94605		0.01	Yes	Yes			1	Urban
Median	Median	043A 4663 038 03		Keller Av	City of Oakland	LEA	OPR	Street Remnant	CCD6	Oakland	94605		0.01	No	Yes			1	Urban
Median	Median	043A 4663 038 03		Keller Av	City of Oakland	LEA	OPR	Street Remnant	CCD6	Oakland	94605		0.01	Yes	Yes			1	Urban
Median	Median	048 6869 001 00		Skyline Bl	City of Oakland	PWA	Maintenance	Remnant	CCD6	Oakland	0		0.52	No	Yes			1	Closed-cone Pine-Cypress
Median	Median	048 6869 001 00		Skyline Bl	City of Oakland	PWA	Maintenance	Remnant	CCD6	Oakland	0		0.00	Yes	Yes			1	Closed-cone Pine-Cypress
Median	Median	048 6869 001 00		Skyline Bl	City of Oakland	PWA	Maintenance	Remnant	CCD6	Oakland	0		0.00	Yes	Yes			1	Closed-cone Pine-Cypress
Median	Median	048 6869 008 00		Keller Av	City of Oakland	PWA	Maintenance	Vacant Lot	CCD1	Oakland	94605		0.12	No	Yes			1	Urban
Median	Median	0488 7125 002 00	4869	Broadway	City of Oakland	LEA	OPR	Remnant	CCD1	Oakland	94618		0.26	No	Yes			1	Urban
Median	Median	0488 7125 002 00	4869	Broadway	City of Oakland	LEA	OPR	Remnant	CCD1	Oakland	94618		0.18	Yes	Yes			1	Urban
Median	Median	0488 7125 003 00	4875	Broadway Tr	City of Oakland	LEA	OPR	Ostrander Park	CCD1	Oakland	94618		0.08	No	Yes			1	Urban
Median	Median	0488 7125 003 00	4875	Broadway Tr	City of Oakland	LEA	OPR	Ostrander Park	CCD1	Oakland	94618		0.27	Yes	Yes			1	Urban
Median	Median	048D 7209 013 00		Castle Dr	City of Oakland	LEA	Parks and Recreation	Open Space		Oakland	0		0.00	Yes	Yes			1	Urban
Median	Median	048D 7209 012 00		Castle Dr	City of Oakland	LEA	Parks and Recreation	Open Space		Oakland	0		0.00	Yes	Yes			1	Urban
Median	Median	048D 7209 012 00		Castle Dr	City of Oakland	LEA	Parks and Recreation	Open Space		Oakland	0		0.00	Yes	Yes			1	Closed-cone Pine-Cypress
Median	Median	048D 7209 013 00		Castle Dr	City of Oakland	LEA	Parks and Recreation	Open Space		Oakland	0		0.01	Yes	Yes			1	Urban
Median	Median	048D 7209 021 00		Castle Dr	City of Oakland	LEA	OPR	Open Space		Oakland	0		0.01	Yes	Yes			1	Urban
Median	Median	048D 7209 022 00		Castle Dr	City of Oakland	LEA	OPR	Open Space		Oakland	0		0.00	Yes	Yes			1	Urban
Median	Median	048D 7228 023 00		Mountain Gate Wy	City of Oakland	LEA	OPR	1' strip	CCD4	Oakland	94611		0.00	Yes	Yes			1	Coast Oak Woodland
Median	Median	A1		A1							0		0.08	No	Yes			1	Urban
Median	Median	A1		A1							0		0.23	Yes	Yes			1	Urban
Median	Urban/Residential	037A 3152 008 00		Keller Av	City of Oakland	PWA	Maintenance	1' strip	CCD7	Oakland	94605		0.86	No	Yes			1	Coast Oak Woodland
Median	Urban/Residential	037A 3152 008 00		Keller Av	City of Oakland	PWA	Maintenance	1' strip	CCD7	Oakland	94605		0.11	No	Yes			1	Urban
Other	Developed	029 1067 013 00		Jordan Rd	City of Oakland	PWA	Maintenance	Avenue Terrace Playground	CCD4	Oakland	94602	Developed, Avenue Terrace Playground	0.12	No	Yes			0	Urban
Other	Developed	029 1067 013 00		Jordan Rd	City of Oakland	PWA	Maintenance	Avenue Terrace Playground	CCD4										

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	No	3	Urban
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	No	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	No	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.02	No	No	Yes	No	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	No	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	No	3	Coast Oak Woodland
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.00	No	No	Yes	No	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.02	No	No	Yes	No	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		18.18	No	No	Yes	Yes	3	Coast Oak Woodland
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		1.77	No	No	Yes	Yes	3	Coastal Scrub
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	Yes	3	Urban
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		6.29	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.01	No	No	Yes	Yes	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		3.42	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		4.34	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		1.95	No	No	Yes	Yes	3	Coast Oak Woodland
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.44	No	No	Yes	Yes	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.79	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.31	No	No	Yes	Yes	3	Coast Oak Woodland
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.42	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.00	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.88	No	No	Yes	Yes	3	Eucalyptus
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.63	No	No	Yes	Yes	3	Coast Oak Woodland
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.03	No	No	Yes	Yes	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.00	No	No	Yes	Yes	3	Valley/foothill Riparian
Ridgetop	North Oakland Sports	048H 7526 002 01		Tunnel Rd	City of Oakland	LEA	OPR	Sports Center	CCD1	Oakland	94611		0.00	No	No	No	Yes	3	Valley/foothill Riparian
Urban/Residential	Urban/Residential	028 0974 024 00		Rettig Pl	City of Oakland	LEA	OPR	Median/Park	CCD4	Oakland	94602		0.03	No	No	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	028 0974 024 00		Rettig Pl	City of Oakland	LEA	OPR	Median/Park	CCD4	Oakland	94602		0.13	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1061 016 03	3137	Monterey Bl	City of Oakland	PWA	Maintenance	Open Space	CCD4	Oakland	94602		0.04	Yes	Yes	Yes	Yes	1	Annual Grassland
Urban/Residential	Urban/Residential	029 1073 002 00	3475	Victor Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.17	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 003 00	4175	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94619		0.18	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 004 00	4169	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.12	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 005 00	4163	35th St	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.11	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 006 00	4157	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.11	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 007 02		35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.12	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 007 03	4151	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.01	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 007 03	4151	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.18	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 007 04	4135	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.09	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 007 04	4135	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.10	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 008 01	4123	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.11	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 008 01	4123	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	0		0.16	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 008 01		Midvale Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.05	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 018 02	4109	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.03	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1073 018 02	4109	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.03	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 019 02	4101	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.02	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 019 02	4101	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.05	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 020 02	4045	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.07	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1073 021 02	4039	35th Av	City of Oakland	PWA	Maintenance	Hillside Retaining Wall	CCD4	Oakland	94602		0.07	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1075 027 02	2936	London Rd	City of Oakland	PWA	Maintenance	Open Space	CCD4	Oakland	94602		0.09	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1075 027 02	2936	London Rd	City of Oakland	PWA	Maintenance	Open Space	CCD4	Oakland	94602		0.13	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1077 037 00	2848	Kitchener Ct	City of Oakland	PWA	Maintenance	Vacant Lot	CCD4	Oakland	94602		0.18	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1077 037 00	2848	Kitchener Ct	City of Oakland	PWA	Maintenance	Vacant Lot	CCD4	Oakland	94602		0.01	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1078 004 02	2833	Kitchener Ct					CCD4	Oakland	0		0.16	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1078 005 02	2841	Kitchener Ct					CCD4	Oakland	0		0.16	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1078 006 01	2849	Kitchener Ct	City of Oakland	PWA	Maintenance	Street portion	CCD4	Oakland	94602		0.11	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1078 007 01	4291	Wilshire Bl	City of Oakland	PWA	Maintenance	Street Portion	CCD4	Oakland	94602		0.08	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1086 009 00		Redwood Rd					Oakland	0			0.22	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1086 009 02		Redwood Rd	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94619		0.06	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1086 010 02		Redwood Rd	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94619		0.06	No	No	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1090 006 11	3724	Redwood Rd	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94619		0.01	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1090 006 11	3724	Redwood Rd	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94619		0.04	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1090 014 00	3724	Redwood Rd					CCD4	Oakland	94619		0.12	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1090 014 02	3724	Redwood Rd	City of Oakland	LEA	OPR	Redwood Heights Rec Cente	CCD4	Oakland	94619		0.02	No	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1090 014 02	3724	Redwood Rd	City of Oakland	LEA	OPR	Redwood Heights Rec Cente	CCD4	Oakland	94619		0.04	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029 1158 011 03		Butters Dr	City of Oakland	LEA	OPR	open space	CCD4	Oakland	94608		0.21	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1158 011 03		Butters Dr	City of Oakland	LEA	OPR	open space	CCD4	Oakland	94608		0.03	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1159 006 02		Butters Dr	City of Oakland	LEA	OPR	open space	CCD4	Oakland	94608		0.20	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1159 006 02		Butters Dr	City of Oakland	LEA	OPR	open space	CCD4	Oakland	94608		0.08	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1167 012 00		Butters Dr	City of Oakland	CEDA	CEDA Watershed	Watershed	CCD4	Oakland	0		0.14	No	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029 1167 012 00		Butters Dr	City of Oakland	CEDA	CEDA Watershed	Watershed	CCD4	Oakland	0		0.13	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	029A 1320 049 01	3800	Lyman Rd	City of Oakland	PWA	Maintenance	Street Remnant	CCD4	Oakland	94602		0.03	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029A 1322 037 00	3933	Hanly Rd	City of Oakland	LEA	OPR	Diamond Park	CCD4	Oakland	94602		0.01	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	029A 1358 043 00	2230	Melvin Rd	City of Oakland	PWA	PWA	Street	CCD4	Oakland	94602		0.00	Yes	Yes	Yes	Yes	1	Urban
Urban/Residential	Urban/Residential	037 2575 015 01	4655	Geranium Pl	City of Oakland	PWA	Maintenance	Open Space, Wooded	CCD6	Oakland	94619		0.04	No	Yes	Yes	Yes	1	Eucalyptus
Urban/Residential	Urban/Residential	037 2575 015 01	4655	Geranium Pl	City of Oakland	PWA	Maintenance	Open Space, Wooded	CCD6	Oakland	94619		0.01	No	Yes	Yes	Yes	1	Annual Grassland
Urban/Residential	Urban/Residential	037 2575 015 01	4655	Geranium Pl	City of Oakland	PWA	Maintenance	Open Space, Wooded	CCD6	Oakland	94619		0.13	Yes	Yes	Yes	Yes	1	Eucalyptus

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type
Urban/Residential	Urban/Residential	037A 3141 001 09		Skyline Bl	City of Oakland	LEA	OPR	Leona Heights Park	CCD6	Oakland	94619		0.06	No	No			1	Coastal Scrub
Urban/Residential	Urban/Residential	037A 3141 001 09		Skyline Bl	City of Oakland	LEA	OPR	Leona Heights Park	CCD6	Oakland	94619		0.16	No	No			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	037A 3141 001 09		Skyline Bl	City of Oakland	LEA	OPR	Leona Heights Park	CCD6	Oakland	94619		0.23	No	Yes			1	Coastal Scrub
Urban/Residential	Urban/Residential	037A 3141 001 09		Skyline Bl	City of Oakland	LEA	OPR	Leona Heights Park	CCD6	Oakland	94619		0.00	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	037A 3144 036 05		Redwood Rd	City of Oakland	LEA	OPR	Open Space, Chaparral	CCD6	Oakland	94619		0.09	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	037A 3144 036 05		Redwood Rd	City of Oakland	LEA	OPR	Open Space, Chaparral	CCD6	Oakland	94619		0.42	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	040A 3426 032 00	7832	Hillmont Dr						Oakland	0		0.23	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.00	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.18	No	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.05	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.29	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.09	Yes	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.29	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	040A 3449 023 01		Sterling Dr	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.09	Yes	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	043A 4644 002 02	2824	82nd Av	City of Oakland	CEDA	Housing	Private Community	CCD7	Oakland	94605		0.07	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4644 009 02	8251-8327	Golf Links Rd	City of Oakland	CEDA	Housing	Vacant Lot	CCD7	Oakland	94605		0.00	No	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	043A 4644 009 02	8251-8327	Golf Links Rd	City of Oakland	CEDA	Housing	Vacant Lot	CCD7	Oakland	94605		0.49	Yes	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	043A 4644 009 03	3245	Golf Links Rd						Oakland	0		0.12	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4644 025 09	8207	Golf Links Rd	City of Oakland	CEDA	Housing	Vacant Lot	CCD7	Oakland	94605		0.09	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4651 009 05	8395	Golf Links Rd	City of Oakland	CEDA	Housing	Vacant Lot	CCD7	Oakland	94605		0.13	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4651 009 14	8379	Golf Links Rd	City of Oakland	CEDA	Housing	Vacant Lot	CCD7	Oakland	94605		0.15	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4651 019 04	8477	Golf Links Rd	Redevelopment Agency	CEDA	Redevelopment	affordable housing lot		Oakland	0		0.13	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	043A 4684 019 00		Oak Knoll Bl	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.01	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	043A 4684 021 00		Oak Knoll Bl	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.00	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	043A 4684 021 00		Oak Knoll Bl	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.14	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 5607 001 02		Lawlor St	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.00	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5607 001 02		Lawlor St	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.10	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5607 006 04	2575		City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.17	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5607 007 01	9796	Lawlor St	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.17	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 009 00	2661	98th Av	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.00	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 009 00	2661	98th Av	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.12	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 025 00	2645	Cherokee Av	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.07	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 025 00	2645	Cherokee Av	City of Oakland	PWA	Maintenance	Remnant	CCD7	Oakland	94605		0.07	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 026 00	2621	Cherokee Av	City of Oakland	OFD	Fire	Fire Station	CCD7	Oakland	94605		0.01	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 026 00	2621	Cherokee Av	City of Oakland	OFD	Fire	Fire Station	CCD7	Oakland	94605		0.11	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5613 027 00	2603		City of Oakland	PWA	Maintenance	Playground	CCD7	Oakland	94605		0.11	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5661 027 03		Peralta Oaks Dr	City of Oakland	LEA	OPR	Peralta Oaks Planting	CCD7	Oakland	94605		0.14	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5662 013 03		Peralta Oaks Dr	City of Oakland	OPR	OPR	Peralta Oaks Planting	CCD7	Oakland	94605		0.15	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 5662 047 02	2946	Barnett St	City of Oakland	LEA	OPR	Peralta Oaks Planting	CCD7	Oakland	94605		0.14	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6140 001 00	247	Marlow Dr	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD7	Oakland	94605		0.14	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6140 027 03		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	94605		0.22	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6140 027 03		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	94605		0.01	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6140 027 04		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD7	Oakland	94605		0.29	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6140 027 04		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD7	Oakland	94605		0.06	No	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	048 6140 027 04		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD7	Oakland	94605		0.02	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6140 027 04		Revere Av	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD7	Oakland	94605		0.00	No	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	048 6156 012 00	251	Marlow Dr	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	0		0.43	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6156 012 00	251	Marlow Dr	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	0		0.44	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6156 012 00	251	Marlow Dr	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	0		0.44	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6156 012 00	251	Marlow Dr	City of Oakland	LEA	OPR	Sheffield Rec Center	CCD1	Oakland	0		0.42	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6178 002 00	56	Montwood Wy	City of Oakland	LEA	OPR	Open Space, wooded	CCD7	Oakland	94605		0.11	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6330 009 01	4615	Grass Valley Rd	City of Oakland	OFD	Fire	Fire Station #28	CCD7	Oakland	94605		0.37	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6413 004 05		Sequoyah Rd	City of Oakland	PWA	Maintenance	Open Space, chaparral	CCD7	Oakland	94605		0.06	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6413 004 05		Sequoyah Rd	City of Oakland	PWA	Maintenance	Open Space, chaparral	CCD7	Oakland	94605		0.10	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6818 001 01		Sequoyah Rd	City of Oakland	PWA	Maintenance	Open Space, grass	CCD7	Oakland	94605		0.01	No	No			1	Urban
Urban/Residential	Urban/Residential	048 6818 001 01		Sequoyah Rd	City of Oakland	PWA	Maintenance	Open Space, grass	CCD7	Oakland	94605		1.43	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6818 001 01		Sequoyah Rd	City of Oakland	PWA	Maintenance	Open Space, grass	CCD7	Oakland	94605		0.26	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6854 002 06	4430	Sequoyah Rd	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.00	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6854 002 06	4430	Sequoyah Rd	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.30	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6854 003 02	4424	Sequoyah Rd	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.16	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048 6868 001 01		Oak Hill Rd	City of Oakland	PWA	Maintenance	Oak Hill Knoll	CCD7	Oakland	94605		0.16	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6868 001 05		Oak Hill Rd	City of Oakland	PWA	Maintenance	Oak Hill Knoll	CCD7	Oakland	94605		0.00	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6868 001 05		Oak Hill Rd	City of Oakland	PWA	Maintenance	Oak Hill Knoll	CCD7	Oakland	94605		0.00	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048 6869 007 00		Keller Av	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		1.93	No	No			1	Coastal Scrub
Urban/Residential	Urban/Residential	048 6869 007 00		Keller Av	City of Oakland	PWA	Maintenance	Vacant Lot	CCD7	Oakland	94605		0.08	No	Yes			1	Coastal Scrub
Urban/Residential	Urban/Residential	048A 7095 049 00	6175	Broadway	City of Oakland	LEA	OPR	Vacant Lot	CCD1	Oakland	94618		0.21	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048A 7110 034 00	5900	Broadway	City of Oakland	LEA	OPR	Vacant Lot	CCD1	Oakland	94618		0.07	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	0488 7125 001 28		Broadway Tr	City of Oakland	LEA	OPR	Remnant	CCD1	Oakland	94618		0.12	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	0488 7139 003 01	6401	Broadway Tr	City of Oakland	LEA	OPR	Remnant	CCD1	Oakland	94618		0.17	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	0488 7150 003 00		Jacobus Av	City of Oakland	PWA	Maintenance	2' reserve	CCD1	Oakland	94618		0.02	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048C 7186 021 00	5962-6008	Johnston Dr	City of Oakland	PWA	Maintenance	3' reserve	CCD4	Oakland	94611		0.00	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048C 7186 022 00	5932	Johnston Dr	City of Oakland	PWA	Maintenance	3' reserve	CCD4	Oakland	94611		0.00	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048C 7186 022 00	5932	Johnston Dr	City of Oakland	PWA	Maintenance	3' reserve	CCD4	Oakland	94611		0.01	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048D 7207 019 00		Mountain Bl	City of Oakland	LEA	OPR	Vacant Lot	CCD4	Oakland	94611		0.07	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048D 7272 012 00	9519	Skyline Bl	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94611		0.28	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048D 7281 048 00		Girvin Dr	City of Oakland	LEA	OPR	Shepherd Canyon Park	CCD4	Oakland	94611		0.18	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048D 7281 050 01		Girvin Dr	City of Oakland	LEA	OPR	Shepherd Canyon Park	CC										

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type
Urban/Residential	Urban/Residential	048E 7320 071 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94611		0.96	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7320 073 00		Skyline Bl	City of Oakland	LEA	OPR	Open Space	CCD4	Oakland	94611		0.17	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7320 075 00		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.25	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7320 082 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, chaparral	CCD4	Oakland	94611		0.89	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7320 082 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, chaparral	CCD4	Oakland	94611		0.50	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7321 001 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.21	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7321 001 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.10	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7321 008 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.45	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7321 008 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.21	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7321 008 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.11	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7321 022 04	8173	Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.01	No	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7321 022 04	8173	Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.20	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7322 001 01		Arrowhead Dr	City of Oakland	OFD	Fire	Fire Station #6	CCD4	Oakland	94611		0.30	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7322 036 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.38	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 036 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.53	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 036 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.00	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 036 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.00	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 039 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, chaparral	CCD4	Oakland	94611		0.17	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 039 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, chaparral	CCD4	Oakland	94611		0.14	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7322 044 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.02	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 044 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.28	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 044 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.23	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7322 048 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.23	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7322 048 01		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.21	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7322 089 00		Skyline Bl	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.16	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7334 050 04	66	Snake Rd	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.02	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7334 050 04	66	Snake Rd	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.07	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7334 050 04	66	Snake Rd	City of Oakland	LEA	OPR	Open Space, wooded	CCD4	Oakland	94611		0.03	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7349 016 03		Magellan Dr	City of Oakland	LEA	OPR	Open space, wooded	CCD4	Oakland	94611		0.08	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7349 016 03		Magellan Dr	City of Oakland	LEA	OPR	Open space, wooded	CCD4	Oakland	94611		0.00	Yes	Yes	Yes	Yes	1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7349 031 00		Snake Rd	City of Oakland	LEA	OPR	Remnant, cut-bank & woods	CCD4	Oakland	94611		0.01	No	CCD4			1	Urban
Urban/Residential	Urban/Residential	048E 7349 031 00		Snake Rd	City of Oakland	LEA	OPR	Remnant, cut-bank & woods	CCD4	Oakland	94611		0.08	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7360 018 00	1942	Mountain Bl	City of Oakland	LEA	OPR	Path, stairs from street	CCD4	Oakland	94611		0.00	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7362 003 00	1687	Mountain Bl	City of Oakland	LEA	Library	Montclair Library	CCD4	Oakland	94611		0.22	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7365 035 00		Cortereal Av	City of Oakland	LEA	OPR	Path	CCD4	Oakland	94611		0.06	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7365 036 00		Medau Pl	City of Oakland	LEA	OPR	Path	CCD4	Oakland	94611		0.13	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7365 036 00		Medau Pl	City of Oakland	LEA	OPR	Path	CCD4	Oakland	94611		1.27	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7376 006 01	7369	Lot, wooded	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.27	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7376 011 02	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.16	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7377 003 01	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.10	No	CCD4			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 003 01	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.11	No	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7377 003 01	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.08	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 005 00	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.00	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 005 00	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.11	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 005 00	73XX	Skyline Bl	City of Oakland	LEA	OPR	Lot, wooded	CCD4	Oakland	94611		0.03	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7377 037 03		Skyline Bl	City of Oakland	LEA	OPR	Lot, chaparral	CCD4	Oakland	94611		0.07	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 037 03		Skyline Bl	City of Oakland	LEA	OPR	Lot, chaparral	CCD4	Oakland	94611		0.58	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7377 039 00		Skyline Bl	City of Oakland	LEA	OPR	Lot, chaparral	CCD4	Oakland	94611		0.21	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7404 036 00	216	Duncan Wy	City of Oakland	LEA	OPR	Remnant, wooded	CCD4	Oakland	94611		0.01	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7435 014 01	6345	Valley View Rd	City of Oakland	LEA	OPR	Lot, grass	CCD4	Oakland	94611		0.20	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7435 014 01	6345	Valley View Rd	City of Oakland	LEA	OPR	Lot, grass	CCD4	Oakland	94611		0.01	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7435 014 01	6345	Valley View Rd	City of Oakland	LEA	OPR	Lot, grass	CCD4	Oakland	94611		0.13	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7450 023 01		Skyline Bl	City of Oakland	LEA	OPR	Lot, woods	CCD1	Oakland	94611		0.25	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7450 023 01		Skyline Bl	City of Oakland	LEA	OPR	Lot, woods	CCD1	Oakland	94611		0.00	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7450 023 01		Skyline Bl	City of Oakland	LEA	OPR	Lot, woods	CCD1	Oakland	94611		0.80	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7450 023 01		Skyline Bl	City of Oakland	LEA	OPR	Lot, woods	CCD1	Oakland	94611		0.19	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.00	No	No			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.27	No	No			1	Urban
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.57	No	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.26	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.17	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7531 001 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.04	Yes	Yes			1	Closed-cone Pine-Cypress
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.53	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.07	No	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.52	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.17	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.83	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.30	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7531 002 00		Broadway Tr	City of Oakland	LEA	OPR	RW Freeway Ramp	CCD1	Oakland	94618		0.46	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7563 055 00	613	Pinewood Rd	City of Oakland	LEA	OPR	1' curb strip	CCD1	Oakland	94611		0.00	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7566 021 00		Swinland Rd	City of Oakland	LEA	OPR	Lot, grass	CCD1	Oakland	94611		0.00	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	048E 7586 004 00		Frontage Rd	City of Oakland	LEA	OPR	Open space, RW	CCD1	Oakland	94618		0.01	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7586 004 00		Frontage Rd	City of Oakland	LEA	OPR	Open space, RW	CCD1	Oakland	94618		0.00	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	048E 7611 025 00		Robison Dr	City of Oakland	LEA	OPR	2' strip at end of Street	CCD1	Berkeley	94705		0.00	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7611 026 00		Amito Av	City of Oakland	LEA	OPR	2' strip between lots	CCD1	Berkeley	94705		0.00	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	048E 7612 027 00	1006	Amito Dr	City of Oakland	OFD													

Area Type	Area Name	APN	Number	Street	Owner	Agency	Department	Use	Council District	City	Zip Code	Comments	Acres	Within 100' of Structures	Within 300' of Structures	Crown Fire	Flame Length >8'	Priority	Vegetation Type
Urban/Residential	Urban/Residential	048H 7704 008 00		Panoramic Wy	City of Oakland	LEA	OPR	Lot, wooded	CCD1	Berkeley	94704		0.05	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	37A-3161-120									0		0.34	No	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	37A-3161-120									0		0.05	Yes	Yes			1	Annual Grassland
Urban/Residential	Urban/Residential	48F-7355-19									0		0.16	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	48F-7355-19									0		0.04	No	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	48F-7355-19									0		0.32	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	48F-7355-19									0		0.14	Yes	Yes			1	Coast Oak Woodland
Urban/Residential	Urban/Residential	48F-7355-19									0		0.00	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	48F-7355-19v									0		0.07	No	Yes			1	Urban
Urban/Residential	Urban/Residential	48F-7366-21-2									0		0.04	No	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	48F-7366-21-2									0		1.17	Yes	Yes			1	Eucalyptus
Urban/Residential	Urban/Residential	A2									0		0.52	Yes	Yes			1	Urban
Urban/Residential	Urban/Residential	A3									0		0.87	Yes	Yes			1	Urban

APPENDIX D
Fire Behavior Analysis

APPENDIX D

Fire Behavior Analysis

FLAMMAP FIRE BEHAVIOR MODELING

The FlamMap software package (Finney et al. 2015) was used to evaluate fire behavior in order to inform the prioritization of vegetation management recommendations included in this Vegetation Management Plan (VMP). FlamMap utilizes the same fire spread equations built into the BehavePlus software package, but allows for a geographical presentation of fire behavior outputs as it applies the calculations to each pixel in an associated geographic information system (GIS) landscape (Finney 1998). The FlamMap software package is a publicly available resource available through the Fire, Fuel, and Smoke Science Program of the U.S. Forest Service. FlamMap is a GIS-based software package that models potential fire behavior for constant weather conditions (wind and fuel moisture) and generates map files of potential fire behavior characteristics (e.g., flame length, crown fire activity). FlamMap outputs represent fire behavior calculated for each pixel within the analysis area independently and do not calculate fire spread across a landscape. The software requires a minimum of five input variables, including elevation, slope, aspect, fuel model, and canopy cover. To utilize the crown fire activity model for forested land cover types, additional input variables are necessary, including stand height, canopy base height, and canopy bulk density. Wind and weather data are also critical components to FlamMap modeling efforts. The following sections present a background on fire behavior modeling and present the methods and data sources used in performing the FlamMap fire behavior modeling analysis for the Plan Area.

FIRE BEHAVIOR MODELING BACKGROUND

Predicting wildland fire behavior is not an exact science due to the many variables that must be considered. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather, the limits of weather forecasting, and the weather that is often created by firestorms. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire information (Rothermel 1993). To be used effectively, the basic assumptions and limitations of fire behavior modeling applications must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuel less than 0.25 inches in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect, while fuels greater than 3 inches in diameter have no effect on fire behavior.
- Second, the model bases surface fire calculations and descriptions on a wildfire spreading through fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are classified as grass, grass/shrub, shrub, timber litter, timber understory, or slash.

APPENDIX D (Continued)

- Third, the software assumes that weather is uniform. However, because wildfires almost always burn under non-uniform conditions, creating their own weather, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, fire behavior computer modeling systems are not intended for determining sufficient fuel modification zone/defensible space widths. However, results can provide the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

FlamMap can provide valuable fire behavior predictions, which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Fuels are made up of the various components of vegetation, both live and dead, that occur in a particular landscape. The type and quantity will depend upon soil, climate, terrain, and management and disturbance (e.g., fire) history. The major fuel groups of grass, grass/shrub, shrub, trees, tree litter, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven principal fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982). According to the model classifications, fuel models used for fire behavior modeling (BehavePlus, FlamMap, FARSITE) have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface area-to-volume ratio. Observation of the fuels in the field determines which fuel models should be applied in modeling efforts. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models:

- Grasses – Fuel Models 1 through 3
- Brush – Fuel Models 4 through 7
- Timber – Fuel Models 8 through 10
- Logging slash – Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the development of 40 newer fire behavior fuel models (Scott and Burgan 2005) developed for use in the BehavePlus, FlamMap, and FARSITE modeling systems. These newer models attempt to improve the accuracy of the 13 standard fuel models and to allow for the simulation of fuel treatment

APPENDIX D (Continued)

prescriptions. The following describes the distribution of fuel models among general vegetation types for the 40 newer fuel models:

- Non-burnable – Models NB1, NB2, NB3, NB8, NB9
- Grass – Models GR1 through GR9
- Grass shrub – Models GS1 through GS4
- Shrub – Models SH1 through SH9
- Timber understory – Models TU1 through TU5
- Timber litter – Models TL1 through TL9
- Slash blowdown – Models SB1 through SB4.

FLAMMAP ANALYSIS

FlamMap software was utilized to graphically depict potential fire behavior in the Plan Area occurring during extreme fall weather conditions (off-shore, Diablo wind conditions). As noted, FlamMap software requires a minimum of five separate input files that represent field conditions in the analysis area, including elevation, slope, aspect, fuel model, and canopy cover. Given the extent of tree-dominated vegetation types in the Plan Area, stand height, canopy base height, and canopy bulk density input files were also incorporated. Each of these files was created as a raster GIS file using ArcGIS 10.5 software, exported as an ASCII grid file, then utilized in creating a FARSITE Landscape file that served as the base for the FlamMap runs. The resolution of each grid file and associated ASCII file that was used in the models described herein is approximately 3 meters (1/9 arc second), based on available digital terrain data (described below). In addition to the Landscape file, wind and weather data are incorporated into the model inputs. The output fire behavior variables chosen for the modeling runs include flame length and crown fire activity.

The analysis area selected for the fire behavior modeling effort included all of the canyon, ridgetop, and City parks lands and open space classifications (as described in Section 9.2 of the VMP). Urban and residential parcels, roadsides, medians, and other developed classifications were omitted as they fall within 100 feet of existing structures and within 30 feet of roads and management of vegetation in these areas would be classified as Priority 1.

The following provides descriptions of the input variables used in processing the FlamMap models. Data sources are cited and any assumptions made during the modeling process are described. Following the discussion of model inputs, a summary of model outputs is provided.

APPENDIX D (Continued)

Model Inputs

Elevation

Elevation data were derived from a 1/9 arc-second resolution National Elevation Dataset (NED), acquired from the U.S. Geological Survey (USGS) National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center and projected in the NAD 1983, California State Plane, Zone 3 coordinate system, with units in feet (USGS 2013a, 2013b). Elevation values in the modeling area range from 72 feet to 1,545 feet above mean sea level (AMSL). This data was utilized to create an elevation grid file, using units of feet AMSL. Elevation is a required input file for FlamMap runs and are necessary for adiabatic adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances.

Slope

Using ArcGIS Spatial Analyst tools, a slope grid file was generated from the elevation grid file described above. Slope measurements utilized values in percent of inclination from horizontal. Slope values in the analysis area range from 0% to 147%. The slope input file is necessary for computing slope effects on fire spread and solar radiance.

Aspect

Using ArcGIS Spatial Analyst tools, an aspect grid file was generated from the elevation grid file described above. The aspect values utilized were azimuth degrees. Aspect values are important in determining the solar exposure of grid cells.

Fuel Model

Vegetation coverage data in the form of a GIS shapefile were used in this analysis to create a fuel model file for existing conditions, which was derived from the vegetation community/land cover type data mapped for the Plan Area (Appendix B). Using the vegetation community/land cover type data, field assessments were conducted to classify the different types into appropriate fuel models. In many areas, different fuel models were assigned to the same mapped vegetation community/land cover type (e.g., eucalyptus) based on observed field conditions and management history, which required subdividing some vegetation community/land cover polygons. For example, a tree-dominated vegetation type may be classified as a timber litter model if the understory consisted of dead and downed leaves and woody fuel, or as a grass model if the understory had been subject to management (e.g., grazing) that reduced surface fuel loads to grasses. Once fuel model values were assigned to vegetation community/land cover type polygons, the vector-based fuel model data file was converted to a grid file for inclusion in FlamMap modeling.

APPENDIX D (Continued)

A photo series presenting representative field photographs of each of the different fuel models used in this analysis is presented in Appendix D-1. A map of fuel types for the analysis area is presented in Appendix D-2. Fuel model assignments for existing vegetation conditions are presented in Table D-1.

Canopy Cover

Canopy cover is a required raster file for FlamMap operations. It is necessary for computing shading and wind reduction factors for all fuel models. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy. Crown closure refers to the ecological condition of relative tree crown density. Stands can be said to be “closed” to recruitment of canopy trees but still only have 40% or 50% canopy cover. Coverage units can be categories (0–4) or percentage values (0–100) (Seli et al. 2015).

Canopy cover for the analysis area was derived from 2012 LiDAR tree canopy cover data made available by the California Department of Forestry and Fire Protection (CAL FIRE 2015). This dataset was converted from raster to vector format in a GIS and the data analyzed for the analysis area. Minor edits to the dataset were made based on field observations and comparison with digital aerial photos. The file was then converted back to raster format and included two values representing percent of tree canopy cover: 0 (no tree canopy) and 100 (tree canopy).

Stand Height

Stand height is a representation of the average height of dominant and co-dominant trees in a stand (not the tallest height or average height of all trees) and is used in FlamMap for computing wind reduction to midflame height and spotting distances from torching trees. Input values are numeric (Seli et al. 2015). For this analysis, stand height values are represented in feet. Stand height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap. As described, field evaluations conducted to define fuel model assignments also included identification of stand height values for tree-dominated vegetation types. The stand height assignments are presented in Table D-1, by fuel model.

Canopy Base Height

Canopy base height is a variable used for determining transition from surface fire to crown fire and represents the height to the bottom of the live tree crown. Input values are numeric (Seli et al. 2015). For this analysis, canopy base height values are represented in feet. Canopy base height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap. As described, field evaluations conducted to define fuel model assignments also included identification of canopy base height values for tree-dominated vegetation types. Observed base heights were typically correlated with management history. For example, grazed areas (beneath trees) typically had 4-foot to 5-foot base heights, the heights that goats grazed up

APPENDIX D (Continued)

to. In areas where hand crews had treated surface vegetation, 8-foot base heights were typically observed. The stand height assignments are presented in Table D-1, by fuel model.

Canopy Bulk Density

Canopy bulk density is incorporated to determine the characteristics of crown fires and describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit. Input values are numeric (Seli et al. 2015). For this analysis, canopy bulk density values are represented in $\text{kg/m}^3 \times 100$ (kilograms per cubic meter x 100). Canopy bulk density is a necessary data set for utilizing the torching, spotting, and crown fire model in FlamMap. Data for the analysis area were derived from an analysis of canopy bulk density data for the Plan Area (LANDFIRE 2017).

Table D-1 provides a description of fuel models (including one non-burnable model) coded for the Plan Area that were subsequently used in the FlamMap analysis.

Table D-1
Fuel Model Characteristics

Fuel Model	Description	Land Cover*	Stand Height (feet)	Canopy Base Height (feet)
GR1 (101)	Short, Sparse Dry Climate Grass	Annual Grassland, Closed-Cone Pine-Cypress, Coast Oak Woodland, Eucalyptus, Perennial Grassland, Redwood, Urban	0, 35, 40, 45, 50, 60, 65, 80, 100, 110	0, 3, 4, 5, 8
GR4 (104)	Moderate Load, Dry Climate Grass	Annual Grassland	0	0
GS2 (122)	Moderate Load, Dry Climate Grass-Shrub	Coast Oak Woodland, Coastal Scrub, Eucalyptus	0, 25, 35, 40, 60	0, 2, 3, 4
SH1 (141)	Low Load, Dry Climate Shrub	Coastal Scrub	0	0
SH5 (145)	High Load, Dry Climate Shrub	Chamise-Redshank Chaparral, Closed-Cone Pine-Cypress, Coast Oak Woodland, Coastal Scrub, Eucalyptus	0, 25, 30, 35, 40, 60, 100, 110	0, 2, 3, 4
TU1 (161)	Low Load, Dry Climate Timber-Grass-Shrub	Closed-Cone Pine-Cypress, Coast Oak Woodland, Eucalyptus, Redwood	0, 45, 60, 100, 110	4, 6, 8
TU5 (165)	Very High Load, Dry Climate Timber-Shrub	Closed-Cone Pine-Cypress, Coast Oak Woodland, Eucalyptus, Urban (acacia and mixed tree stand)	0, 35, 40, 45, 60, 75, 100, 110, 120	2, 3, 4, 8
TL2 (182)	Low Load Broadleaf Litter	Coast Oak Woodland, Eucalyptus, Urban, Valley/Foothill Riparian	30, 35, 40, 45, 60, 100, 110	3, 4, 5
TL3 (183)	Moderate Load Conifer Litter	Closed-Cone Pine-Cypress, Eucalyptus, Redwood	60, 110	4
TL6 (186)	Moderate Load Broadleaf Litter	Eucalyptus, Urban	80, 110	4, 8

APPENDIX D (Continued)

Fuel Model	Description	Land Cover*	Stand Height (feet)	Canopy Base Height (feet)
TL8 (188)	Long Needle Litter	Closed-Cone Pine-Cypress	35, 100	4
TL9 (189)	Very High Load Broadleaf Litter	Eucalyptus	100	8
NB1 (91)	Non-burnable	Freshwater Emergent Wetland, Urban	0, 35, 40	0, 2, 4

Note: * As mapped by Horizon (2017; Appendix B).

Weather

Historical weather data for the Plan Area was utilized in determining appropriate fire behavior modeling inputs. For this analysis, 97th percentile fuel moisture and wind speed values were derived from Remote Automated Weather Station (RAWS) data and utilized in the fire behavior modeling efforts conducted in support of this VMP. Data from two RAWS in the Plan Area was utilized for modeling fire behavior, including the Oakland (North) RAWS (approximately 250 feet north of the City-owned Grizzly Peak Open Space parcels), and the Oakland (South) RAWS (located in the central portion of the Plan Area, on the City Stables property). Table D-2 summarizes location information and available data ranges for these two RAWS.

Table D-2
Remote Automated Weather Station Characteristics

Station Characteristic	Oakland (North)	Oakland (South)
Latitude	37° 51' 54"	37° 47' 10"
Longitude	-122° 13' 15"	-122° 08' 41"
Elevation	1,403 feet	1,095 feet
Data Years	1981, 1984, 1988, 1995-2016	1995-2016

To determine weather-related modeling inputs, RAWS fuel moisture and wind speed data were downloaded, processed, and analyzed using the FireFamilyPlus version 4.2 (FireFamilyPlus 2016) software package to determine 97th percentile (extreme) fire weather conditions. Data from the two RAWS was combined into a Special Interest Group (SIG) in the FireFamilyPlus software, with data from each station being weighted equally. The project SIG was evaluated from August 15 through November 15 for each year between 1995 and 2016 (extent of available data record). Data derived from this analysis included 97th percentile values for 1-hour, 10-hour, and 100-hour fuel moistures, live herbaceous moisture, live woody moisture, and 20-foot sustained wind speed. The weather data was also evaluated to determine the maximum sustained wind.

APPENDIX D (Continued)

These weather values were incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Wind direction and wind speed values for the FlamMap run were manually entered during the data input phase. Table D-3 presents the wind and weather values used in the FlamMap fire behavior modeling runs conducted in support of this VMP.

Table D-3
FlamMap Weather Input Variables

Model Variable	Value
1-hour fuel moisture	3%
10-hour fuel moisture	4%
100-hour fuel moisture	8%
Live herbaceous moisture*	30%
Live woody moisture	59%
20-foot wind speed (mph)	39 mph (maximum speed)
Wind direction	60 degrees

Note: * Live herbaceous moisture values were lower than 30% so the herbaceous fuels are considered fully cured (Scott and Burgan 2005).

Finally, wind vectors were modeled within the FlamMap runs using the WindNinja tool embedded in the FlamMap software. WindNinja models the effect of topography on wind speed and direction and generates wind vector files for use in the modeling runs. The grid resolution for the WindNinja analysis was set at 60 meters.

Model Outputs

Two output grid files were generated for the FlamMap run and represent flame length and crown fire activity. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et al. 2008). It is a somewhat subjective and non-scientific measure of fire behavior, but is extremely important to fireline personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1993). Flame length values in the resulting grid file are in feet. Table 5 in the VMP presents an interpretation of flame length and its relationship to fireline intensity. Model outputs for crown fire activity include three potential options: surface fire, passive crown fire (torching), or active crown fire. Surface fires may transition to crown fire, depending on surface fire intensity and crown characteristics. Ladder fuels facilitate ignition of crown fuels by the surface fire and then transition to some form of crown fire (Seli et al. 2015).

APPENDIX D (Continued)

Maps depicting flame length values and crown fire activity values are presented in Appendices D-3 and D-4, respectively. Table D-4 summarizes the fire behavior modeling results, by location.

**Table D-4
Fire Behavior Modeling Results**

Location	Flame Length	Crown Fire
Canyon Areas		
Garber Park	Flame lengths low (< 4 feet).	Surface fire only.
Dimond Canyon Park	Flame lengths high (> 8 feet) in coastal scrub and one coastal oak woodland area along Park Boulevard with grass/shrub understory. Flame lengths low to moderate (< 8 feet) in remaining areas of the property.	Primarily surface fire throughout the property, although small pockets of active crown fire occur the coastal oak woodland area along Park Boulevard with grass/shrub understory and in a few small areas within the drainage with high slope gradients.
Shepherd Canyon Park	Flame lengths high (> 8 feet) in area along the western side of Shepherd Canyon Road where broom exists beneath eucalyptus tree canopies. Flame lengths moderate (< 8 feet) within eucalyptus stand along Escher Drive. Flame lengths low (< 4 feet) throughout the remainder of the property.	Active and passive crown fire concentrated along the western side of Shepherd Canyon Road where broom exists beneath eucalyptus tree canopies. Surface fire throughout the remainder of the property.
Leona Heights Park	Flame lengths high (> 8 feet) in coastal oak woodlands in upland areas in the eastern and northern portions of the park. Flame lengths low (< 4 feet) within redwood stands along the drainage bottom, with some isolated active crown fire in areas with steep slope gradients. Flame lengths low (< 4 feet) within the managed eucalyptus and oak stands at the park's western edge.	Active and passive crown fire in coastal oak woodlands in upland areas in the eastern and northern portions of the park. Primarily surface fire within redwood stands along the drainage bottom, with some isolated active crown fire in areas with steep slope gradients. Surface fire only in the managed eucalyptus and oak stands at the park's western edge.
Ridgetop Areas		
North Oakland Regional Sports Field	Flame lengths high (> 8 feet) throughout property.	Active crown fire throughout most of the property's tree-dominated vegetation (eucalyptus and coastal oak woodland). Surface fire concentrated in managed areas along dirt access road and in area between ball field and eucalyptus stand.
Grizzly Peak Open Space	Flame lengths high (> 8 feet) throughout coastal scrub vegetation. Flame lengths low (< 4 feet) in coastal oak woodland. Variable flame lengths within pine and eucalyptus stands (low to high, dependent on canopy base heights and shading of surface fuels).	Torching of tree canopies along upper, northeastern portion of property and active crown fire along lower, southwestern portion of property.
City Stables	Flame lengths low (< 4 feet).	Surface fire only.
City Parklands and Open Space		

APPENDIX D (Continued)

Location	Flame Length	Crown Fire
Sheffield Village Open Space	Flame lengths high (> 8 feet) in coastal scrub, oak stands with a heavy shrub understory, and isolated areas within oak woodlands with grass understory where slope gradients are high. Flame lengths moderate (< 8 feet) in pine and eucalyptus stands adjacent to the golf course. Flame lengths low (< 4 feet) throughout the remainder of the property.	Active crown fire in coastal scrub (where overstory trees are present), oak stands with a heavy shrub understory, and isolated areas within oak woodlands with grass understory where slope gradients are high. Surface fire only throughout the remainder of the property.
Knowland Park and Arboretum	Flame lengths high (> 8 feet) in the coastal scrub and chaparral stands in the central and eastern portions of the property. Flame lengths moderate (< 8 feet) in the eucalyptus stands in the western portion of the property. Flame lengths low (< 4 feet) throughout the remainder of the property.	Active crown fire in the coastal scrub and chaparral stands in the central and eastern portions of the property (where overstory trees are present) and in the eucalyptus stands in the western portion of the property. Surface fire only throughout the remainder of the property.
Joaquin Miller Park	Flame lengths high (> 8 feet) throughout the northern and central portions of the park within non-managed oak, pine, eucalyptus, and acacia stands and within the acacia and mixed tree stands within the southern (lower) portions of the park. Flame lengths low to moderate (< 8 feet) in the lower, developed and managed portions of the park and along the park's western edge where it abuts Castle Drive (except acacia and mixed tree stands).	Active and passive crown fire within the northern and central portions of the park within non-managed oak, pine, eucalyptus, and acacia stands. Active and passive crown fire also within the acacia and mixed tree stands within the southern (lower) portions of the park. Surface fire only within redwood stands and throughout the lower, developed and managed portions of the park (except acacia and mixed tree stands).
King Estates	Flame lengths low (< 4 feet) throughout the property's coastal oak woodlands and grasslands. Flame lengths moderate (< 8 feet) to high (>8 feet) in the coastal scrub areas of the property.	Isolated active crown fire only in coastal scrub where overstory trees are present. Surface fire only throughout the remainder of the property.
Other (Blue Rock Court)	Flame lengths high (> 8 feet) in the eucalyptus stand in the center of the property. Flame lengths low (< 4 feet) throughout the remainder of the property.	Active and passive crown fire in the eucalyptus stand in the center of the property. Surface fire only throughout the remainder of the property.
Other (Leona Street)	Flame lengths low (< 4 feet) in coastal oak woodland and annual grassland. Flame lengths high (> 8 feet) in eucalyptus stand at the property's southern end.	Surface fire only in coastal oak woodland and annual grassland. Active crown fire in eucalyptus stand at the property's southern end.
Other (McDonell Avenue)	Flame lengths low (< 4 feet).	Surface fire only.
Other (Police/Safety Department)	Flame lengths low (< 4 feet).	Surface fire only.
Other (Tunnel Road Open Space)	Flame lengths low (< 4 feet).	Surface fire only.
Other (Beaconsfield Common)	Flame lengths high (> 8 feet) in coastal scrub. Flame lengths low to moderate (< 8 feet) in coastal oak woodland and pine stands.	Active and passive crown fire in eucalyptus stands. Surface fire in coastal oak woodland and pine stands.
Other (Sulfur Springs Park)	Flame lengths high (> 8 feet) in eucalyptus stands. Flame lengths low to moderate (< 8 feet) in coastal oak woodland and pine stands.	Active and passive crown fire in coastal scrub (where overstory trees are present). Surface fire in coastal oak woodland and pine stands.

APPENDIX D (Continued)

INTENTIONALLY LEFT BLANK

APPENDIX D-1
Fuel Model Photo Series

APPENDIX D-1



Photo 1. Fuel Model GR4 (104) - Moderate Load, Dry Climate Grass.
Higher fire hazard, non-grazed grassland (King Estates, January 5, 2017).



Photo 2. Fuel Model GR1 (101) - Short, Sparse Dry Climate Grass.
Lower fire hazard, grazed grassland (King Estates, September 12, 2017).

APPENDIX D-1



Photo 3. Fuel Model GR1 (101) - Short, Sparse Dry Climate Grass.
Lower fire hazard, grazed grasses with eucalyptus overstory (Skyline Boulevard, September 11, 2017).



Photo 4. Fuel Model GR1 (101) - Short, Sparse Dry Climate Grass.
Lower fire hazard, grazed grasses with oak overstory (Shepherd Canyon Park, September 11, 2017).

APPENDIX D-1



Photo 5. Fuel Model GS2 (122) - Moderate Load, Dry Climate Grass-Shrub.
Higher fire hazard, un-grazed grasses with scattered shrubs and eucalyptus sprout growth (North Oakland Regional Sports Field, September 11, 2017).



Photo 6. Fuel Model GS2 (122) - Moderate Load, Dry Climate Grass-Shrub.
Lower fire hazard, grazed grasses with scattered shrubs (Grizzly Peak Open Space, September 12, 2017).

APPENDIX D-1



Photo 7. Fuel Model SH1 (141) - Low Load, Dry Climate Shrub.
Lower fire hazard, grazed grasses between shrubs (King Estates, September 12, 2017).



Photo 8. Fuel Model SH5 (145) - High Load, Dry Climate Shrub.
Higher fire hazard, high brush load with scattered oak and eucalyptus trees (North Oakland Regional Sports Field, September 11, 2017).

APPENDIX D-1



Photo 9. Fuel Model SH5 (145) - High Load, Dry Climate Shrub.
Higher fire hazard, high brush load (coastal scrub) (Sheffield Village Open Space, September 12, 2017).



Photo 10. Fuel Model SH5 (145) - High Load, Dry Climate Shrub.
Higher fire hazard, high brush load beneath young eucalyptus trees (North Oakland Regional Sports Field, September 11, 2017).

APPENDIX D-1



Photo 11. Fuel Model TU1 (161) - Low Load, Dry Climate Timber-Grass-Shrub.
Higher fire hazard, eucalyptus with broom understory (Shepherd Canyon Park, September 11, 2017).



Photo 12. Fuel Model TU1 (161) - Low Load, Dry Climate Timber-Grass-Shrub.
Higher fire hazard, un-grazed grass and shrub understory with oak, pine, and bay overstory (Sulphur Springs Park, September 12, 2017).

APPENDIX D-1



Photo 13. Fuel Model TU1 (161) - Low Load, Dry Climate Timber-Grass-Shrub.
Lower fire hazard, redwood with seedling understory (Joaquin Miller Park, September 12, 2017).



Photo 14. Fuel Model TU5 (165) - Very High Load, Dry Climate Timber-Shrub.
Higher fire hazard, eucalyptus overstory with seedling and brush understory (North Oakland Regional Sports Field, September 11, 2017).

APPENDIX D-1



Photo 15. Fuel Model TU5 (165) - Very High Load, Dry Climate Timber-Shrub.
Higher fire hazard, pine and oak overstory with seedling and brush understory (Joaquin Miller Park, September 12, 2017).



Photo 16. Fuel Model TL2 (182) - Low Load Broadleaf Litter.
Lower fire hazard, oak woodland with twig and leaf litter surface fuels (Sheffield Village Open Space, September 12, 2017).

APPENDIX D-1



Photo 17. Fuel Model TL2 (182) - Low Load Broadleaf Litter.

Lower fire hazard, oak woodland with fern, ivy, leaf litter surface fuels (Garber Park, September 13, 2017).



Photo 18. Fuel Model TL3 (183) - Moderate Load Conifer Litter.

Lower fire hazard, redwood stand with needle litter and small twig/branch surface fuels (Joaquin Miller Park, September 12, 2017).

APPENDIX D-1



Photo 19. Fuel Model TL6 (186) - Moderate Load Broadleaf Litter.

Lower fire hazard, eucalyptus stand with leaf litter and small twig/branch surface fuels (Shepherd Canyon Park, January 19, 2017).



Photo 20. Fuel Model TL8 (188) - Long Needle Litter.

Lower fire hazard, pine stand with needle litter and low grass surface fuels (Joaquin Miller Park, September 12, 2017).

APPENDIX D-1



Photo 21. Fuel Model TL9 (189) - Very High Load Broadleaf Litter.

Higher fire hazard, eucalyptus stand with heavy leaf litter, bark, and small twig/branch surface fuels (North Oakland Regional Sports Field, January 19, 2017).

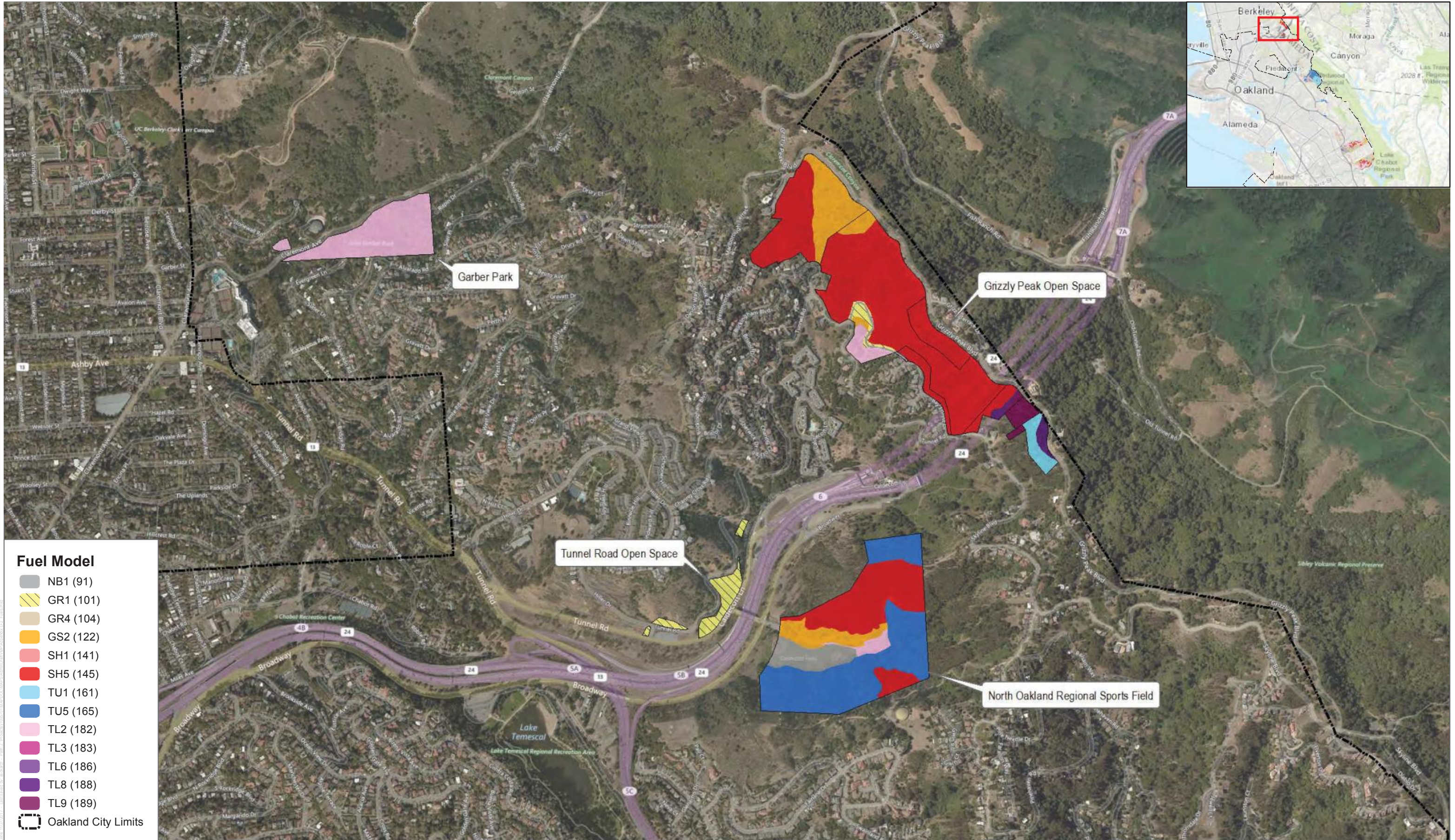


Photo 22. Fuel Model NB1 (91) - Developed.

Developed, dirt, or paved areas, no fire spread (Joaquin Miller Park, September 12, 2017).

APPENDIX D-2

Maps – Fuel Types

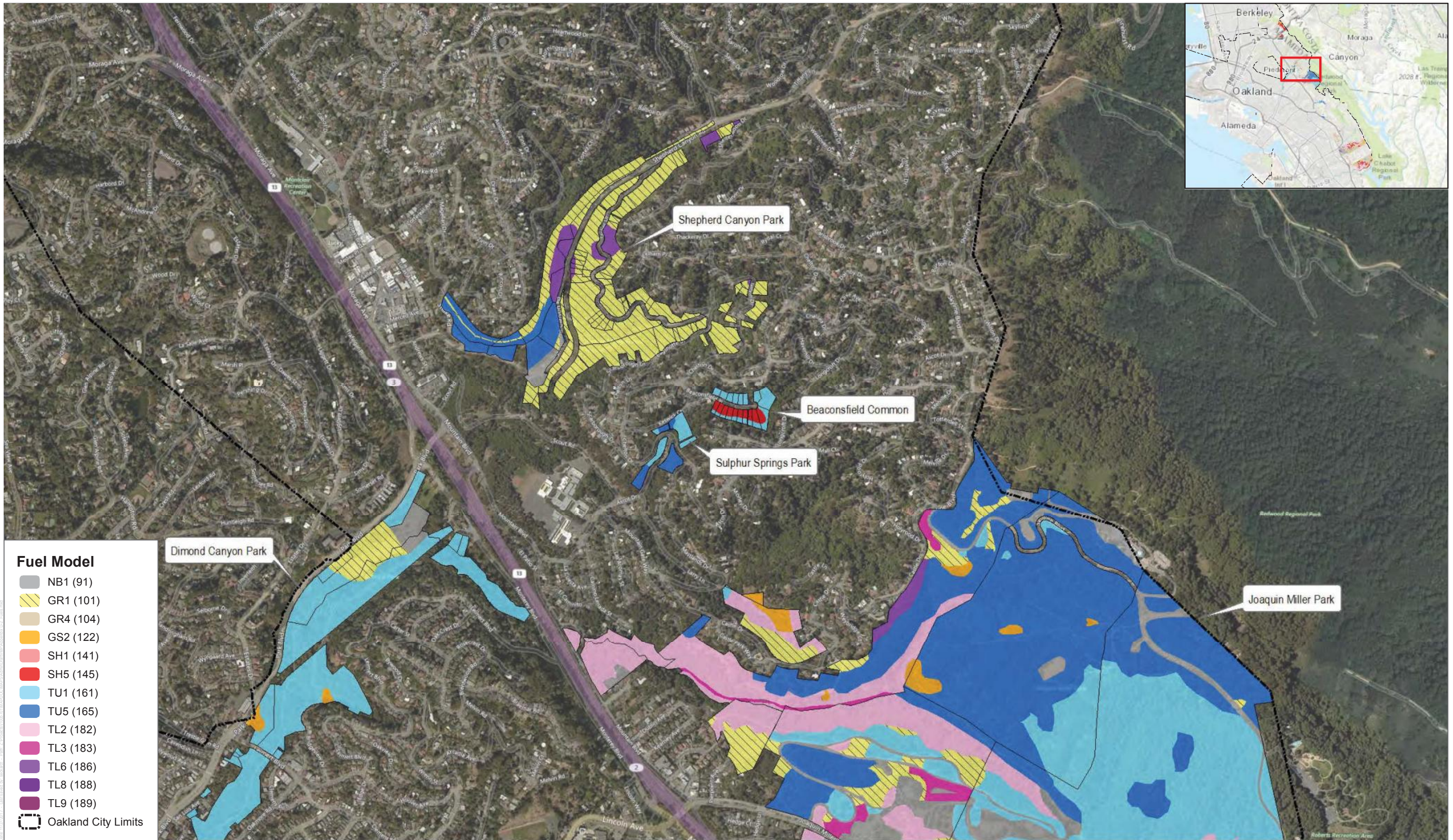


Fuel Model

	NB1 (91)
	GR1 (101)
	GR4 (104)
	GS2 (122)
	SH1 (141)
	SH5 (145)
	TU1 (161)
	TU5 (165)
	TL2 (182)
	TL3 (183)
	TL6 (186)
	TL8 (188)
	TL9 (189)
	Oakland City Limits

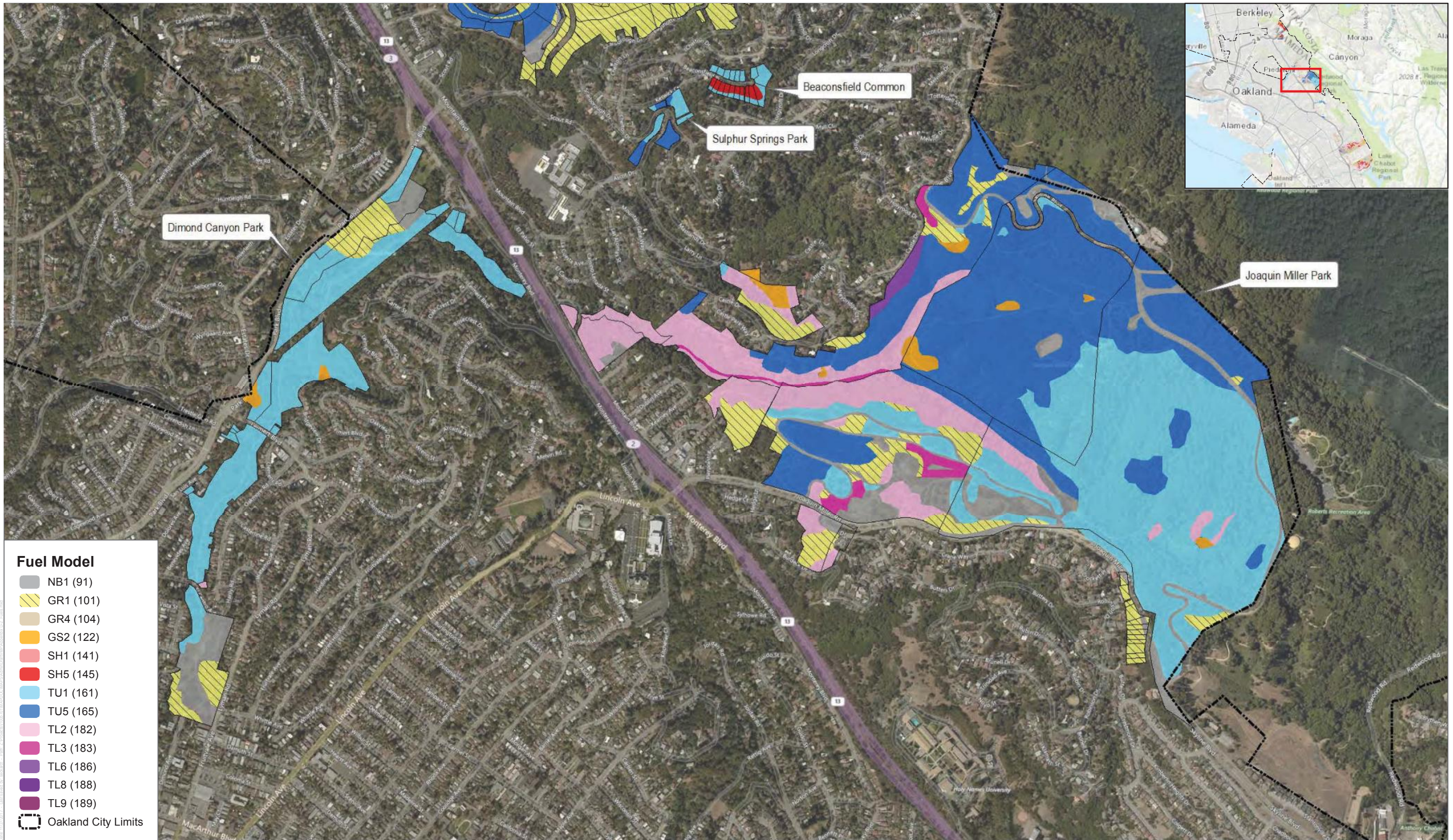
SOURCE: USGS 2017; ESRI 2017; Dudek 2017





SOURCE: USGS 2017; ESRI 2017; Dudek 2017





SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-2.3

Fuel Types

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California

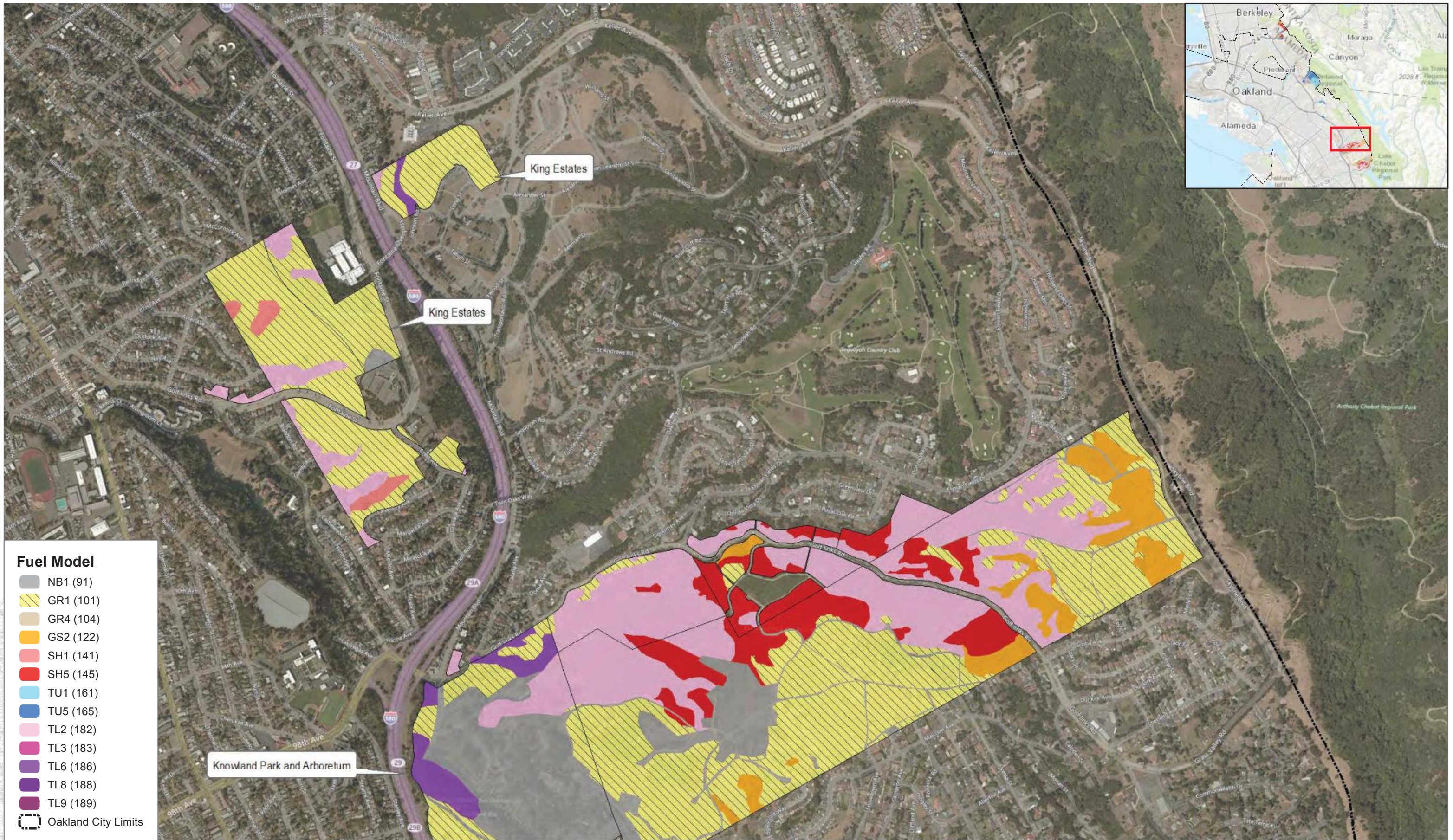


SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-2.4

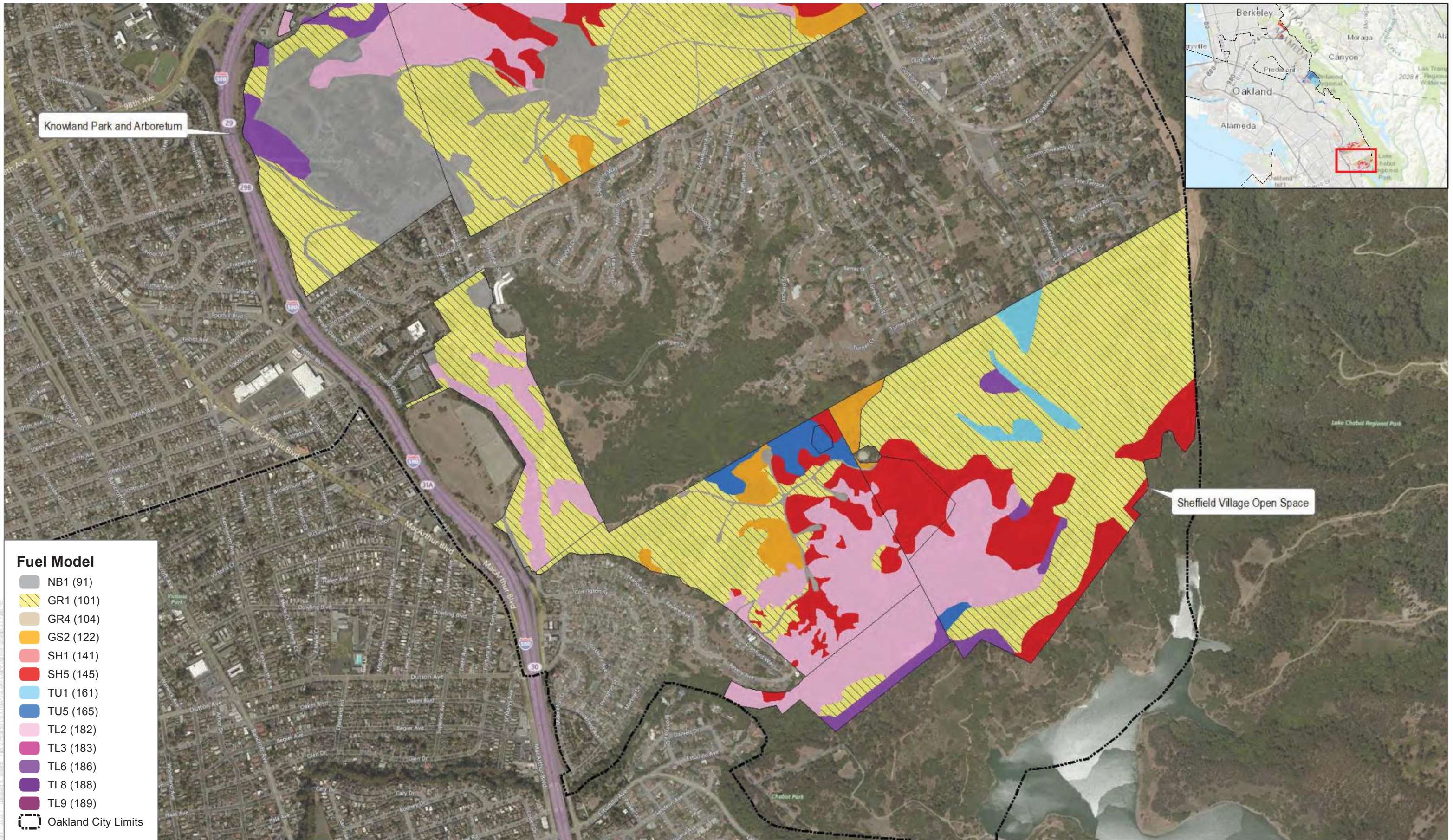
Fuel Types



- Fuel Model**
- NB1 (91)
 - GR1 (101)
 - GR4 (104)
 - GS2 (122)
 - SH1 (141)
 - SH5 (145)
 - TU1 (161)
 - TU5 (165)
 - TL2 (182)
 - TL3 (183)
 - TL6 (186)
 - TL8 (188)
 - TL9 (189)
 - Oakland City Limits

SOURCE: USGS 2017; ESRI 2017; Dudek 2017





Knowland Park and Arboretum

Sheffield Village Open Space

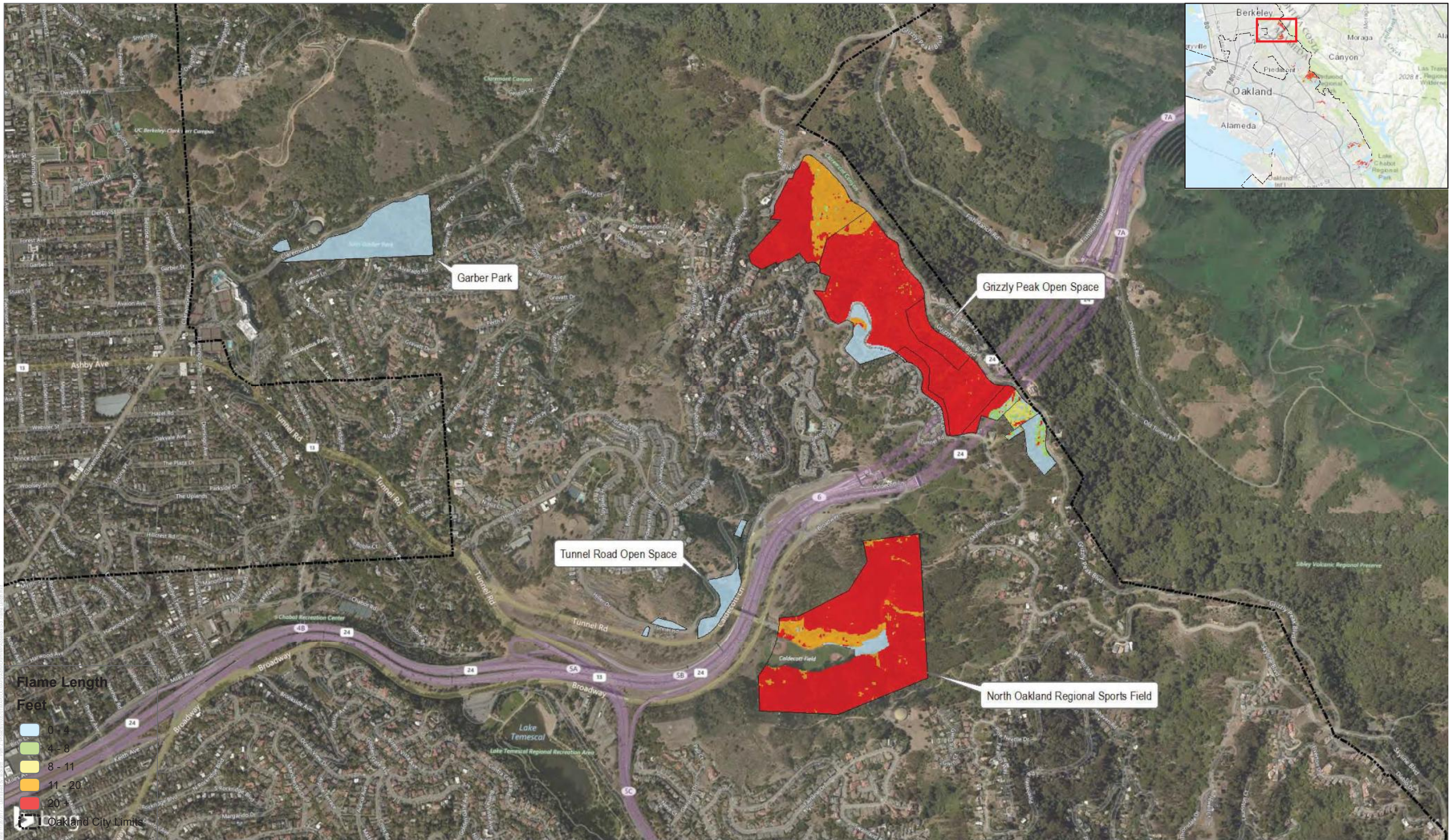
- Fuel Model**
- NB1 (91)
 - GR1 (101)
 - GR4 (104)
 - GS2 (122)
 - SH1 (141)
 - SH5 (145)
 - TU1 (161)
 - TU5 (165)
 - TL2 (182)
 - TL3 (183)
 - TL6 (186)
 - TL8 (188)
 - TL9 (189)
 - Oakland City Limits

SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-3

Maps – Fire Behavior (Flame Length)



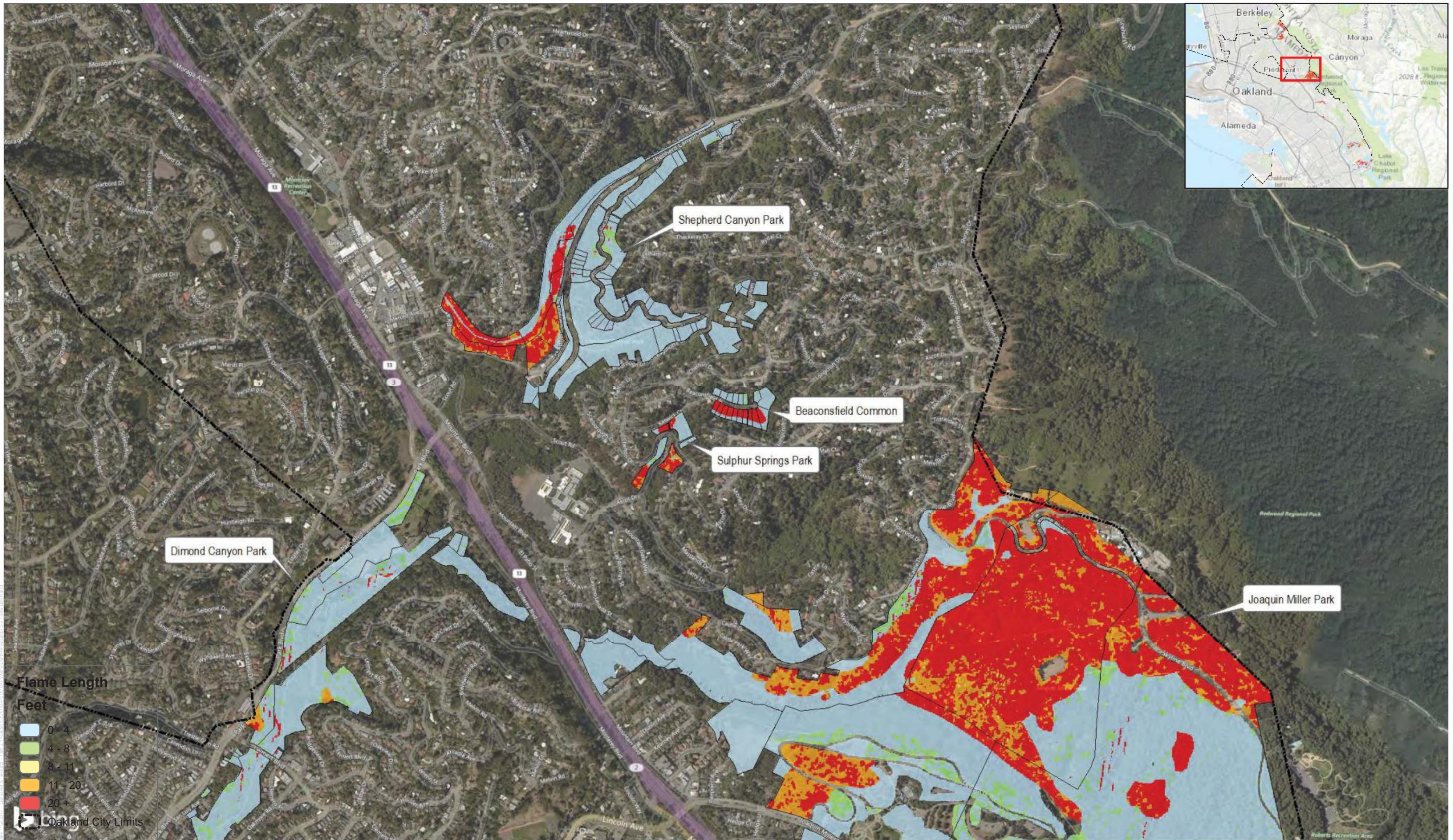
SOURCE: USGS 2017; ESRI 2017; Dudek 2017

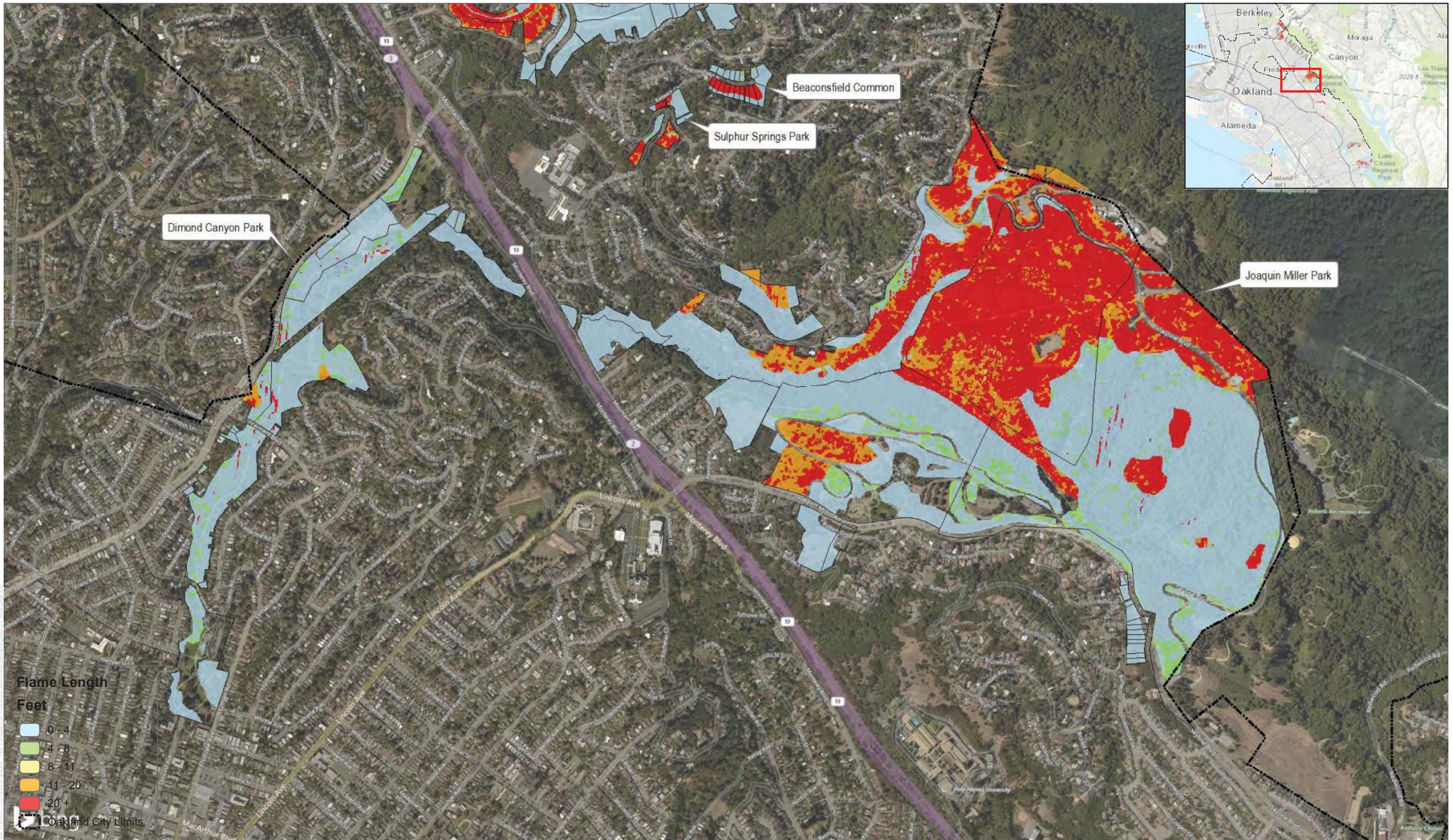


APPENDIX D-3.1

Fire Behavior (Flame Length)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California



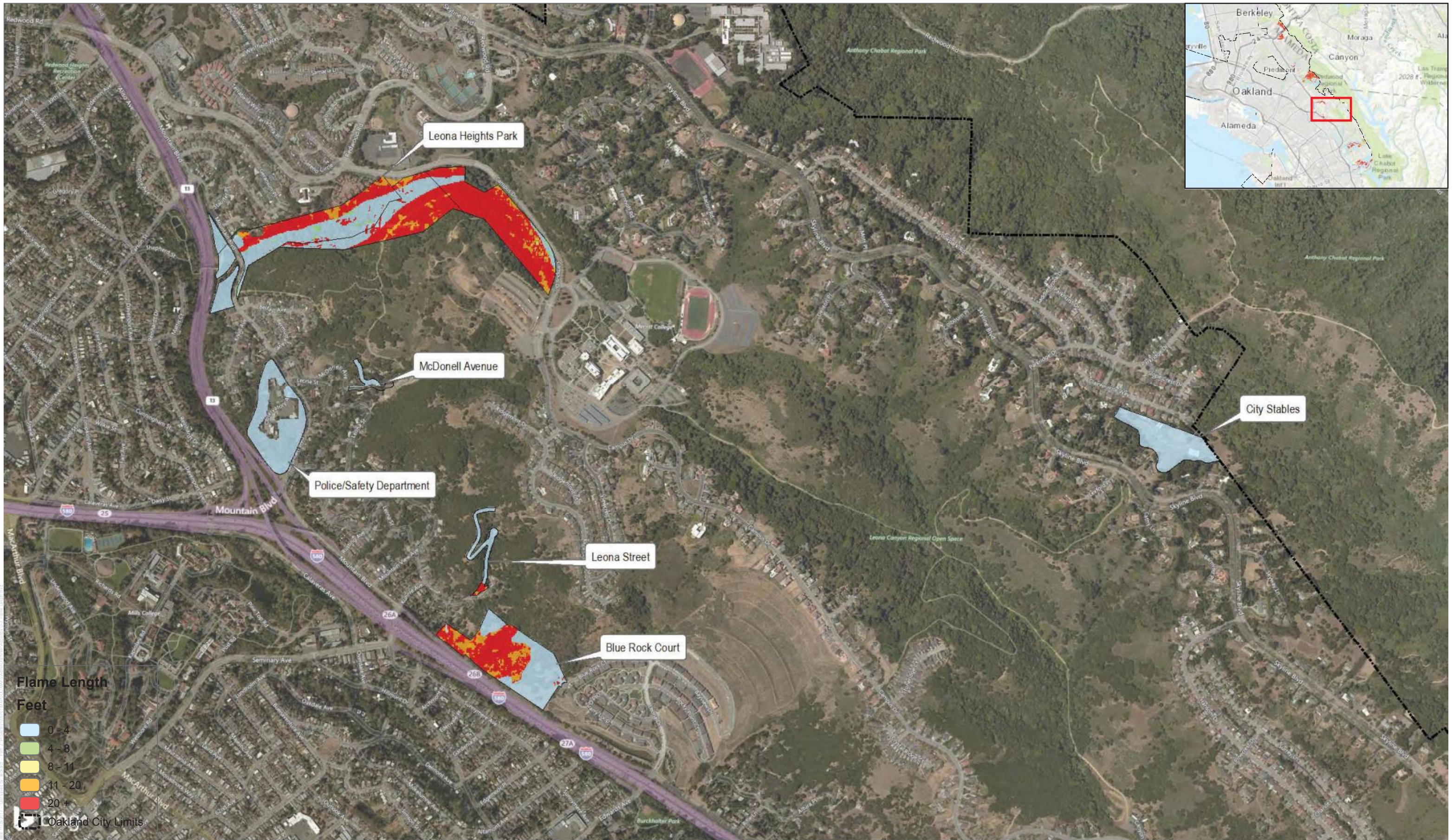


SOURCE: USGS 2017; ESRI 2017; Dudek 2017

APPENDIX D-3.3

Fire Behavior (Flame Length)



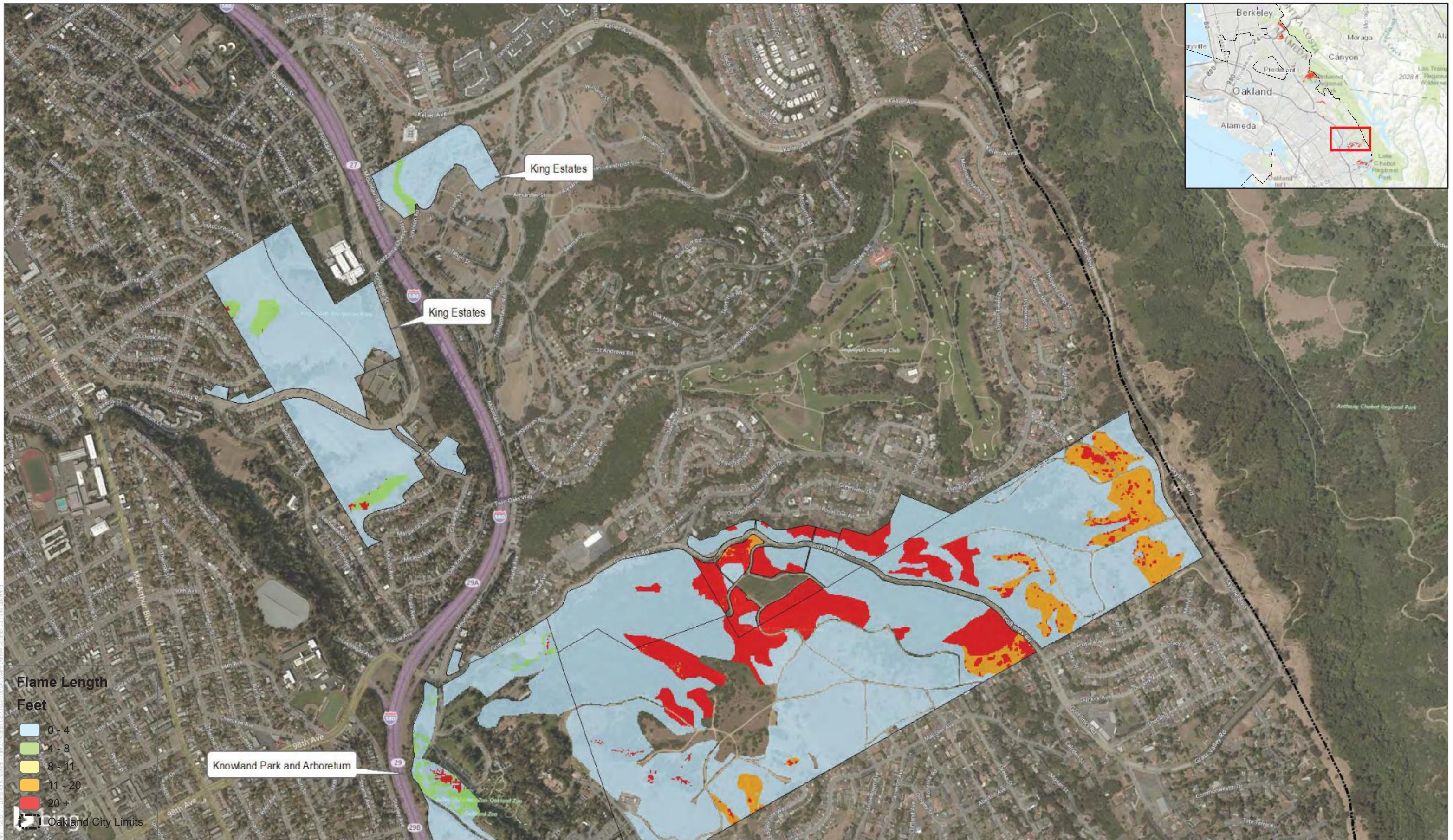


SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-3.4

Fire Behavior (Flame Length)



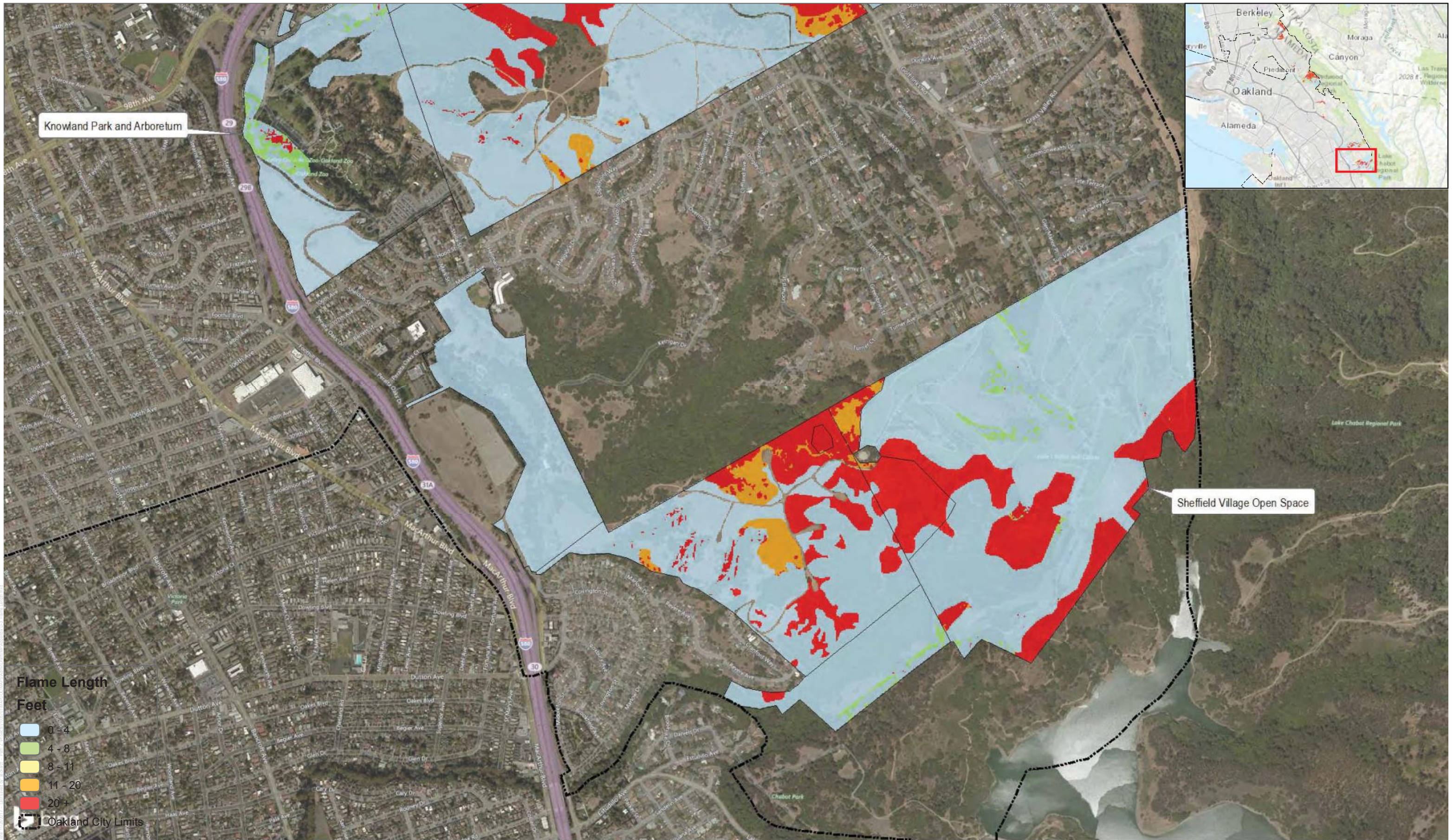
SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-3.5

Fire Behavior (Flame Length)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California



SOURCE: USGS 2017; ESRI 2017; Dudek 2017



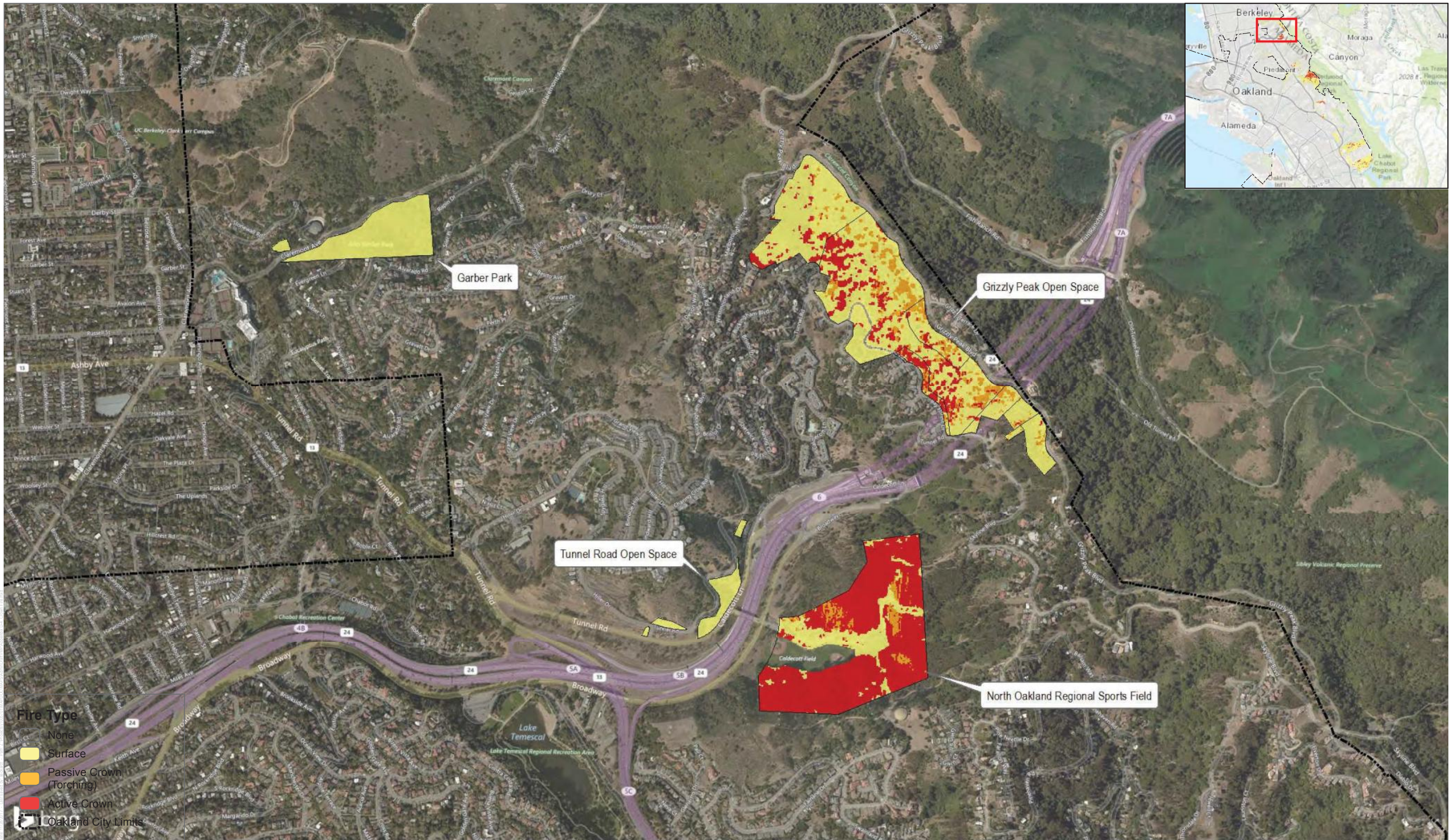
APPENDIX D-3.6

Fire Behavior (Flame Length)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California

APPENDIX D-4

Maps – Fire Behavior (Crown Fire Activity)



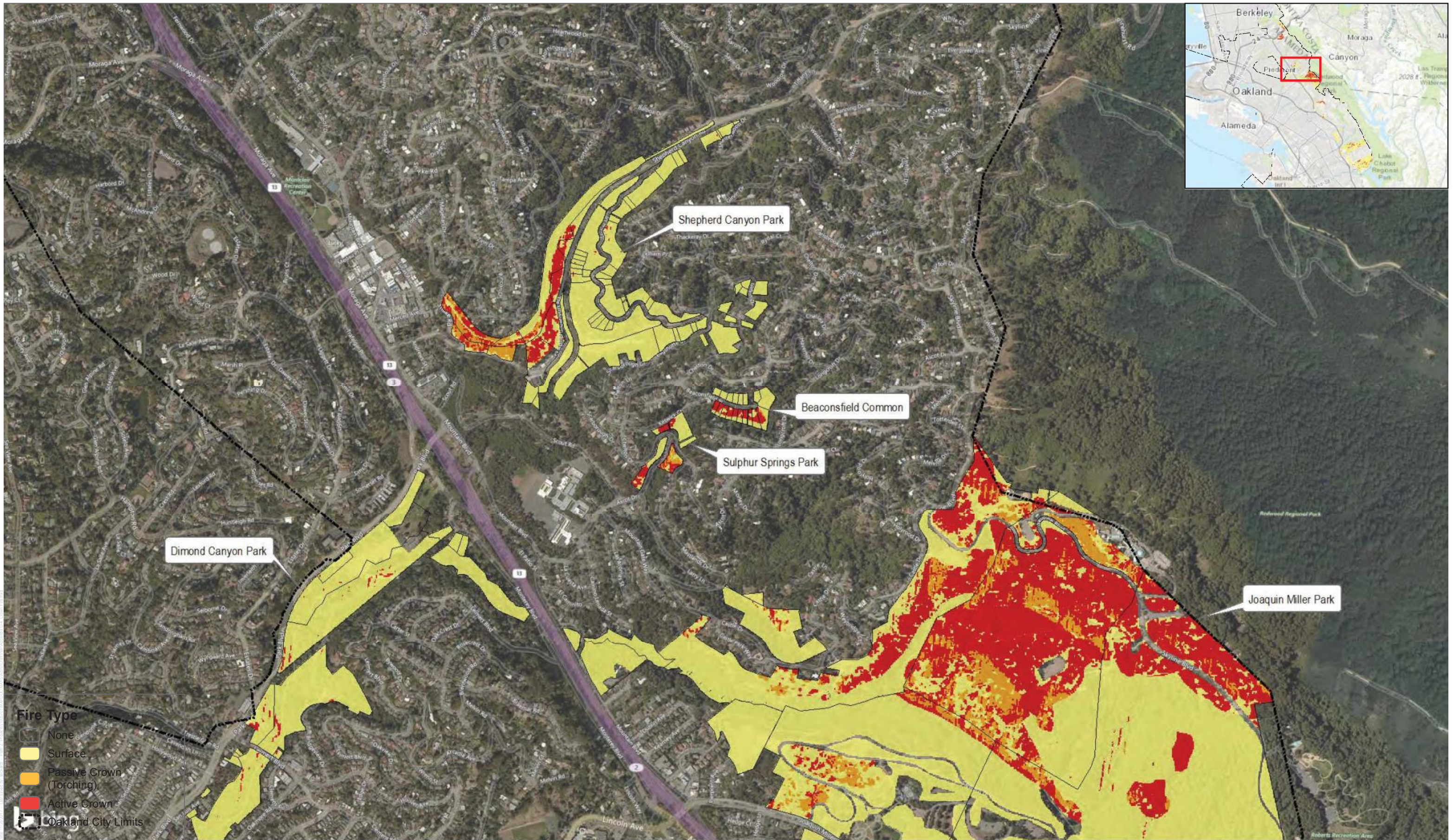
SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.1

Fire Behavior (Crown Fire Activity)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California



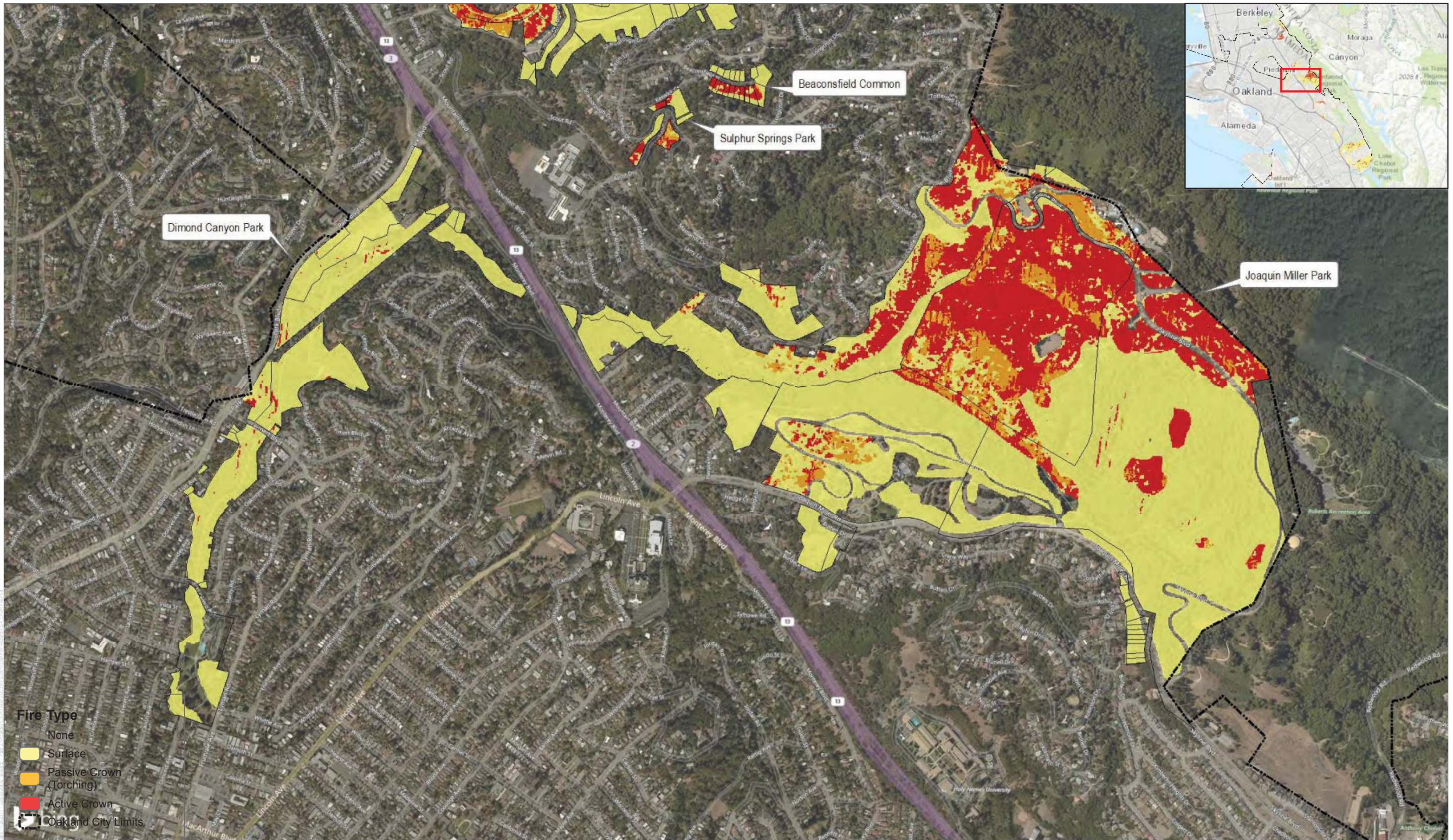
SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.2

Fire Behavior (Crown Fire Activity)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California

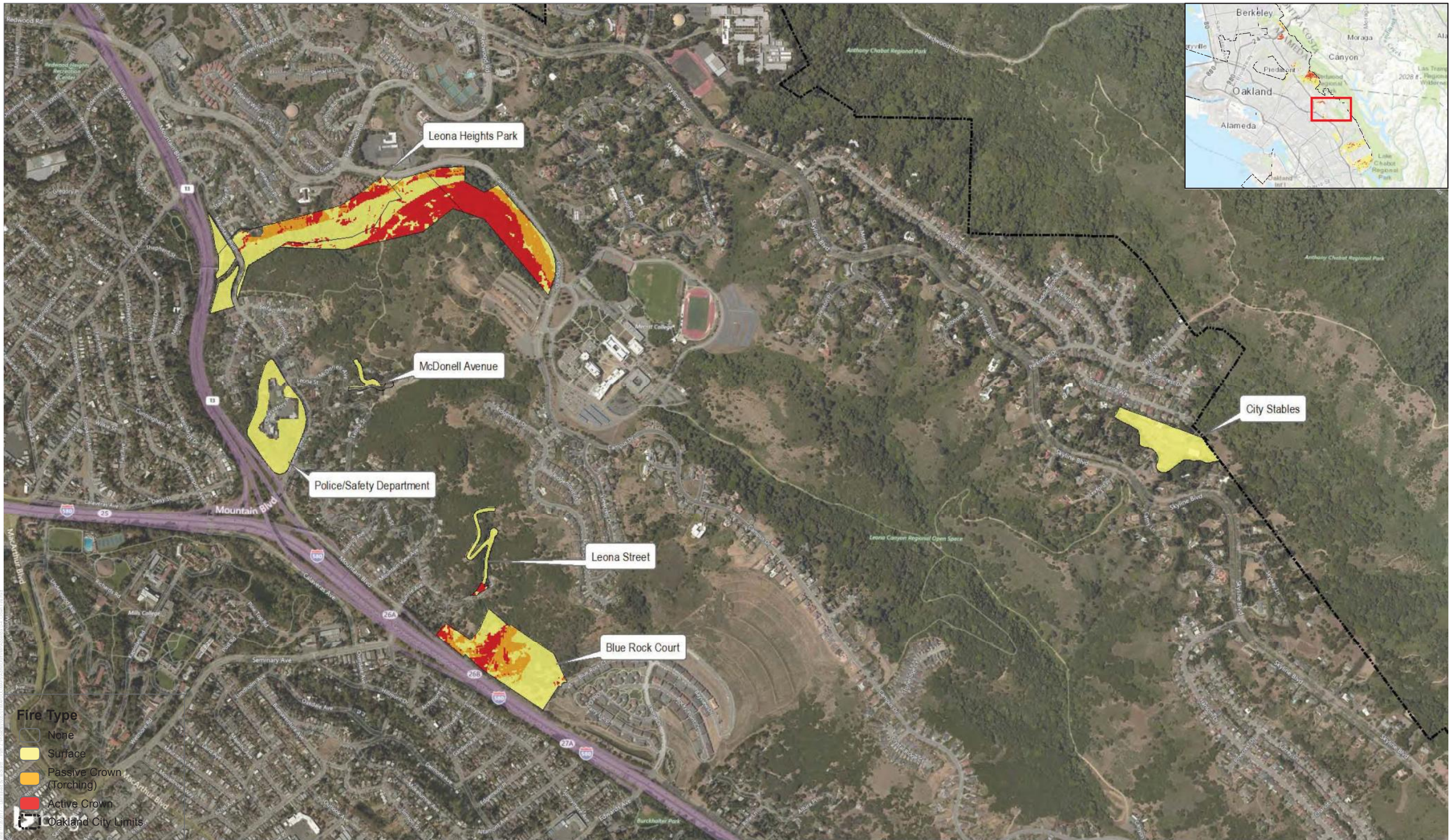


SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.3

Fire Behavior (Crown Fire Activity)

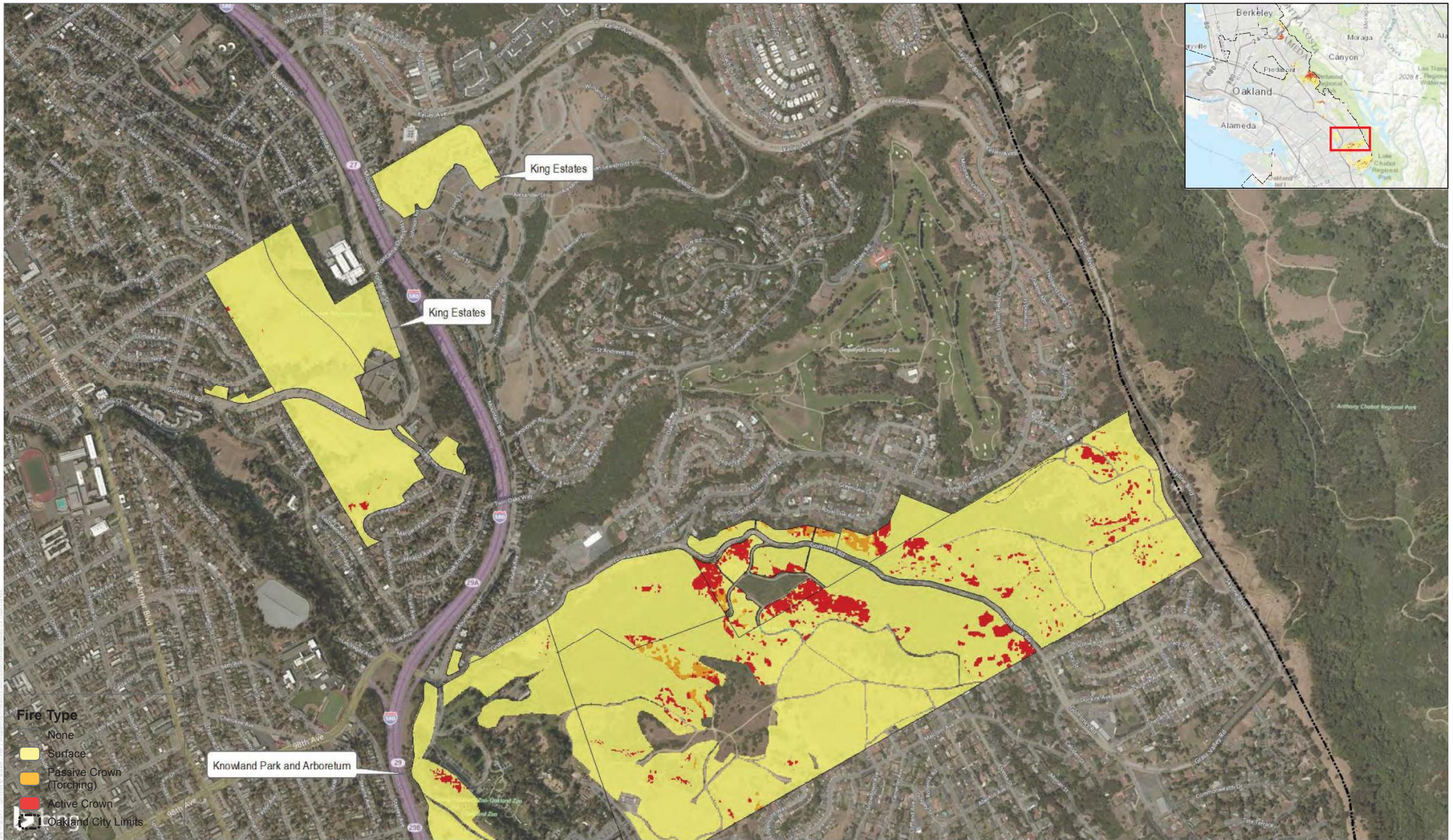


SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.4

Fire Behavior (Crown Fire Activity)



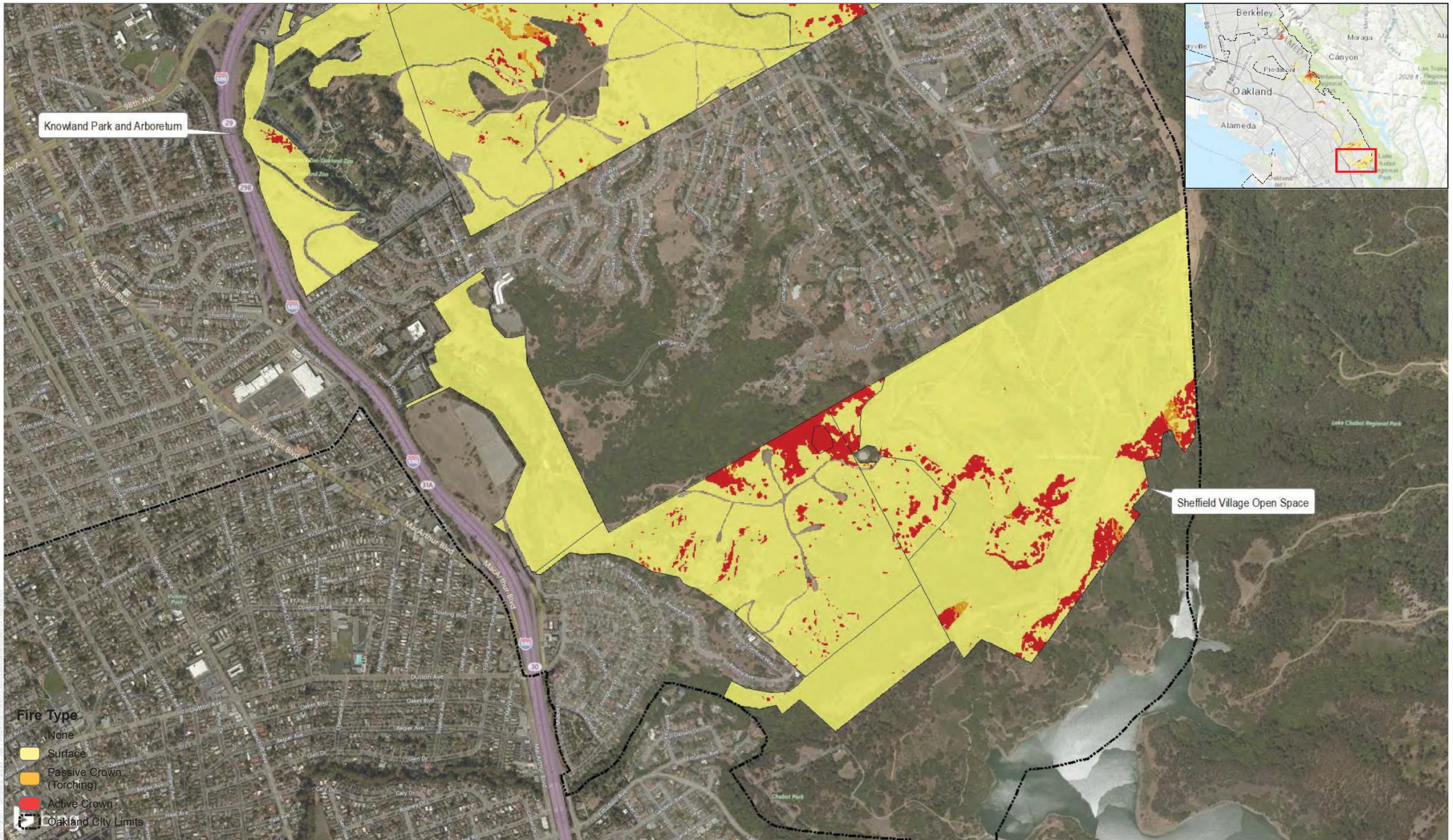
- Fire Type**
- None
 - Surface
 - Passive Crown (Torching)
 - Active Crown
 - Oakland City Limits

SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.5

Fire Behavior (Crown Fire Activity)



SOURCE: USGS 2017; ESRI 2017; Dudek 2017



APPENDIX D-4.6

Fire Behavior (Crown Fire Activity)

Appendix D (Fire Behavior Analysis) - Draft Vegetation Management Plan - City of Oakland, California

APPENDIX E

Summary of Public Engagement Survey Results



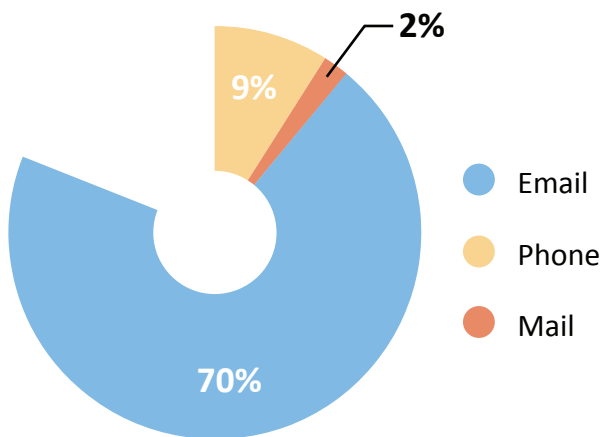
City of Oakland Vegetation Management Plan

March-May 2017, Community Survey Results

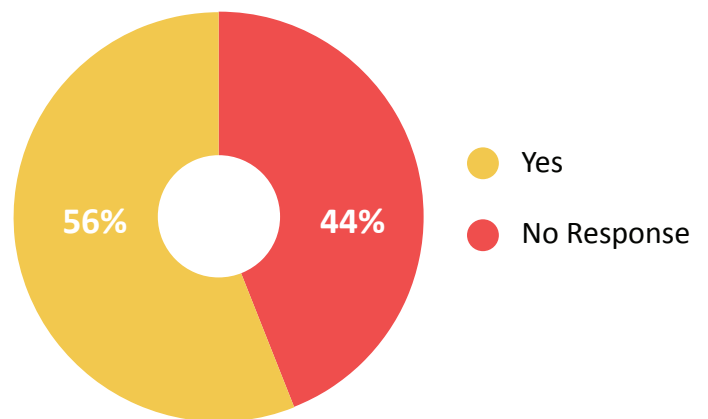
Total Responses: 316

Total Unique/Individual Responses: 310

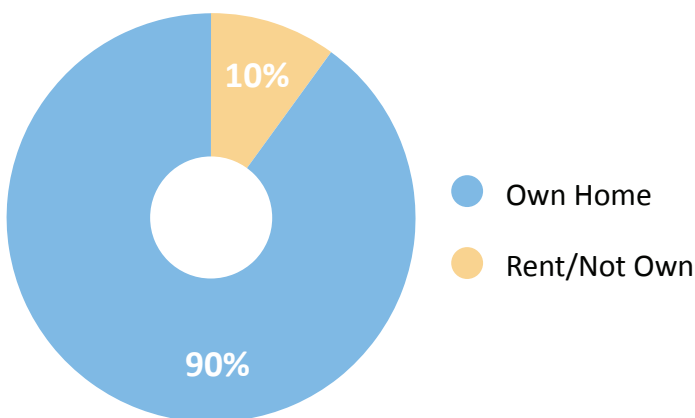
Preferred Method of Contact



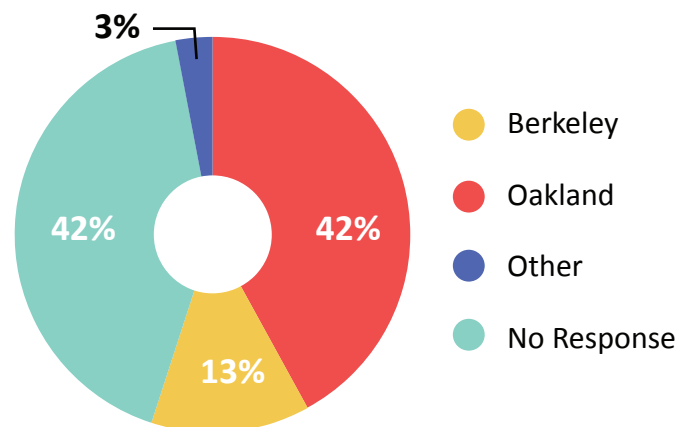
Add to Mailing List:



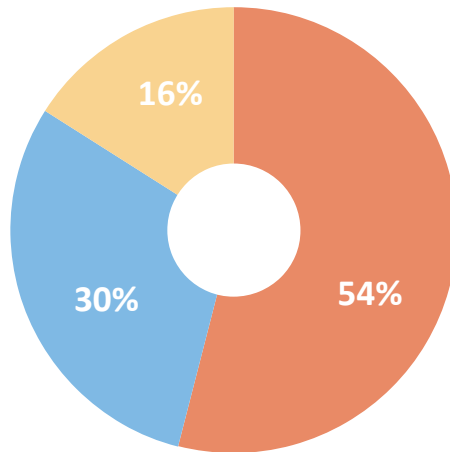
Home Ownership:



Percentage of respondents from East Bay Hills:

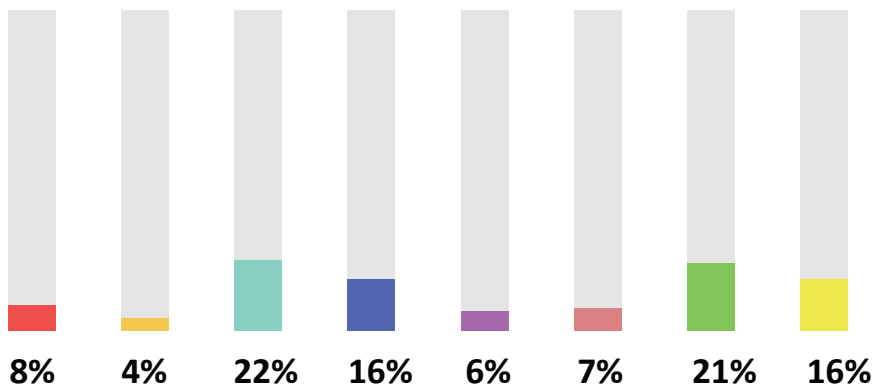


Since living in home, changes have been noticed in:



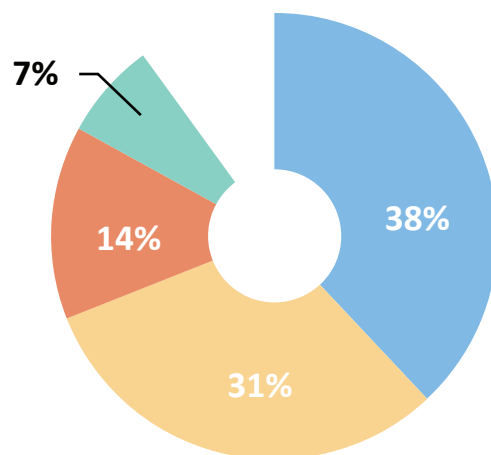
- Accumulation of flammable weeds, brush, trees, and other fire fuels
- Risk of fire to houses in the community
- No change

Since living in home, closest a fire has come it:



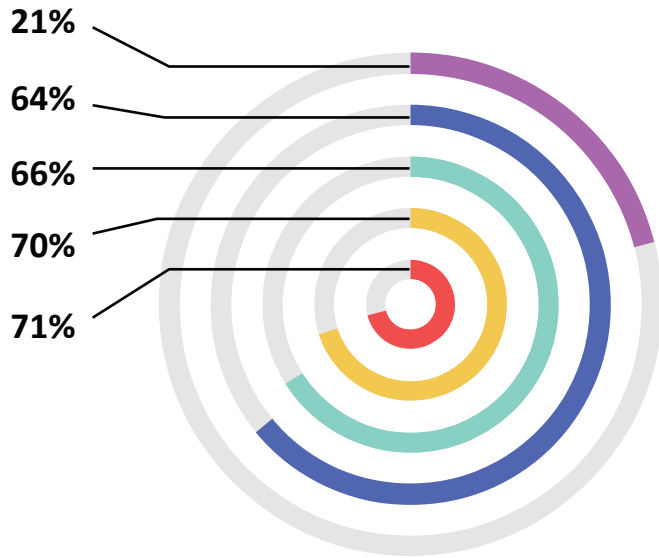
- On Property
- Up to property line
- Within 1 mile
- Between 1 and 5 miles
- Between 5 and 10 miles
- More than 10 miles away
- No fire threat
- Not Sure

I worry about fire:



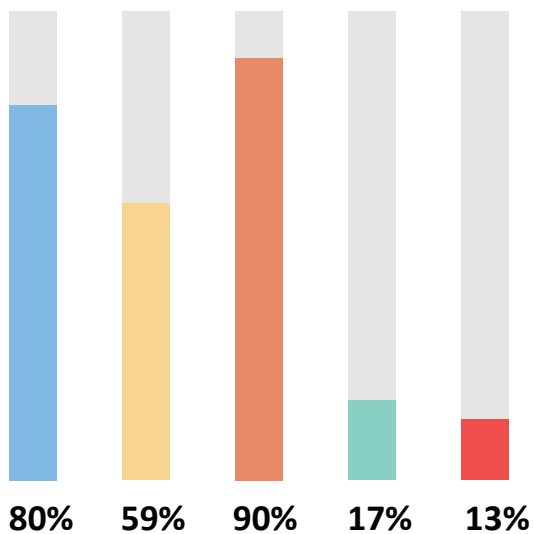
- Sometimes
- Often
- Never
- Constantly

Goals to be included in the Vegetation Management Plan:



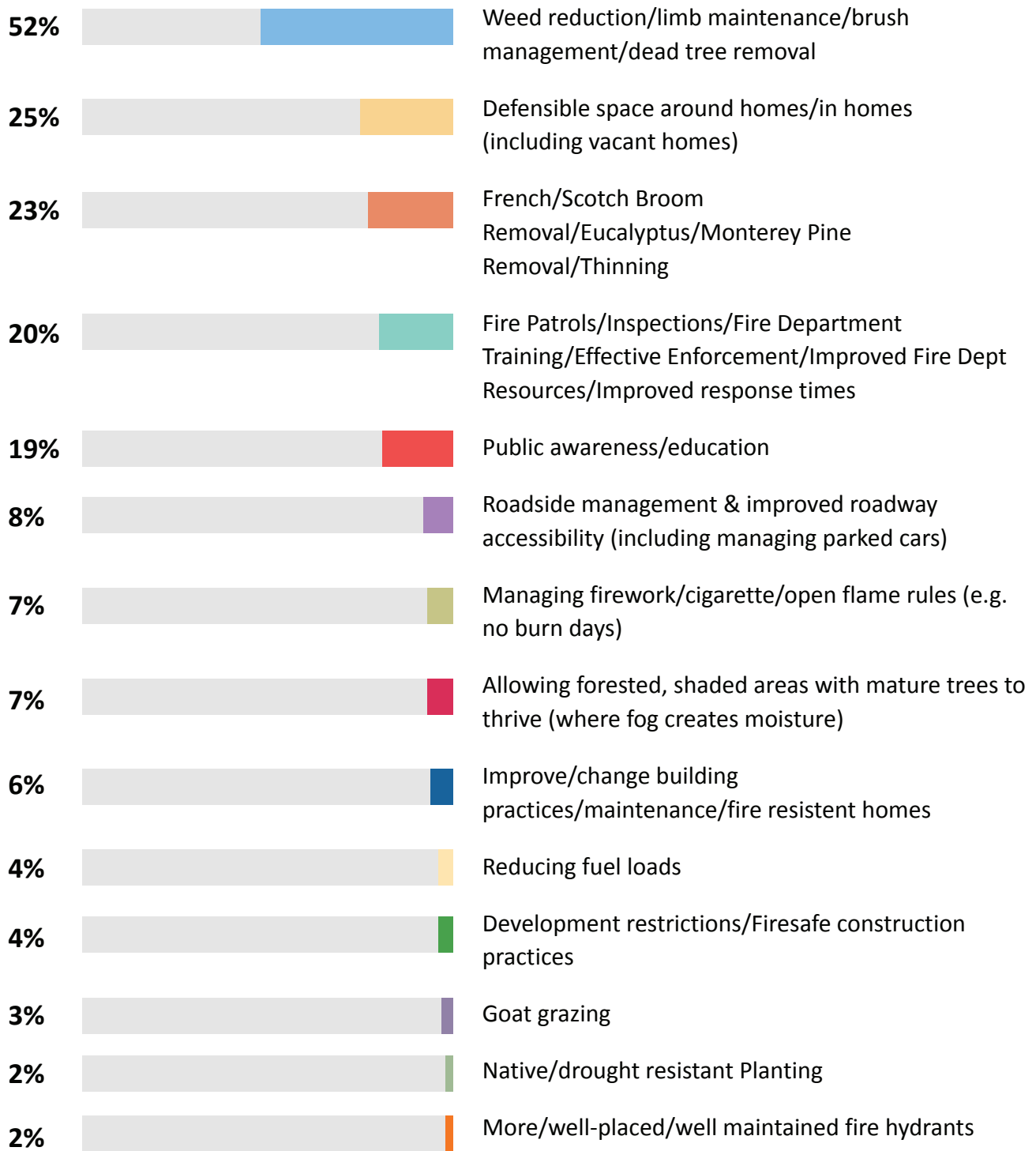
- Reduce fire hazard on City-owned land and along critical access routes with in the City's designated Very High Fire Hazard Severity Zone
- Manage vegetation to reduce the likelihood of ignitions and extreme fire behavior, and to enhance public and firefighter safety
- Implement practices to avoid or minimize impacts to natural resources
- Maintain an active role in regional efforts to reduce fire hazard in the Oakland hills
- Other

Preferred Vegetation Management Techniques:

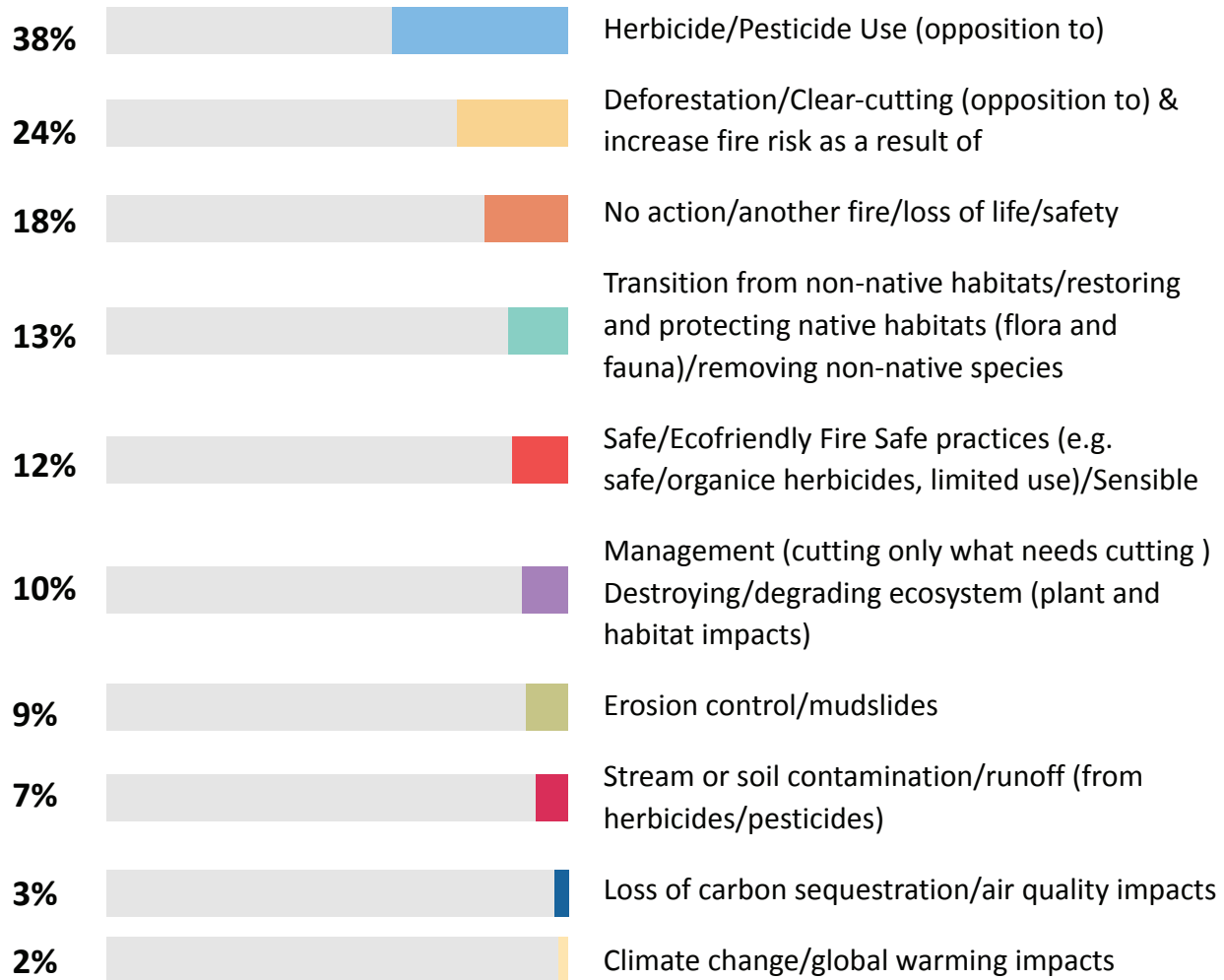


- Manual
- Mechanical
- Grazing
- Herbicides
- Other

In your community, what reduces wildfire risk?



Environmental Concerns:



APPENDIX F

*The Weed Workers' Handbook - A Guide to
Techniques for Removing Bay Area Invasive Plants*

THE WEED WORKERS' HANDBOOK

**A Guide to
Techniques for
Removing Bay Area
Invasive Plants**



**The Watershed Project
California Invasive Plant Council**

Authors

Pete Holloran (chapters 1-5)
Anouk Mackenzie (chapter 6 and resources)
Sharon Farrell
Doug Johnson

Editing and Proofreading

Cynthia Harrington
Anne Hayes

Design and Production

Melanie Haage

Illustrations

Ryan Jones

© 2004 by The Watershed Project and
California Invasive Plant Council
All rights reserved. First edition published May 2004.



1327 South 46th Street, Building 155
Richmond, CA 94804
www.thewatershedproject.org
(510) 231-5655



California Invasive Plant Council
1442-A Walnut Street #462
Berkeley, CA 94709
www.cal-ipc.org
(510) 843-3902

“It’s an amazing feeling of accomplishment when I visit some of our old sites. What had been a monoculture of an invasive species is being transformed by native plants taking the site back over, making it look like we had never been there.”

Ken Moore, Wildlands Restoration Team, Santa Cruz



“When environmental restoration is most successful, it also improves our hearts, and cultivates an enduring relationship with Nature. . . . Done properly, environmental restoration restores far more than just the land.”

Richard Nilsen, from Helping Nature Heal



“While we bemoan the lack of funding for our restoration work, it has an undeniable positive side: it forces us to rely on volunteers. How many of us have made exciting discoveries, gained insights into the world and into ourselves—learned things we didn’t even know existed until they came into our consciousness? We who work in the difficult environment of fragmented, highly impacted natural systems in urban areas develop insights which may prove invaluable as the human societal and environmental crisis deepens. The knowledge gained from our experience may become in demand as awareness of the connection between human welfare and the natural world increases. Such knowledge cannot be found in our traditional repositories and disciplines. And, most surprising of all, we discover that when we understand how the world works we come to understand ourselves.”

Jake Sigg, California Native Plant Society, Yerba Buena Chapter

CONTENTS

PREFACE	vii
CHAPTER 1 Background: Putting Weed Work in Context	1
CHAPTER 2 Strategy: Planning for Effectiveness	7
CHAPTER 3 Communication: Talking about Wildland Weeds	13
CHAPTER 4 Coordination: Organizing Volunteer Weed Projects	19
CHAPTER 5 Tools and Techniques: Manually Controlling Wildland Weeds	29
Integrated Pest Management	30
Key Control Techniques	34
Tool Safety, Care, and Selection	44
Weed Workers' Tools Explained	46
Weed Workers' Tools Illustrated	50
CHAPTER 6: The Plants: How to Remove Bay Area Weeds	53
Vines	
Cape ivy (<i>Delairea odorata</i>)	56
Ivy species (<i>Hedera helix</i> and <i>H. canariensis</i>)	58
Himalayan blackberry (<i>Rubus discolor</i>)	60
Periwinkle (<i>Vinca major</i>)	62
Shrubs	
Broom species (<i>Genista monspessulana</i> , <i>Cytisus scoparius</i> , and <i>Spartium junceum</i>)	64
Cotoneaster species (<i>Cotoneaster franchetii</i> , <i>C. pannosa</i> , and <i>C. lactea</i>)	68
Sticky eupatorium (<i>Ageratina adenophora</i>)	70
Perennials and Biennials	
Artichoke thistle (<i>Cynara cardunculus</i>)	72
Bull thistle (<i>Cirsium vulgare</i>)	74
Fennel (<i>Foeniculum vulgare</i>)	76
Perennial pepperweed (<i>Lepidium latifolium</i>)	78
Poison hemlock (<i>Conium maculatum</i>)	80
Annuals	
Italian thistle (<i>Carduus pycnocephalus</i>)	82
Mustard species (<i>Brassica nigra</i> and <i>B. rapa</i>)	84
Wild radish species (<i>Raphanus sativus</i> and <i>R. raphanistrum</i>)	85
Yellow starthistle (<i>Centaurea solstitialis</i>)	87

Perennial Grasses	
Ehrharta (<i>Ehrharta erecta</i>)	90
Giant reed (<i>Arundo donax</i>)	92
Harding grass (<i>Phalaris aquatica</i>)	94
Pampas grass and Jubata grass (<i>Cortaderia selloana</i> and <i>C. jubata</i>)	96
Perennial ryegrass (<i>Lolium perenne</i>)	99
Purple velvet grass (<i>Holcus lanatus</i>)	100
Annual Grasses	
Annual ryegrass (<i>Lolium multiflorum</i>)	102
Ripgut brome (<i>Bromus diandrus</i>)	104
Trees	
Acacia species (<i>Acacia melanoxylon</i> and <i>A. decurrens</i>)	106
Blue gum eucalyptus (<i>Eucalyptus globulus</i>)	108
Tree of heaven (<i>Ailanthus altissima</i>)	110
RESOURCES	112
GLOSSARY	115
BIBLIOGRAPHY	119
ACKNOWLEDGMENTS	120

PREFACE

Welcome! The handbook you're holding contains vital information for restoring Bay Area wildlands. We hope it becomes a valuable tool for guiding your efforts in protecting local natural areas from the impacts of invasive plant species.

Most likely, you know from first-hand experience that invasive weeds are a serious ecological problem in the Bay Area. You may have witnessed grasslands overrun by yellow starthistle, or walked through an ivy-choked woodland. And, like many others, you are working to do something about it.

This handbook distills the collective knowledge of Bay Area individuals and organizations that have been involved in weed control and wildland restoration projects for over a decade. It provides background on the strategic planning that needs to happen before you actually remove any weeds, and offers detailed information on specific weeds and the techniques and tools best suited to working on them. The information in this handbook is intended to help us all conduct our weed control efforts more effectively.

Countless Bay Area volunteers and park managers have helped us learn about invasive plant control over the last decade. Many of them also contributed their time and expertise to this handbook—thanks to all.

If you have comments or suggestions for future editions, please let us know at www.cal-ipc.org.

We look forward to seeing you in the field!

Sharon Farrell, The Watershed Project
Doug Johnson, California Invasive Plant Council

1

BACKGROUND: PUTTING WEED WORK IN CONTEXT



Invasive species are one of the most serious environmental problems of the twenty-first century. They crowd out native species, disrupt natural processes, and impose tremendous costs on human communities. This is even more true for California than for most other states in the country. A few key facts illustrate the scope of the problem:

- u Nearly half of the plants and animals listed as endangered species in the United States have been negatively affected by invasive species.
- u Invasive species inflict an estimated \$116 billion in economic damages annually in the United States and impose an additional \$21 billion in control costs.
- u Yellow starthistle has expanded its range in California at an exponential rate since mid-century. It now occupies 14 million acres of rangeland, more than 15 percent of the state's land area.
- u Of the nearly 1,400 non-native plant species naturalized in California, at least 72 have significant ecological impact.

Scientists have been watching these problems get worse for several decades, but only in recent years has the matter received serious attention at national and international levels. In 1997, five hundred scientists and land managers wrote an open letter to then-Vice President Gore requesting action on invasive species. They declared, “We are losing the war against invasive exotic species, and their

economic impacts are soaring. We simply cannot allow this unacceptable degradation of our Nation’s public and agricultural lands to continue.”

In response, President Clinton signed Executive Order 13112 in 1999. This established a National Invasive Species Council to coordinate federal activities and develop a National Invasive Species Management Plan. The council has since released a draft plan. The State of California is also working on its own plan, the California Noxious and Invasive Weed Action Plan.

But leadership is hardly limited to these formal institutions. In fact, such plans exist mainly because of a groundswell of public interest in invasive species and the damage they can cause. During the last decade, tens of thousands of Bay Area residents have dedicated at least part of a Saturday morning to removing weeds by hand. No matter what happens to the national and state plans, it’s people like them—weed workers and land stewards, dedicated volunteers and hardworking professionals—who will have the greatest impact on the invasive species problem in our local parks and open space for some time to come.



This handbook arose in response to widespread interest among Bay Area weed workers for a compilation of information on the best tools and techniques for addressing the invasive plant problem in local parks and open space. (Throughout this handbook, we refer to parks and open space in a general sense, meaning any parcel of land, whether public or private, where invasive plants pose a problem to remnant wild ecosystems.) During our months working on this handbook, we spoke with several dozen weed workers, most of whom have more than ten years of experience with Bay Area weeds. We have sought to distill their expertise and experience and deliver it to you in a clear and straightforward way.

The primary audience for this handbook includes volunteers who are just getting into weed work, more seasoned volunteers who aim to start a weed program on their own, and interns and seasonal staff who work for the diverse agencies that manage public open space. But even long-time volunteers and professionals may find something useful in these pages.

This sense of the audience drove some of our decisions about what to include. Because of the heavy emphasis on volunteers and interns, we focused our review of tools and techniques on hand tools and manual removal techniques, although we do provide some information about power tools and herbicide treatments as well.

This chapter provides an overview of the invasive problem in the Bay Area and the various agencies and non-profit organizations that are key actors in the field. The second chapter provides strategic advice about setting priorities. If you

can only remove a small portion of the weeds in a park, which ones do you work on, and where? Chapters 3 and 4 address some of the social dimensions of weed work: educating people about weeds and organizing volunteer work parties. The last two chapters are the heart of this handbook: chapter 5 contains a synopsis of the most useful tools and techniques used by Bay Area weed workers, and chapter 6 contains information on the control of thirty-six invasive plants found in the Bay Area.

WEEDS AND WEED WORK IN THE BAY AREA

Weeds have a long history in the Bay Area. Some may have arrived here as early as the middle of the eighteenth century, dispersing northward from European settlements in Baja California in advance of the arrival of the first Europeans in San Francisco Bay in 1769. The spread of invasive plants since then has been swift and steady. California's grasslands were the first to be transformed as invasive annual grasses from the Mediterranean quickly became dominant, helped by heavy overgrazing and droughts during the nineteenth century.

In the last few decades of the nineteenth century, land speculators planted tens of thousands of blue gum eucalyptus trees across California in an attempt to increase the value of their property for resale. Touting the silvicultural value of the trees, these speculators made profits while the unfortunate ones who purchased the land found that the trees were almost useless for lumber. Despite the mounting evidence, several more waves of eucalyptus plantings followed, finally stalling by the first part of the twentieth century.

This fervor for planting trees, stoked by the invention in Arbor Day in 1872 and the popularity of Frederick Law Olmsted's urban beautification movement, led to widespread plantings of many other tree species in the Bay Area, including some, like acacia and tree of heaven, that have since become invasive. Periwinkle and pampas grass were quite popular among gardeners in late nineteenth-century California, which explains their widespread distribution today.

Other invasives were never planted intentionally but spread into Bay Area wildlands once they had arrived in the area. Yellow starthistle, a native of southern Europe and western Eurasia, was first documented in Oakland in 1869. It probably arrived here by way of Chile, as a contaminant in imported bags of alfalfa seed. It spread quickly in the Bay Area and the Sacramento Valley and eventually throughout the state. In 1919 botanist Willis Jepson noted how quickly it had spread near his boyhood home of Vacaville: "It is 1,000 times as common as ten years ago, and perhaps even six years ago." Now that's a good argument for catching the next invasion early and preventing it from getting out of hand!

Public Agencies and Organizations

Open space protection also has a long history in the Bay Area, including such notable events as William Kent's donation of Muir Woods to the nation in 1907; East Bay voters taxing themselves in the middle of the Great Depression to purchase lands that became the heart of the East Bay Regional Park District; the innovative preservation efforts in Marin that led to the founding of Audubon Canyon Ranch and the Point Reyes National Seashore; and the parks-to-the-people movement of the late 1960s and early 1970s that led to the creation of the Golden Gate National Recreation Area (GGNRA) in San Francisco, Marin, and San Mateo counties.

This network of protected open space is governed by an alphabet soup of different public agencies, each with a mandate to protect the natural resources they contain. Since that often means controlling invasive plants, these agencies are often at the forefront of the struggle. These agencies include the National Park Service, the California Department of Parks and Recreation, the East Bay Regional Park District, the Midpeninsula Regional Open Space District, and many other city, county, and regional authorities that manage Bay Area wildlands.

In 2000, the State of California authorized funding to promote local coordination among weed workers in every California county. The legislation encouraged the formation of Weed Management Areas to receive the state funding. Most counties now have WMAs, and these groups provide a forum for public and private landowners and interested non-profit organizations to coordinate their land management efforts and to develop countywide strategies for controlling weeds.

Non-Profit Organizations

In 1965, a group of citizens in the East Bay organized a campaign to save an arboretum in Tilden Park, and the California Native Plant Society evolved out of that effort. CNPS is now the largest such society in the United States. Its members have long been concerned about the growing threat of invasive plants to the state's flora. In 1990, its Yerba Buena chapter began regular weeding work parties in San Francisco under the leadership of Jake Sigg, who also became active in statewide invasive plant issues.

Around the same time, the GGNRA's invasive plant program got off the ground with the formation of the Habitat Restoration Team under the leadership of Maria Alvarez (National Park Service) and Greg Archbald (Golden Gate National Parks Association—now the Golden Gate National Parks Conservancy). That effort gave rise to one of the nation's largest community-based stewardship programs, involving thousands of community members in

weed work every year and training dozens of professional weed workers who now hold leadership positions throughout the Bay Area.

Also in the early 1990s, up in Davis, John Randall was developing what would become the Nature Conservancy's Wildland Invasive Species Program. And down in Santa Cruz, Ken Moore was leading the Wildlands Restoration Team in its efforts to address invasive plants in the Santa Cruz Mountains. As other groups began to join the struggle, it was clear that a critical mass was gathering.

In 1993, weed workers from around the state gathered to found Cal-EPPC, the California Exotic Pest Plant Council (now the California Invasive Plant Council). The organization patterned itself after the Florida EPPC, which was having considerable success bringing people together to strategize about invasive plants and develop better techniques for controlling them. Cal-IPC's annual symposium (held each October), newsletter, brochures, and Web site all aim to make information accessible to weed workers in the state. The group also coordinates efforts to assess which plants are invasive in California.

In a parallel development, public awareness and concern was beginning to grow about the state of San Francisco Bay and its natural resources. The Watershed Project (formerly the Aquatic Outreach Institute) formed to bring an educational message to the community—that our actions, whether through using pesticides in the garden, pouring oil down the storm drain, or allowing invasive plants to take over creeks and open space, affect the water quality of the Bay. The Watershed Project has helped support the steady growth of citizen involvement in creek groups, especially in the East Bay, where these groups are especially active in removing invasive plants. Through its workshops, newsletters, teacher training initiatives, and other outreach activities, Watershed Project staff members have taught thousands of students, teachers, and concerned citizens how to prevent pollution and protect and restore natural resources.

Today, these groups have partnered to produce this handbook. Drawing on the technical expertise of Cal-IPC members and the educational expertise of the Watershed Project, the handbook is aimed at increasing the effectiveness of Bay Area weed workers. The next episode of this story is yours to write!

2

STRATEGY: PLANNING FOR EFFECTIVENESS



Someone once described the spread of invasive plants as a “raging biological wildfire—out of control and spreading rapidly.” It’s an apt analogy. Invasive plants and wildfires can both inflict heavy economic and ecological damage. Much like wildfires, weed infestations can start small and then expand rapidly if not quickly controlled. And like wildfire management, effective weed management depends on four key strategies: prevention, early detection, control, and restoration.

We’ll cover these four strategies a bit later, but first a question: Do those who fight wildfires try to get as much information about a fire before deciding how best to fight it? Of course they do, and they use maps to help organize that information. The same is true for weed workers. Knowing what’s at stake—which invasive plants are threats and what they are threatening—is an essential step in developing an effective weed management strategy. Are there particular natural resources that are especially important to protect? Are there particular weeds that you know from reputation or personal experience could cause serious damage if they become established in your park? Which of the weeds in your park have the potential for rapid expansion and which have been there for decades without much change in the size of their populations? These are all geographical questions in the end, so it’s only natural to use a map to organize the information.

MAPPING

Weed maps are great tools for prioritizing your work, monitoring your success, and creating a documentary record for those who will take your place in the future. A well-made map can also be an engaging outreach tool; like photographs, a single map can be worth a thousand words.

Mapping by hand is the simplest way to track weed infestations, rare plant populations, or other conservation targets. Select a base map—a USGS quad, a park trail map, or even an aerial photo—and then mark where particular weeds are found. Some weed workers make maps of particular invasive plant species on separate copies of the base map, one species per copy; others mark up a single copy. A map with just the right level of detail is what you're after, and that depends on your goals and aptitude. Map the type and size of the infestation using a standard set of symbols and indicate areas you have found to be weed-free. Also, of course, mark your conservation targets—the things you want to conserve.

It is also possible to map your weeds using a Geographic Information System (GIS) in combination with data collected in the field using a Global Positioning System (GPS) unit. This computer-intensive method is becoming the norm among professional weed managers, but many continue to rely on hand-drawn maps. For more information on both methods, refer to the California Department of Food and Agriculture's weed mapping handbook at cain.nbii.gov/weedhandbook.

PRIORITIZATION

Once you have identified your conservation targets and the weed infestations that threaten them, you can begin establishing some priorities. You may find that your first priority is to protect endangered species populations and other valuable areas, just like someone fighting a wildfire might seek to protect people and buildings. But that's not your only priority. You also want to contain the fire (stop the big infestations from expanding) while extinguishing spot fires that have jumped outside the perimeter (eliminating pioneer weed populations). You're looking for a balanced mix of the four main strategies mentioned earlier: prevention, early detection, control, and restoration.

PREVENTION

Preventing a new weed from becoming established in a park or open space is one of the best things you can do for the land. Weeds are so numerous in the Bay Area that it may be hard to imagine having to deal with new ones, but the distribution of weeds is always changing, due, in large part, to the activities of humans. You and your fellow outdoor enthusiasts may even be contributing to the spread of

weed seeds from one local park to another. They can be dispersed by mountain bike tires, for example, or hiking boot treads.

If you want to prevent new invasions, think about how they might get there. If there are equestrian users in your park or open space, work with them to use certified weed-free hay for their animals. If there are neighboring properties that have an invasive weed that has not yet arrived on yours, then work with them to eliminate it on theirs, or at least prevent it from reproducing. If there is construction work, landscaping, or other management that might entail seeding or planting, make sure that they don't include invasive plants in their seed mix or planting palette. You'd be surprised how often this happens! Construction equipment itself is also a vector for moving weed seeds, so it's a good idea to keep an eye on the area over time.

EARLY DETECTION AND ERADICATION

Detecting new weeds and responding to them quickly is as important as prevention. It's almost certain that new weeds will arrive in your park. But the inevitability of arrival doesn't mean that they will persist. That's where you come in.

Containing a new weed, like containing an epidemic, depends on identifying it as soon as possible and initiating a rapid, coordinated response. Sounds challenging, but at a local scale it can be relatively straightforward. The main thing is to be attentive. If you see a plant that you've never seen before, try to find out what it is by asking an expert or keying it out (using the *Jepson Manual*, for instance). If it turns out to be an invasive plant and still occurs in relatively low numbers, try to eradicate the entire population.

Eradication means eliminating every single individual from the population, not just most of them. If you're diligent enough, and visit the site year after year to ensure that plants germinating from the seedbank are never able to set seed, you can be successful in eradicating the population. (Imagine if someone had done that with yellow starthistle back in the nineteenth century when it was first becoming established in California!)

The keys to eradication are detecting a new infestation early, responding quickly, and monitoring it carefully. An underlying assumption is that the invasive plant, once eradicated, is unlikely to reinvade. If it's likely to do so—for instance, if it occurs in great numbers on an adjacent property—then by all means try to keep it out of your park or open space, but it doesn't make sense to mount an all-out effort to eradicate every last individual. The probability of reinvasion is too high.

It's hard to overemphasize the importance of detection. New weed populations can't be eradicated if they're not detected! The good news is that it gives you an excuse to spend time hiking around your favorite place. Many weed workers

make a habit of walking every trail in the park at least once or twice a year to increase their likelihood of detecting any new weed populations. Some agencies have even instituted invasive plant patrols made up of volunteers who systematically search trails and other likely places for weed populations.

All this work is really worth it. As two veteran weed workers put it, “preventing or stopping just one new invasive weed would be of greater conservation benefit in the long run than far more costly and difficult efforts to control an already widespread pest.”

CONTROL

When a particular weed has become widespread—like wild oats in a park with extensive annual grasslands—eradication is often no longer a sensible strategy. Instead, the most effective action may be to control its spread or lessen its impacts. Your park or open space may have, in addition to grasslands dominated by annual grasses, serpentine prairies where wild oats are just getting established. Though it may be well beyond your ability to eradicate wild oats from the entire park, you might more easily limit its spread into the serpentine prairies.

This example illustrates why focusing on outlier populations—small patches of a weed in an area that is otherwise relatively free of it—is often much more important than focusing on large, dense patches of that weed. It’s easy to feel compelled to throw all your effort into working on a major infestation. But that’s like sending fire fighters into the middle of a huge wildfire while ignoring its perimeter. It keeps on spreading, as if you hadn’t done a thing.

A strategy of containment may be your best option for invasive plants like Cape ivy or blue gum eucalyptus, which would require huge amounts of labor to fully eradicate and whose spread is mostly limited to areas in the immediate vicinity. For such plants, it’s better to focus on containing the large infestations and eliminating all the outlier populations than to spend countless hours trying to eradicate the main populations. Containment works well with infestations of these two plants because their pattern is to expand outward from the edge of the infestation, Cape ivy with advancing vines, and blue gum eucalyptus with new seedlings. (Eucalyptus seeds don’t tend to disperse very far.) Cleared areas around a patch of Cape ivy—containment paths—allow weed workers to easily patrol for new vines. Plants that disperse their seeds more widely, such as jubata grass, are not as effectively controlled using containment.

Once you’ve tackled an outlier population and removed all the plants you can find, keep track of its location—preferably on a map—and take notes on your effort. You are working against not only the plants you see in front of you, but also the weed seeds in the soil. They can last a long time in the seedbank, for many decades in the case of French broom, or just a few years in the case of small-

seeded plants like pampas grass. Once you've decided to eliminate that outlier population, it's important to return every winter or spring until no more seeds are germinating. Maps and good record-keeping will help you be persistent.

Except in really small parks, it is nearly impossible to keep track of all the sites where you have removed weeds unless you keep written records. Since every site where you have removed weeds needs to be revisited, you will come to rely on your records to make sure that you do. Develop a simple form for tracking the what, where, when, why, and who of work performed.

Conservation targets, maps, outliers, containment, and persistence—these basic ideas will stand you in good stead as you decide how to focus your weed efforts. The aim of control is not to eradicate weeds, but to reduce weed density and abundance below an acceptable threshold. The methods for both eradication and control are similar and include a wide variety of techniques that are treated at much greater length in chapter 5.

RESTORATION

Weed removal is ultimately about returning the native plant community to the area. Once we have removed the weeds, there are often native seeds in the soil that helps restore native vegetation. But in other cases, if the native seedbank has been exhausted, revegetation—that is, replanting with natives—might be necessary after weed removal. This handbook does not cover revegetation, but here are a few tips to keep in mind. In heavily impacted areas, it may be necessary to partner with a native plant nursery that can propagate seedlings from locally gathered seed. When describing your project to others, make sure to communicate the role of weed removal in the greater picture of restoration. This is especially important when you are working on large areas that are in the public eye.

"It's invaluable to have intimate on-the-ground experience with the land. Where you're working with the same piece of land, where you see the changes, season by season, year after year, you're making acute observations about the dynamics going on, and that is what is in such short supply. If you don't know the actual on-the-ground situation, then anything you do as a manager is going to be somewhat off."

Jake Sigg, California Native Plant Society, San Francisco

WEED WORK IN PRACTICE: ADAPTIVE MANAGEMENT

Translating these key strategies into action will keep you busy. Learning from your initial actions, so that your next set of actions is more effective, will keep

you smart. It's common sense really—start with a plan, carry it out, check to see if it worked, adjust accordingly, and carry on.

Conservation practitioners have formalized this common sense approach into what they call *adaptive management*. We always have the potential to learn something from our management actions—but only if we monitor and assess the impact of those actions. For weed workers, this can mean something as simple as visiting an outlier population a year after removing all the above-ground individuals. If there are seedlings coming up, then we need to do something we didn't have to do last year: treat seedlings, not big plants. This might call for a different control technique, one more suitable for seedlings.

Monitoring is the key. Without some kind of monitoring, there is essentially no way that you can succeed. The seedbank will always work against you. But monitoring doesn't have to be painful and involve lots of data collection and analysis. The simple steps of keeping good records and visiting all your sites repeatedly go a long way.

3

COMMUNICATION: TALKING ABOUT WILDLAND WEEDS



Reaching out to all kinds of people is one of the best things you can do for the long-term health of your favorite park. Talking to passers-by while you're working can be even more important than getting the work done. Doing so can lead to a big donation to your cause or even turn angry adversaries into awesome advocates.

Such outreach can have ripple effects that extend far beyond the park's borders. When enough people understand the impacts that invasive plants can have on the landscape, they will avoid planting them in their gardens and become more likely to support stewardship efforts at the ballot box by voting for local parks and open space measures.

Some people are blessed with the ability to communicate complicated ideas quickly and effectively. These natural communicators make it look effortless in a way that can be intimidating for the rest of us. But we're not doomed to being tongue-tied. This chapter provides some simple techniques that will help you convey important messages about wildland weeds to diverse audiences.

THE ABCs OF INTERPRETATION

You are engaged in the art of interpretation whenever you are talking with park visitors along a trail or to a group of volunteers at a work party. This word came into widespread use among park rangers during the last half-century to distinguish between mere instruction and information on one side and provocation

and revelation on the other. The National Association for Interpretation defines interpretation as “a communication process that forges emotional and intellectual connections between the interests of the audience and the meanings inherent in the resource.”

Interpretation is an art rather than a science because it requires you to re-create all the information that you have learned—the number of weeds in the park, their names, what plants they’re crowding out, all the stories you’ve heard

about invasive plants worldwide—in a way that’s accessible, meaningful, and compelling to your audience. Since it took you months and years to learn all those things, it doesn’t make sense to expect your audience to do so in just a few minutes. But that doesn’t mean you can’t convey complicated ideas. Follow these ABCs of interpretation, which come from a talented interpreter who has also led hundreds of work parties.

“When we encounter people on the trail, they’ll ask, ‘What are you doing?’ They can even be a little bit confrontational. They just see green plants lying dead on the ground. We sit down and explain why we’re doing this, and more often than not—probably 80 percent of the time—they turn around completely and say, ‘You know, I’ve never thought of that. I’ve never thought that a plant could be a problem.’ And sometimes people walking along the trail have said, ‘You know, I’d like to write you a check right now, on the spot.’ Even as much as \$500!”

Ken Moore, Wildlands Restoration Team, Santa Cruz

Know your Audience. If you can connect what you have to say to something in your audience’s experience, your message is much more likely to be remembered. Don’t assume that they know how pervasive the problem of invasive plants is, or how it affects the beauty of this special place. Build connections with them by using photographs (before-and-after photos of your site) and visual cues (point out a plant in flower that you’re trying to protect). Engage as many senses as possible. Crush a yerba buena leaf, for example, and invite them to smell the

delicious scent and then tell them how it’s threatened by ivy. Have fun with those common names. Why is it “sticky” monkeyflower? What about skunkweed? Should you make a coffeeberry brew?

Keep it Basic. Don’t overwhelm your audience with information, even if it’s a captive audience that has joined you for a work party. They came to work, not listen to you ramble on, and a person is only going to retain so much. Stick to the most important ideas. Don’t worry, though, that your knowledge about the nat-

ural world will not be useful. It will serve you when the occasion presents itself—when you notice a rare migrant bird singing in a nearby thicket, or when you encounter an uncommon plant that has seeded itself into your worksite following weed removal, or when you respond to innocent questions about the name of that hawk with a red tail. Seize the teachable moment—but keep it only for that moment and then let it go!

Remember the Context. If a couple out on a walk stops to ask a simple question, respond with a simple answer, in a manner that encourages dialogue. Be respectful of the context and make it your goal simply to forge connections with others. Don't launch into a ten-minute lament about how invasive species are turning the planet into a single homogeneous biosphere. Develop an elevator version of your spiel: it should last no longer than an elevator ride and convey enough interesting information and inspiration that your listeners want to spend more time with you.

These principles apply not only to speaking but also to the printed word. Take advantage of opportunities to spread the word about your project. For instance, posting signs at your worksite with before-and-after photographs can serve as excellent advertising for your work.

TERMS

Part of the genius of the English language is its versatility and its remarkable abundance. Take *weeds*, for example, and the other words we use to describe them: invasive plants, alien plants, exotic plants, exotic pest plants, non-indigenous plants, non-native plants. The meanings overlap, but none are exact synonyms.

First, it is important to be accurate. Not all non-native plants are invasive, so these terms should not be used interchangeably. In fact, only a small percentage of non-native plants are widely naturalized in California's wildlands, and of these, only a few cause significant ecological damage—these are the invasive plants.

Second, it is important to use such terms with an appreciation for their cultural meanings. In a place with as much cultural diversity as the Bay Area, consider how your terms might be heard. You may use “non-native” in an innocent and descriptive manner, but it may carry other meanings for an audience of schoolchildren from immigrant families. This makes it doubly important to stress that it is not the non-native nature of the plants that present problems—there are many non-native plants that we love! But there are a few that can be quite destructive.

Familiar metaphors can help illustrate the point. A common one is that invasive plants act like bullies, taking over entire habitats. Another is that invasive

plants act like a business monopoly that uses its market power to force other firms out of business and drive up prices. Like the anti-trust regulators who rein in monopolies, weed workers are helping to level the playing field for everyone.

Metaphors can be incredibly useful, but they can also oversimplify your message. Writers in the popular press often latch onto war metaphors to express a sense of drama. Weed workers are described as “weed warriors” battling an invading army of invasive plants marching through native plant territory. Such metaphors paint an antagonistic image of weed workers and do not capture the positive spirit or complexity of ecological restoration.

FREQUENTLY ASKED QUESTIONS ABOUT INVASIVE PLANTS

Here are some questions that you should be prepared to encounter when you work on invasive weeds, along with some general answers.

Does the park staff know you’re doing this? Yes, they are quite supportive of this project. They are especially concerned about these weeds because they threaten some sensitive areas that they’re trying to protect.

That plant is pretty, why are you removing it? Pretty, yes, but it can have harmful effects on our natural environment. Many other plants—and the animals that need them—are being crowded out by this plant species. Some invasive plants are easy to hate because they’re ugly or prickly, but many are quite beautiful. In fact, many of these plants were brought here originally for use as ornamentals, without knowing that later they would become such problems.

Why are you cutting down trees? It’s true that trees are beautiful and we tend to think of trees as good for the environment. We’re definitely not removing all the trees. But these particular trees are taking over this area, destroying the vegetation that was here before and replacing it with a much less diverse plant community.

Are all weeds bad? Not all plants that we call *weeds* are a problem ecologically. Not all of the “weeds” that grow in your yard are a problem here in the park, although some are. But it’s true that wildland weeds have a negative ecological effect. Plants are not inherently good or bad—remember, each of these weeds is native somewhere. Back there, it might even be threatened by invasive plants from somewhere else—perhaps even California! Some plants simply have the ability to do more damage than good in the natural environment in a particular place.

Since most of us humans are from somewhere else, does this mean we should be removed? Definitely not. We’re working on plants, and in fact many non-native plants do just fine here. It is a very small percentage that actually take off in the

landscape at the expense of many other organisms. This is typically because the climate suits it, and because native animals or insects don't eat the plant, giving it a competitive advantage over other plants. Weed work is about supporting natural diversity—removing these few problem species allows hundreds of others to flourish.

What will happen if we do nothing? Some of these invasive plant infestations have the potential to become a virtual monoculture, forming patches where almost no other plants grow. The diverse mix of plants and animals that were here before is then lost.

What will happen to the animals that are using those invasive plants? Usually, the animals are using invasive plants for food or shelter because the native plants that historically served that purpose are gone or greatly reduced. If we restore those plants as the invasives are removed, the animals can begin using the native plants again.

What will it look like when you're finished? At the very end, it will look beautiful, more like that area over there that hasn't been invaded. In the medium term, it might look rather bad, since we have to remove a bunch of plants.

Why is this area fenced off? Will it always be fenced? It's important that we protect the newly planted seedlings so they can get established. Once they are strong enough to stand up to deer browsing, foot traffic, and new weed seeds, the fences can come down.

How can I get involved? Glad you asked. We have materials right here with contact information to make it easy for you to get involved.

When confronted with questions like these, keep in mind that you often have only a minute or two to answer the question. Using the ABCs of interpretation—know your Audience, keep it Basic, remember the Context—will help you have a creative, constructive conversation. It's some of the most important work you'll do!

4

COORDINATION: ORGANIZING VOLUNTEER WEED PROJECTS



An increasing number of land managers throughout the Bay Area sponsor regular opportunities for volunteers to participate in weed control efforts. There are dozens of work parties happening every month in public parks and open space, along urban creeks, and even on private land. But there are also tens of thousands of acres that have not yet been adopted by a dedicated band of volunteer weed workers.

Before you go out and start ripping out Cape ivy, however, there are a few important things to think about. Do you have permission to work in the area of concern? Can you confidently recognize your target weed and not confuse it with a native plant? Are you versed in the potential risks of poison oak and wasps? Do you know how to run a work party for volunteers? You need to be able to answer these and other key questions before initiating an invasive weed program. In this chapter, we offer tips for those readers who want to organize their own weed projects.

WORK CLOSELY WITH THE LAND MANAGER

In this era of reduced budgets, our parks and open space can sometimes look and feel as if they have been forgotten by the agencies responsible for them. It's easy to feel indignant towards the land manager—how dare they let such a gem of open space go to ruin! Usually, though, park staff members are just as concerned as you are, but they don't have adequate resources to take care of everything. That's where you and your volunteers can have a huge impact. Your

demonstrated commitment and helpful attitude—not to mention your on-the-ground success—can encourage upper-level managers to devote more attention (and maybe funding) to natural resource management.

Building a good relationship with park staff at the field level will help you in many ways. If they understand and support your work, they can give invaluable logistical assistance, from providing tools and garbage bags to helping publicize your workdays and hauling away your debris. Even if they are too pressed with other business to provide much assistance on the ground, their partnership is still essential, because removing weeds can sometimes be controversial. So make sure that the land manager knows exactly what you are doing and has given you permission to engage in particular land management activities. Public agencies hold parks in trust for the community at large, and they are responsible for the long-term stewardship of the land.

Here are a few tips for building a strong relationship with land managers.

Understand and appreciate the agency predicament. It doesn't help your cause to accuse an agency of being a poor manager that isn't doing its job. Acknowledge that times are tough, and that agency personnel don't have nearly enough resources to do all the work that needs doing. Understand that agencies are usually juggling complex issues like recreational use, grazing, fire control, and the like.

Ask the agency to assign a particular staff member as your liaison. This helps the continuity and clarity of communications. Your liaison can become your best advocate and ally if they know what you are doing. Communicate with your liaison regularly.

Ask for help from the agency when you need it. Park staff will have some resources that can help your work, and soliciting their active involvement helps build a partnership with the landowner. That's a much stronger position than being a lone operator.

Garner support for your work from all levels of management. Your relationship with an agency will be strongest if upper-level managers—particularly those who are elected or serve in supervisory positions—also understand and support your stewardship efforts. Let them know that you are a team player who truly wants to work with them.

Know and adhere to the agency's liability policies and permit requirements. Before you start volunteering—and especially before you start leading other volunteers—make sure that you understand the ins and outs of a particular agency's

liability policies and permit requirements. These are not uniform across agencies. The National Park Service, for example, requires its volunteers to sign a form acknowledging that the park will cover any medical expenses, while other agencies take the opposite approach and require their volunteers to sign a liability release form.

Leave a paper trail to ensure accountability. Most agencies experience frequent turnover in field staff positions, so you may have to work with new people every year who are unfamiliar with your project and the history of your relationship with the agency. A paper trail can help bring them up to speed. In the unlikely event of conflict, you will feel much more comfortable if you have documented everything—permits, waivers, releases, date and time of work parties, maps and photographs demonstrating accomplishments, plans, and so on—in writing.

In dealing with the public or the media, identify yourself as a volunteer working on behalf of the agency. If you receive public recognition for your weed work, be sure to acknowledge the land manager. When working on public land, it's often important that people know that you are working with the consent of the public's representative, the agency that owns the land in question. It helps to wear a shirt, cap, or even a patch that identifies you as a volunteer working for the park or open space, especially when working in remote areas.

KNOW HOW TO DISTINGUISH AMONG THE INVASIVE WEEDS AND THE NATIVE PLANTS

Your knowledge of plants doesn't have to be perfect. There's not a single weed worker who isn't still learning. The best thing you can do is to get really good advice early in the process. Go on a walk with the local plant experts. Ask them what the worst weeds are. Ask them what other plants can be confused for that weed. When possible, visit proposed work sites with them and ask them to help you identify plants in the vicinity, particularly ones that you should be sure not to disturb (like rare ones).

As a leader, it's up to you to make sure your volunteers aren't removing the wrong thing. Your best strategy for working with volunteers may be to focus on just one or two weeds at a time that are easy to distinguish.

KNOW ALL ABOUT POISON OAK

It is especially important that you are good at identifying poison oak, which is common (and native) in many plant communities throughout the Bay Area. The consequences of exposure to poison oak can be severe. Roughly 10 percent of the population is extremely sensitive to poison oak and may require medical

intervention (steroids or hospitalization) if their skin is exposed to it. Another 10 percent is apparently immune, but most of us exhibit a wide range of sensitivity to urushiol, the rash-causing compound found in poison oak leaves and twigs.

Many California residents can identify poison oak when its shiny and oily red or bright green leaves announce its presence. But when its deciduous leaves have fallen, or when it adopts one of its other forms—it can be a vine, a tree, or even an ankle-high shrub in grasslands—it can be hard to recognize. As a coordinator of volunteer work parties, you should become a practiced observer of its many forms.

Before selecting a work site, carefully scout the area for poison oak. If poison oak is common, the site may be unsuitable for a volunteer workday. If it is uncommon, flag the areas with poison oak and caution people to stay away from them. We recommend that you work only in areas where poison oak does not occur, unless you have an experienced team of folks who are used to working around poison oak. At the beginning of each workday make sure that every participant can recognize poison oak in its various forms and that they know how to stay out of it.

Sometimes, despite all precaution, volunteer leaders and their weed workers are exposed to poison oak. Here are some measures that you can take to minimize the impact of accidental exposure.

Wear long pants and long-sleeve shirts to limit direct exposure to the skin. If gloves have an elastic cuff, shirt sleeves can be tucked into the glove. Likewise, tucking pants into socks or boot tops can help limit contact.

Remove and wash clothing immediately after the event. This will prevent the oils from migrating to couches, clothes in the hamper, and other surprising locations. Clothing and gloves exposed to poison oak should be washed; cold water and regular detergent work just fine. Take caution with boots and tools, which can become vectors for spreading urushiol, poison oak's irritant.

Use a barrier lotion like Ivy Block to protect exposed skin, especially the gap between glove and sleeve.

Use an oil remover like Tecnu to wash skin immediately after potential exposure. Many weed workers find this to be effective in reducing the extent and intensity of poison oak rashes. It seems to be less effective when the urushiol has already permeated the skin after a long day in the field.

Take a cool shower with a non-moisturizing soap. Laundry detergent bar soap like Fels-Naptha also helps to remove urushiol from the skin. Hot water and moistur-

izing soaps open up the pores on your skin, making them even more receptive to urushiol, so stick with cold water and non-moisturizing soap at first.

If a rash has developed, there are ways to minimize its impacts. A new product called Zanel is advertised as being able to remove urushiol after it has penetrated the skin and developed into a rash. It's expensive (nearly \$40 for a one-ounce tube that's good for about fifteen treatments), but some urushiol-sensitive weed workers swear by it. For severe cases, consult a doctor, who may prescribe cortisone shots that reduce swelling. That's the only treatment available when the rash becomes systemic.

KNOW ABOUT POSSIBLE WASP DANGER

Some weed workers feel that wasps are an even more serious issue than poison oak. Unlike poison oak, wasps seldom provide any advance warning—their nests are much more difficult to spot than poison oak bushes. Encounters with wasps don't happen often, but they are worth mentioning during your safety talk at the beginning of every work party.

For most people, being stung by a wasp is a painful annoyance, but for others it can trigger a serious allergic reaction called anaphylaxis. Those with the most severe reactions require treatment within minutes in order to avoid anaphylactic shock. Such people often carry a portable device that administers epinephrine, the most common being the EpiPen. As a work party leader, you should make sure that your volunteers, particularly those with severe allergies, are familiar with the risks involved. (For legal reasons, you can't administer the EpiPen, otherwise it would be a good thing to carry with you in your emergency medical kit.)

If your group encounters a wasp nest, mark the surrounding area with caution tape to keep people away from it. If people get stung, you're better off bringing the work party to an end and getting them home (or to a hospital if the allergic reaction is really serious) as soon as possible. There's no sense in putting people at risk by trying to get a bit more work done.

KNOW ABOUT TOOL SAFETY

As a work party leader, you must not only know how to use every tool safely, but also how to instruct all your volunteers in their safe use. Treat the subject seriously and forthrightly at the beginning of the work party, demonstrate how to use the tool properly and safely so that everyone can see how it works, and also demonstrate unsafe practices as well. Remind people how to work with tools in a group setting—such things as carrying tools low, not on your shoulder, and maintaining a safe distance between yourself and other volunteers. If you're

going to have your volunteers work with tools that require safety equipment, don't rely on them to bring safety gear. You should provide it yourself and require them to use it. This includes having leather gloves for volunteers working with sharp tools like pruners or loppers.

Be prepared for minor injuries by carrying with you, to every work party, a full first-aid kit and a cell phone. If cell phone reception is not good at your worksite, know where the closest phone is and how to reach park rangers and other emergency personnel. Some weed workers who regularly lead work parties have chosen to take CPR and EMT training courses so that they are even better prepared in the event of an emergency.

CALL IT A WORK PARTY! FACILITATING COMMUNITY PARTICIPATION

Who knew that there would be so many things to think about when working on weeds! So take a deep breath and say, "I'm a volunteer. I'm interested in doing this because I love this place and I love being outdoors." You don't have to obtain degrees in botany, interpretation, volunteer management, and medicine in order to make a difference.

It's helpful to know your limits. If you're a volunteer just getting started, don't try to take on too much. In our experience, coordinating anything more frequent than a monthly work party is too much for most volunteers. Only paid coordinators, or those rare volunteers who have fifteen to twenty hours a week to dedicate to stewardship, are able to handle the complex logistical details associated with more frequent work parties or with organizing dedicated work parties for school or corporate groups.

Assuming, then, that you know the limits of your ambition, here are a few tips about running successful work parties. One golden rule: long-term sustainability depends on short-term enjoyment. If it ain't fun, it ain't going to last. Work parties can involve challenging labor, but volunteers won't return if they don't get something positive and meaningful out of it. A few volunteers are drawn to weed work primarily for the exhausting physical labor, but they won't give you a broad base from which to grow. Reaching out to all kinds of people and accommodating their diverse needs and interests—even if you don't achieve quite as much on any given work day—is often critical to the long-term success of a weed program.

Below is a listing of the tasks to do before, during, and after a work party. The list will help you plan your own event. And here are several key things to remember for improving your success in attracting and sustaining a dedicated group of volunteers: first, maintain your enthusiasm! Nothing kills the spirit of a work party like a leader who isn't enjoying herself. Second, identify tasks that can be

achieved during a single work party—“Let’s remove every broom plant between here and that tree today.” And finally, offer a range of tasks that will provide variety for returning volunteers—“Who wants to pull broom? Who wants to collect native grass seed?”

Before the Day of the Work Party

- u Coordinate everything with your park liaison.
- u Scout the work site carefully, paying particular attention to poison oak and where the closest bathrooms are.
- u Take “before” photographs while you’re there.
- u Borrow sufficient tools and gloves, and get a first-aid kit from the park or other sources.
- u Develop an elevator talk that succinctly introduces yourself and the project to workday participants.
- u Advertise the workday in appropriate venues (posting flyers, placing articles in the local community newspaper, etc.).
- u Be realistic about the duration of the event. Don’t try to fit too much in. In our experience, the ideal work day lasts two to three hours (10:00-12:30, for example) with a break in the middle or toward the end for goodies. Weekend mornings are best, particularly Saturdays.
- u Arrange for donated goodies (or purchase them).
- u See if others will help you lead the event; review with them the goals and tasks for the work party.
- u Identify extra work in case too many people show up for the work party (this can actually happen!).

On the Day of the Work Party

- u Arrive early, and be friendly and welcoming, particularly with people you haven’t met before.
- u Have attendees sign liability forms and waivers while waiting for the group to assemble.
- u Pass a sign-in sheet so you have everyone’s contact info for future work parties.
- u Deliver your elevator talk and go over workday logistics (timing, tasks, poison oak, tool safety, bathroom location).

- u Ask knowledgeable weed workers to team up with new volunteers or to circulate and make sure everyone is getting started.
- u Seize teachable moments (with your workers or members of the public) that illustrate why we're engaged in this work.
- u Take “during” photographs.
- u Take a break for goodies!
- u Quit working, gather up tools, and return to initial assembly site (parking lot, for example). Make sure that all tools and volunteers are accounted for.
- u Thank everyone for coming and let them know how important their help is—and how welcome it would be in the future.
- u Write some notes about who attended the work party, what was accomplished (number of person-hours, area of particular weed removed).
- u Assess the work party itself: what worked, what could be improved, what follow-up is required with any of the volunteers.

After the Work Party

- u Return tools.
- u Report back to your park liaison.
- u Take “after” photographs.
- u Post signs at the work site if it's highly visible.

Ways to Improve Community Participation in Volunteer Work Parties

- u Have a consistent schedule (e.g., 10:00 A.M. on the first Saturday of every month).
- u Use dramatic before-and-after photographs to demonstrate the impact of volunteer labor.
- u Print and distribute flyers for your monthly work party.
- u Produce a calendar of upcoming work parties and post it in appropriate newsletters, list serves, and Web sites.
- u Offer other educational opportunities to your volunteers (field trips, walks with experts).
- u Cultivate fellow volunteer leaders who can help lead work days in your absence.

- u Develop a Web site for your project and keep it up to date.
- u Have a presence at appropriate community events (e.g., neighborhood street fairs).
- u Honor frequent volunteer participants with a gift (mug, T-shirt, cap).
- u Find ways to celebrate successes.

5

TOOLS AND TECHNIQUES: MANUALLY CONTROLLING WILDLAND WEEDS



There is no single right way to control weeds. Although there are many things to think about when deciding which method to choose, three factors are especially important: the nature of the infestation, the tools and techniques available to you, and the biology of the target. The first two issues are discussed in this chapter, while the third is covered in detail in the next chapter.

For various reasons, including liability and union issues, volunteer weed workers in the Bay Area tend to rely on manual techniques using hand tools. Even if you rely exclusively on such techniques in your own work, it's still quite useful to know about the wide range of other techniques that are employed. This chapter provides a broad overview of many control techniques followed by more specific details about manual techniques.

NATURE OF THE INFESTATION

Not all invasive plant infestations are the same. Some contain only a few plants, while others cover acres. Pulling the weeds out by hand might make sense in the former situation, but if the population is large, other techniques, like mowing, might be more appropriate. Terrain is another factor. Mowing works fine on level ground, but it isn't an option on steep or uneven terrain. Proximity to trails and buildings is yet another important thing to think about. Girdling a small invasive tree may make sense if you are working in a wilderness area far from trails or buildings, but it's not the best technique to use in less remote situations

where the invasive tree might present a potential hazard to people or structures or where a dead tree might trigger adverse publicity.

In general, removing large trees is a job that should be left to expert arborists and foresters. When removal isn't an option, populations of invasive trees like blue gum eucalyptus can be contained using hand labor. Removing seedlings and saplings on the edges of the infestation will prevent it from spreading into adjacent native plant communities while you marshal support for the eventual removal of the larger trees.

It's important to keep these considerations in mind when choosing which tool to use. There are no hard and fast rules, so use your common sense, rely on your own experience with the land, and talk with seasoned weed workers if you're feeling particularly uncertain.

TOOLS OF THE TRADE

Relying on a single tool can get you in trouble. It's okay to develop a favorite tool, of course. The Bay Area weed workers who were consulted in writing this handbook each had their own favorite. Some singled out large tools like the Pulaski, with an ax and a hoe on the business end, while others picked much smaller tools such as the soil knife as their favorite. Between these two extremes there were many other preferences, which suggests that there is no single most useful tool for Bay Area weed workers.

They may have made different choices about their favorite tools, but they all shared an intimate familiarity with dozens of tools and techniques. They had avoided the common pitfall of tool users everywhere: if all you know is a hammer, then everything looks like a nail. Focusing on a single tool or technique just won't work when it comes to weeds. It's important to step back from the technology and think about the broader strategy.

INTEGRATED PEST MANAGEMENT

During the last few decades, farmers, ranchers, gardeners, landscapers, and land managers of all types have moved toward a comprehensive strategy for controlling weeds and other pests. This approach, called Integrated Pest Management (IPM), stresses the inclusion of all relevant factors in deciding which techniques are best for dealing with a weed problem. Thus, it is important to consider factors such as the technique's effectiveness in accomplishing your goal, potential disturbance to the environment, the period of time required for effective control, and the direct cost of a treatment technique. It is also important to note that weed workers and land owners may weigh these factors differently depending on their land management goals and policies, the environmental setting, and personal val-

Some General Comments about Weed Control Techniques

The following general considerations apply to all of the control techniques discussed in this chapter:

Minimize soil disturbance. Many invasive plants rapidly move into disturbed areas. In sensitive areas, particularly those that haven't experienced much disturbance, choose control techniques that minimize the level of disturbance. The number of volunteers you are expecting at a work party will affect your choice of site, target, and technique. You don't want lots of people working in a sensitive area with digging tools. The disturbance and trampling could outweigh the gains from removing the invasive plants.

Avoid disturbing wildlife. Limit cutting trees, tree limbs, or very large woody shrubs during bird nesting season as this could disturb or destroy nests. For this reason, the local units of the National Park Service generally do not work on selected weeds in forested, riparian, grassland, and scrub habitats during the nesting season, roughly March 15 to September 1. In some cases, however, where the invasive plant threats are high, park managers conduct nesting surveys prior to removal activities. If nests are found, the project is often placed on hold until after the nesting season is over.

Anticipate erosion problems. Rice straw, wood chips, or permeable landscape fabrics may help reduce erosion problems in areas where weed removal techniques like digging or scraping will leave bare ground. Wattles combined with organic materials such as jute can also be effective. This is particularly important when banks or slopes are exposed. For steep slopes and creek banks it is important to outline an erosion control strategy prior to removing weeds. This strategy should also be approved by the landowner.

Revegetate when appropriate. Cleared areas may need to be revegetated with native plants, but it might not make sense to do so until the infestation is well under control. If the site will require intensive weed control following initial treatment, it may make sense to wait a little bit longer before replanting. The new plantings will be vulnerable to damage during weed control operations. This is particularly true when working with sites infested with Cape ivy or French broom, both of which can require extensive follow-up treatment to deal with resprouting vine fragments or dense seed flushes. In the case of controlling annual grasses, planting shrubs (if appropriate to the environmental setting) can suppress weeds over time as the shrubs establish. Revegetation with locally appropriate plants is an art in itself and is not covered in this handbook.

ues and preferences. Consequently, they may ultimately choose different strategies for controlling the same weed problem.

How might this work with wildland weeds? Let's say you have a big, long-standing patch of French broom. You might use Weed Wrenches to remove the "old-growth" French broom, but that's just the first step. All that newly exposed ground will come up thick with broom seedlings during the next spring. Using a Weed Wrench on the seedlings would be impractical, and it would take a lot of volunteer labor to remove thousands of little seedlings by hand. So your next step might be to use a hoe or McLeod to cut back the seedlings or to ask park staff to spray the dense patch of broom seedlings with herbicide, or to flame it using a propane torch. Do this a couple of years in a row, and the density of broom seedlings might fall low enough for you to rely on hand labor again. An exclusive reliance on a single tool would be less effective in this case. An integrated approach, relying on multiple methods, best addresses the problem and helps native plants reclaim the area.

The four main methods used in IPM are cultural control, mechanical control, biological control, and chemical control. In general terms, cultural control is the least disruptive to the environment. The impact on the environment depends on the circumstances—all four control methods can cause significant impacts. You can minimize such impacts by learning which tools and techniques work best in particular situations. As someone who will be working mainly with volunteers, you may focus exclusively on mechanical control, but it's important to know what other methods are available as well.

Cultural Control

Cultural control refers to cultivation practices that limit weed populations. In traditional IPM, with its focus on cultivated environments like gardens and fields, cultural control includes a wide range of important techniques that help reduce pest problems: choosing pest-resistant plants, choosing the right plants for the right soil and water conditions, rotating crops, and companion planting. Other agricultural practices such as grazing, burning, flooding, mowing, disking, and mulching are examples of cultural control that can address wildland weeds. These cultural techniques can play an important role in an IPM approach to invasive plants in the Bay Area, but for the most part they're beyond the scope of this handbook.

Nevertheless, it's important to point out how effective cultural control techniques can be. Grazing, for example, is considered by some to be the only effective management tool for controlling annual ryegrass in large areas. Goats are often used in such situations. Utilizing goat grazing requires extensive planning. Will you manage them using fencing or herding? Are you willing to sacrifice any of the native plants in the area to be grazed? How long should the

animals graze? The goats will eat almost everything. Other things to think about: the biology of the targeted weeds, the size and density of the infestation, and site conditions, particularly topography. Such considerations are important not only for goat grazing, but also for nearly every other control technique, including cultural ones.

Mechanical Control

For thousands of years, perhaps since the dawn of agriculture, humans have been using simple hand tools to remove weeds or simply pulling them by hand. Such methods can be very effective in controlling small populations of invasive plants, particularly where the weeds are intermixed with native plant communities, or adjacent to sensitive water bodies or rare plant populations.

There are other ways to physically remove weeds. In addition to the hand tools discussed below under “Key control techniques,” large machines may be used to remove weeds. Special harvester boats gather up aquatic weeds and heavy-duty mowers have been designed to move through woody brush. Common construction tools like backhoes and bulldozers are sometimes used to pluck out large plants. Commercial logging equipment can be used to remove invasive trees. However, mechanical control, especially using heavy equipment, is not without risk. It can cause significant disturbance to soil and vegetation and can also introduce weed propagules and pathogens such as the one that causes Sudden Oak Death.

Biological Control

In a farm or garden, biological control can involve releasing beneficial organisms like ladybugs or lacewings that can reduce insect pest numbers. Biological control can also mean creating habitat for such beneficial organisms so that they can keep pest populations in check.

In the case of wildland weeds, classical biological control refers to the importation of host-specific insects or pathogens from the native range of introduced pest plants. (The lack of predation from such co-evolved species is one of the chief reasons that invasive plants can so effectively outcompete native plants.)

Once such organisms are located, extensive research is undertaken to ensure that they will feed only on the targeted weed and not on native plants or crop plants. There have been cases where classical biocontrol organisms have dramatically reduced invasive plant populations, but there are also a few cases where the introduced organism has expanded beyond controlling the intended weed and now affects native plant populations. Researchers at a USDA lab in the East Bay city of Albany are evaluating biocontrol agents for yellow starthistle, brooms, and Cape ivy.

Chemical Control

Herbicides are chemicals—usually synthetic—that kill plants or stunt their growth. Some herbicides are selective (clopyralid, for example, is used to kill yellow starthistle without harming grasses and most other forbs), while others are more general. Herbicides can be applied in many ways at many scales, from aerial spraying over large infestations to discrete brushing on individual plants. Extensive permitting regulates the use of herbicides, especially around surface water.

Liability concerns and state laws and regulations limit the unsupervised use of herbicides by volunteers, but a few Bay Area weed projects have set up programs in which supervised volunteers do use them. Whether operating in a voluntary capacity or for hire, on public or private lands, those using herbicides for wildland weed control must know all state and local regulations. You must understand how to read herbicide labels, the legal description of how the herbicide may be used. You must have landowner permission for the application. And on public lands, you must be trained by an applicator licensed by the state's Department of Pesticide Regulation. Some basic information on common herbicide treatments that have proven useful to some Bay Area weed workers is provided later in this chapter and also in the species accounts in the next chapter.

Environmental toxicologists study how herbicides and other chemicals behave in the environment, including their adsorption to soil particles, their ability to get into groundwater, their influence on other nearby plants through their roots, their rate of decay, and their level of toxicity to humans and wildlife. A good compendium of such information can be found in the Weed Control Methods Handbook on the Web site of the Nature Conservancy's Wildland Invasive Species Team.

KEY CONTROL TECHNIQUES

There are perhaps hundreds of tools that have been used by weed workers at one time or another, but they can be classified into fewer than a dozen major categories. In this section, we describe the fundamental techniques that Bay Area weed workers find most useful.

Pulling

Hands and strong backs are great “tools” for pulling weeds. The human body, despite thousands of years of experience pulling weeds by hand, is nevertheless susceptible to injury when doing so. The back is particularly vulnerable. Protect it using the technique you learned while hauling heavy boxes: lift with your legs, not your back. Wrists and forearms are also sensitive to injury. You can avoid repetitive stress injuries by varying your technique: switching from arm to arm, shifting from kneeling on one leg to the other leg, etc.

There is no single right or healthy way to pull weeds by hand, but you can encourage your volunteers to pay attention to their backs and other sources of discomfort. If it's uncomfortable, they should try another position or use a different tool.

Specialized tools like the Weed Wrench rely on leverage to help you pull woody stems right out of the ground. The Weed Wrench has a tall vertical handle connected to moveable jaws set on a base that rests on the ground. As the handle is pulled back, the jaws close around the woody stem and the base becomes a fixed point against which the plant can be levered out of the ground. These come in several sizes. The ones with longer handles and bigger jaws are needed to pull larger plants, but they are much heavier and awkward to carry very far.

Sometimes, in order to pull larger weeds out of the ground, you will rely on other types of tools to help you gain access to the roots or to loosen the surrounding soil. Shovels, mattocks, hand picks, and Pulaskis can be used to loosen a root ball and to sever tough roots. Pruners, loppers, saws, and other cutting tools can be used to cut roots or to trim branches that block access to the base of the plant.

To minimize soil disturbance when working with small plants, use one hand to hold the soil in place around the base of the plant while pulling with the other hand. Clumps of invasive grasses can be gathered into one hand while you use a soil knife in the other to cut an ice-cream cone shape around the base of the grass. Whenever a plant comes up with soil attached to the roots, shake it gently, preferably close to the ground and right above where you removed the plant. Don't forget that invasive plant seeds thrive in disturbed soil! So minimize disturbance when you can.

Digging

Digging is often done in combination with pulling. When removing yellow starthistle by hand, for example, it often won't come up until you use a digging tool to loosen the plant's roots from the soil. This may also be true when pulling large broom plants with a Weed Wrench. Digging tools from hand trowels to large shovels are useful for such tasks.

For the smaller plants, digging tools like trowels, soil knives, dandelion diggers, and even old screwdrivers and paring knives can be useful. Here your weed work most closely resembles gardening: weeding a newly planted area, attempting to eradicate an invasive plant population (that is, when you have to get every last plant and seedling), or the like. Using such techniques can be quite labor-intensive, so be sure that you will have enough labor to achieve your goal. If not, it may be better to choose a different goal, for instance, trying to control the yellow starthistle by mowing instead of trying to pull every last one. But that's not

to be discouraging! Steady and persistent hand weeding over time can lead to dramatic success.

The most tenacious plants may not respond to pulling or cutting. Sometimes you just have to dig them out. Weed workers sometimes dig out big pampas grass clumps, for example, or the rhizomes of pepperweed or periwinkle. If the digging is extensive, it's wise to talk with the land manager's environmental compliance specialist. There may be archeological concerns that will limit the amount of digging you can do, particularly in areas of known archeological significance. Digging can cause irreparable harm to artifacts.

Long-handled tools like shovels or spades may tempt you to pry weeds out of the ground using leverage rather than digging them out. This may work in some conditions, but it can cause greater soil disturbance and damage the tool. Many shovels aren't sturdy enough to handle being used as a lever. There's a reason Tom Ness used steel in his Weed Wrench! (He developed the Weed Wrench while working on French broom in the Marin Headlands.) Consider using a long steel pry bar if you want to pry stubborn weeds out of the ground, limiting your use of shovels to lighter duty.

Picks and mattocks can be useful in rocky soils, or when the target plant has thick roots. Safety is particularly important with such tools. They should be carried head down, not over the shoulder. Keep well clear of others as you work. Swing the tool with knees bent and feet apart, so that you cannot slice into your shin. Swing from just above shoulder height and let the weight of the falling tool do most of the work.

When digging out plants, it's best to leave the soil on-site by shaking it gently from the roots and to avoid leaving large holes. Digging can cause considerable disturbance, so be certain that you have a plan to deal with the other weeds that may come in following disturbance. Visit the site again every few months to remove any weeds that have colonized the disturbed soil. If you stay on top of it, you can keep the early successional weeds under control relatively easily.

Scraping

Scraping tools are used to target seeds and small weeds or to create containment lines. Like digging, scraping is a form of soil disturbance, so make sure to deal with weeds that establish following scraping. Scraping tools can again be useful in that regard. Pattern hoes and oscillating hoes can be used to cut invasive plant seedlings and other small weeds just below the surface of the soil. McLeods and mattocks can do the same job. Tools with claws are especially useful for removing shallow roots from loose soil or duff.

Scraping is often undertaken to prepare a site for revegetation. Scraping a wild radish patch early in the season, not long after the radish seeds have germinated, will kill that batch of new radish plants and give you time to plant native

plants instead. Some prefer to scrape the area twice or three times in a season to reduce the weed seedbank before planting natives in the scraped area. Take steps to minimize the potential for erosion during the critical time between scraping and planting. If there are native plant seedlings or plantings in the area, hoeing should be done by more experienced volunteers who can recognize the native plants.

Cutting

For some plants, cutting them off at or near ground level is the best way to kill them. This way you avoid soil disturbance and don't have to mess with tenacious roots. This works best with species that don't resprout, but there are techniques that work with those that do. A tree can be cut at the base with pruners (if it is a small sapling), with loppers (a bit bigger), with a pruning saw (bigger still), or with a chain saw (much bigger). You might use all of these tools in a single day. Your choice about which tool to use will depend on many variables, particularly safety issues.

There are lots of different cutting tools and each one has an important role to play in your toolkit. Choosing the right one often depends on biological considerations, safety issues, and efficacy. Over the years, weed workers have developed several key techniques that involve cutting woody plant tissue in some manner. Here are some of the most useful ones.

Cutting. For some plants, cutting them off at ground level is sufficient to kill them. Monterey pine trees, for example, do not resprout as long as they are cut low enough. Cutting can also be a first step in preparing a plant for complete removal later. For instance, weed workers may use a chainsaw to trim back pampas grass to a point where they can dig it out of the ground. Infestations of weedy vines, which twine through woody thickets but are rooted in the soil, often require extensive use of cutting tools to clear away the thickets before the vines can be completely removed.

Grinding or macerating a cut stump. Stump grinding or macerating can also be used to prevent stump resprouts. Though grinding machines are expensive to rent and can be awkward to use in wildlands, some Bay Area weed workers have used them. Stumps are typically ground to a depth of about two feet below the ground. If only a few stumps need grinding, some weed workers remove enough soil around the base of the trunk so that they can cut it just below ground level without getting the chainsaw bar in the dirt. Some practitioners macerate cut stumps to inhibit resprouts. They do this by using a chainsaw to make cuts in a grid pattern (one- to two-inch squares) approximately two to four inches deep in the cut surface of the stump.

Tarpping a cut stump with landscape fabric or black plastic. In this treatment, the stump is cut low and level, then covered tightly with landscape fabric to prevent it from getting any sunlight. The fabric is spread at least two to three feet beyond the edges of the root crown to prevent resprouts from photosynthesizing. Care is necessary to make sure that individual pieces of fabric have enough overlap so that resprouts can't squeeze up between the seams. Because seams tend to be a source of failure, avoid using tarps with seams if you can. The fabric is staked down every few feet—or even every six inches—with U-shaped wire staples to make sure the tarp is securely fastened. Some weed workers even dig a trench around the target and completely bury the edges of the tarp. Covering stumps is feasible only for small areas and needs to be checked two to three times a year to make sure that sprouts haven't burst through the fabric or emerged around the edge. Cut stumps may require up to a year or more of covering to prevent resprouting. The fabric can also be covered with mulch to improve the aesthetics.

Treating a cut stump with herbicide. Many plants, including blue gum eucalyptus and acacia, resprout vigorously after being cut. Repeated cutting may eventually sap the plant of its vigor, but it requires intensive follow-up work, and is seldom efficient unless you have extensive volunteer resources available to prevent resprouts from establishing. That's why many weed workers treat the cut stump with an herbicide such as triclopyr or glyphosate. Practitioners use a high concentration of herbicide—no more than 50 percent, according to some—and apply it immediately upon cutting since the plant tissue heals rapidly, inhibiting uptake of the herbicide. The herbicide needs to be applied only to the exposed cambium, the living tissue in the trunk. It's wasted anywhere else. Unless aesthetics or safety are problems, cut the stump flat at a height of eight to ten inches. Then if it resprouts even after treatment, the stump can be cut again and retreated with herbicide. If aesthetics are a concern, stumps can be cut low and level and, once the herbicide has had a chance to work, covered with a thin layer of mud or brush to reduce the visual impact of newly cut trees.

Girdling, frilling, and drilling. These techniques all take advantage of the vulnerability of the cambium in order to kill a standing tree without felling it. The plant will die if this narrow band of living tissue encircling the entire tree just under the bark is damaged in such a way that it cannot transport water and nutrients between the roots and the rest of the tree. If a small section remains uninjured, however, the plant will keep growing and perhaps even heal the wound over. In most cases, it is preferable to cut down trees, but girdling and the like can be useful in relatively inaccessible areas where the dead tree will become a snag that will be useful to wildlife. These techniques should not be used if the standing dead tree will become a safety hazard or an aesthetic problem, or if it is in an urban

setting that could generate controversy. Girdling involves cutting through the bark and the cambium all the way around the trunk, and is often done using a chainsaw. Frilling accomplishes the same goal without using power tools. Cut long slices downward through the bark to the cambium and then peel them downward. Frilling tends to lose its effectiveness on trees larger than two feet in diameter because their bark becomes too thick for peeling. Another technique, which can be even more efficient and effective, involves drilling small holes in the bark and injecting herbicide. You need to know the proper herbicide type, concentration, and amount. Some practitioners have found that when drilling and injecting herbicide, a 50 percent solution of glyphosate works best. As with all herbicide treatments, this treatment requires supervision, training, and a prescription from a state-certified applicator.

Weed whipping. The next two techniques rely on power tools to increase the number of plants you can cut. As a result, they can be more effective and efficient in certain situations, but also more dangerous. Weed whipping offers the cutting power of a lawn mower but can reach tight spots a mower won't. It relies on a more powerful version of a tool familiar to many homeowners and known variously as a weed whip, weed whacker, or string cutter. A brushcutter, a larger and more powerful version of the weed whip, can be fitted with nylon string, rigid plastic cutting blades, or a wide variety of steel blades ranging in suitability from brush to small trees. A gas-powered motor spins a cylinder at the end of a long metal tube. When a canister containing nylon string is attached to the cylinder, the brushcutter can be used for cutting grasses, seedlings, or herbaceous plants like yellow starthistle. The nylon string doesn't work very well when the vegetation is wet. If the area is perpetually damp, or the vegetation is thicker than can be cut using nylon string—even the newer versions that are reinforced with steel or Kevlar—consider using other techniques. The rigid plastic blades can be very effective with tougher herbaceous weeds or small brush seedlings.

Brushcutting. When fitted with a metal blade, a brushcutter can be very effective in opening up areas covered by tall stands of woody invasive species up to two inches in stem diameter. Brushcutting tends to be used with larger infestations and in places where plants have become overgrown. This can be used as a way to prepare a site for pulling plant roots with a Weed Wrench—in which case, don't cut the stems so low that the Weed Wrench won't be able to grab them—or treating the cut stumps with herbicide. It is sometimes a challenge to move plants that you have just cut so that they are not in your way for cutting other plants. A second person can help with this, but it presents obvious safety concerns. The engine is often loud and the metal blade can throw stones and other debris, so

operating a brushcutter (or working near one) requires extensive protective gear and safety training. For the operator, chaps, helmet, face screen, and ear protection are *de rigueur*. These hazards, particularly the noise, require you to be very sensitive to the safety and comfort of park visitors as well. Using a brushcutter along a busy trail is to be avoided. The metal blade can also throw sparks when it hits rocks, so avoid its use in dry conditions when the fire hazard is high; use plastic blades or string in such conditions.

Mowing. Gas-powered mowers, especially the heavy-duty types used by maintenance divisions in park and open space agencies, can provide some control of certain invasive plants in grassland situations. Yellow starthistle, for example, when mown just as it begins to flower, can be knocked back significantly if done for two to three years in a row. Mowing to prevent seed set can keep some invasives from spreading while you reduce the size of the infestation with other methods. Timing is key. Mowing after invasive annual grasses have gone to seed obviously won't help. Mowing can also present problems if the target plant's seeds can continue to ripen even after being cut off (many thistles) or will reroot or resprout from cut stems (Cape ivy). A tractor-mounted mower can be effective on large parcels. Many different sizes can be rented and delivered to the site. A trained operator is required, as is a site that has been cleared of barbed wire, rocks, and other things which could get caught in the blades. Mowing is often best done in combination with other techniques, like hand pulling subsequent seedlings if they're not too numerous.

Applying Herbicides

There are several simple techniques for weed workers applying herbicide in situations where the landowner or manager has established the appropriate protocols and procedures to comply with pesticide regulations. These techniques require training and supervision by a licensed applicator and should not be undertaken without landowner approval and training certification. Before using such techniques, consider posting signs notifying the public that herbicides are being applied in a particular area. (Depending on the jurisdiction, this may be required by law or regulation.)

Cut-stump treatment. The role of this technique is described in the cutting section above. Herbicide at high concentration is applied to the cut face of the stump either by painting it on with a small brush or by spraying it on using a small bottle like those used to mist houseplants. Because you have direct access to the cambium, the amount of herbicide required is low, especially given the size of the plant. There is little danger of the herbicide contacting other plants directly when using this treatment.

Foliar spray. This technique delivers herbicide to a plant through its foliage, so it uses herbicide less efficiently than in the cut-stump treatment. Because the herbicide is being sprayed, there is the possibility of contacting non-target plants, which can result in undesired damage if you're using a non-selective herbicide like glyphosate. Many applicators use a backpack sprayer, which typically carries several gallons of diluted herbicide. The sprayer tank is kept pressurized by pumping a lever, and herbicide is sprayed from a wand. Wind conditions are always measured, because you are prohibited from spraying in any breeze over a low threshold to avoid drift. To ensure sufficient uptake into target plants it is necessary to cover their leafy surfaces thoroughly. This is easy on small plants, and harder on larger plants. Foliar spray tends to be ineffective on plants that have leaves with thick waxy cuticles.

Wicking. A wicking wand has a sponge on the end that is used to wipe herbicide onto a plant. This can be used for a foliar treatment, in which it has the advantage of getting less herbicide on non-target plants, but the disadvantage of taking more time to coat all surfaces. Wicking wands can also be used for basal bark treatments on woody plants, where herbicide is painted around the bark at the base of the main trunk. This treatment uses special additives that allow the herbicide to penetrate the bark and move into the root system.

A Few Other Techniques

A few additional control techniques are hard to classify. These include:

Solarizing. This technique takes advantage of the vulnerability of plant tissue to extreme heat. A clear plastic tarp allows sunlight to penetrate but traps the heat. In sunny climates the heat can be high enough to kill the plants under the tarp. In practice, the technique is identical to that used in covering a cut stump with landscape fabric, but in this case a clear plastic covering is used. (See Tarping treatment for details.) Solarizing may require up to a year or more of covering to kill the plants underneath the tarp. This technique is ineffective in foggy coastal areas, but weed workers in the East Bay and other areas with hot summers may find it useful for controlling small infestations of certain herbaceous weeds. Some practitioners prefer black plastic, finding it more effective than clear plastic even in inland areas as well as along the coast.

Flaming. Like solarizing, this treatment also relies on the vulnerability of plant tissue to heat. In this case, a propane torch is used to speed up the process. Some weed workers have found that it can be quite effective in controlling the thousands of French broom seedlings that emerge after a large stand has been

removed. Others have recently cited success with poison hemlock. However, its true potential is yet unknown, since this agricultural weed control technique is only now being adapted to wildland weed species and conditions. Stay tuned! As experience accumulates, it's likely to become an important and effective tool for controlling herbaceous invasive plants or small shrub seedlings. Flaming has several advantages, including avoiding ground disturbance, extending the season to include wet and cold weather (using it keeps you warm), and providing greater selectivity than herbicides (it works only on very young plants). Technique, timing, and safety issues are key concerns. The seedlings are not actually burned, but rather heated to the point at which the water in the plant cells boils and ruptures the cells. (Some weed workers describe this technique as “blanching” rather than “flaming,” and if you know your cooking terms you know why.) This stage is not always obvious to the torch operator, so it can be a difficult technique to learn properly. It is best to learn from someone practiced in the art. This treatment should be used only when it is raining or immediately thereafter. For obvious reasons, a propane torch should not be used in wildlands when there is any risk of fire whatsoever. Like many of the techniques described in this book, it is important to gain approval from the land owner or manager prior to implementation, and in this case consultation with your local fire department is a wise precaution.

Mulching. Mulching can be effective for smothering small infestations of herbaceous weeds like kikuyu grass or Harding grass that are hard to control using other techniques. Cover it first with a weed barrier—landscape fabric, nylon, plastic, even cardboard or old carpet—and then place three to six inches of rice straw or wood chips on top of that. Some people prefer fabric over plastic because of its superior ability to let water infiltrate into the soil and prevent erosion problems. Be sure to get *weed-free* mulch. Once the plants underneath are dead, removing the weed barrier will allow you to revegetate the area with native plants. If the barrier material is biodegradable, you can also plant directly into the fabric, cutting small holes to insert plants. Using an organic mulch can alter soil conditions, so this treatment should be used only in areas that have been highly altered already.

Managing Debris Appropriately

Whether pulled, dug, or cut, invasive plants are still invasive plants. Dealing with such debris is an important and often underestimated dimension of weed work. This is especially true for plants like Cape ivy, which has an almost miraculous ability to regenerate from the smallest bits and shreds. (It's so tough that it's been known to resprout even after being bagged in black plastic and left in the sun for months in the heat of a Central Valley summer!) When making plans about how to manage invasive plant debris, take into account considerations like the plant's biol-

ogy, vehicular access to the site, available resources, and site aesthetics. Before embarking on a weed project, always ask yourself: what am I going to do about the debris? Here are some common techniques for dealing with invasive plant material:

Leaving on-site. This is the simplest method. Pull up the plant and leave it right there. It works only if your target plant cannot reroor or resprout, occurs in low densities, and decomposes quickly, as is the case with many herbaceous plants. If you're working on small, dispersed pioneer populations, this strategy often makes good sense.

Piling on-site. This treatment is commonly used for dense stands. By piling the debris in a few stacks rather than scattering it across the entire site, you will free up space for native plants to begin regenerating. (Building high stacks can also provide you and your volunteers with a visible sense of accomplishment—take pictures of your group in front of the debris pile at the end of the day!) Some weed workers pile debris in such a way that they can burn the stacks later in the year, during late fall or early winter, for example. (As with all land management involving prescribed fire, it's important to consult with the local fire department and obtain all appropriate permits.) Others have found that wood and brush piles can provide valuable habitat for wildlife. Aesthetic concerns may compel you to stash debris away out of sight, but this can lead to new infestations if you're not careful. Debris piles often need to be monitored for resprouts and hiding them can make them hard to relocate. If your target is a resprouting vine like Cape ivy, it is often best to cut a containment line around the debris or pile it in the middle of a large tarp. Bucking and tarping on top can also help. In such situations you can separate clean, completely uninfested woody debris (which won't resprout) from herbaceous debris containing Cape ivy. This will reduce the number of Cape ivy-infested piles, and it will be easier for you to deal with resprouts if they're not entangled with branches. Whatever approach you use, monitor regularly for resprouts for several years.

Avoid piling dead plant material in areas where target weeds are likely to grow. For example, if the target quickly colonizes moist soils, consider placing debris in upland areas.

Hauling off-site. This treatment is feasible only when the site is easy to access by vehicle. It is a useful option when working with tree debris or weeds like Cape ivy that have the ability to resprout from the tiniest stem. Hauling and dumping fees can be quite expensive, so be sure to estimate accurately the volume of debris before choosing this technique. For plants that spread by seed, you can reduce the amount of debris by cutting and bagging the seed heads from the invasive plant before removal. This is sometimes done with pampas grass, but only in outlier popula-

tions. When invasive plants are still in the early stages of invasion, it is also often worthwhile to bag plants that may contain viable seeds. Better to haul a few bags away than to take a chance that the viable seeds will reinfest the site. And of course, you want to make sure that the destination site for your hauled debris is not likely to be the source of further infestations (landfills are generally fine, as are composting operations as long as they are hot enough to kill weed seeds or fragments).

Chipping on-site. This treatment can be useful if you are dealing with tree debris and the site is easy to access by vehicle. Branches up to three to four inches in diameter can be chipped into the back of a truck or, if ecologically appropriate, left on-site. Larger pieces of wood can be hauled away for lumber or firewood or left on-site. Like chainsaws and brushcutters, using a chipper requires training and careful safety practices. Make sure you have trained operators prior to using chippers.

TOOL SAFETY, CARE, AND SELECTION

Using a tool safely depends on knowing how to use it properly. Some tools, like a trowel or a dandelion digger, are easy to figure out on your own. Even if you don't quite get it right the first time, you can't inflict much damage on yourself (though one weed worker reported getting a bad blister on his palm the first time he used a dandelion digger without gloves!). Your margin of error for safety is much smaller when working with power tools or tools with sharp blades. That's why it is best to insist on proper training in tool use and safety.

Those working with volunteer weed workers often rely on manual tools because it is possible to train volunteers to use them safely and properly in a relatively short time. Teaching someone how to use a Weed Wrench takes no more than five minutes. Using a Weed Wrench is not without risk, but the infrequent injuries that can occur are relatively minor—bruises, bumps, and backaches mostly. As this example illustrates, many manual tools have two important advantages over other tools: they are relatively simple to use and the risks of their use are relatively minor. (That said, even simple tools like hand picks can be quite hazardous in the hands of a rambunctious crowd of teenagers. Remember one of the ABC lessons in chapter 3: know your Audience!)

It is true that volunteers can be taught how to safely use manual tools with sharp blades. Using a machete is straightforward—it's a simple and very effective tool in brush—but the consequences of an accident are much more severe than they are when using other tools. That's why very few weed workers who work with volunteers use machetes. They choose tools more appropriate for the skill level of their volunteers, even if this means avoiding tools that may be more effective in objective terms (that is, when used by an experienced worker).

Choosing the right tool for the job is not just a decision about technology, but also about sociology. Chapter 4 contains additional considerations about tool safety and use when working with volunteers.

All weed workers using power tools should receive careful training in tool safety, use, and care. For public agencies who are willing to allow volunteers to use power tools—and such agencies are in the minority—this often takes the form of an all-day or half-day workshop.

A well-made tool can last a long time if it is cared for. And a well cared-for tool is also a safer tool. Tool care is often a neglected art, though, which has led exasperated managers to take several approaches for dealing with the problem. One approach is to dedicate the last fifteen minutes of a work party to tool care and cleaning. (Removing seeds and soil from tools and boots is important when dealing with invasive plants because otherwise there's a chance that you and your tools will be transporting invasive plant seeds.) Or you can set aside one work day every few months to paint, repair, and sharpen your tools. Some programs find dedicated volunteers or staff members who enjoy tool care to take responsibility for tool maintenance.

If you have responsibility for choosing tools, choose high-quality ones. Cheap tools usually fall apart rapidly under the stress of vigorous weed work. (On the other hand, you may be better off with relatively lightweight tools, especially if you work with children.) You may choose to purchase or borrow a variety of tools for your work parties—all kinds of volunteers are then likely to find something they're comfortable with—or focus on just a few types of tools, simplifying your planning and training.

WEED WORKERS' TOOLS EXPLAINED

Tool	Target	Considerations
PULLING		
Weed Wrench	tap-rooted shrubs, small trees	works best in winter and spring when soil is moist; can cause soil disturbance; works best with vertical rather than horizontal taproots
pliers	seedlings, narrow-stemmed plants	easy to carry; easy to lose
McLeod, rake	vines	
DIGGING		
round-point shovel		standard multi-purpose shovel; long handles increase leverage; some may prefer short handles
spade		flat-edged, short-handled shovel; only marginally useful
transplanting spade, or sharpshooter		long narrow-bladed shovel, effective on deep root systems; forged steel work ones are much better than cheap stamped steel; if careful, can be used to lever plant out of the ground
trowel	small plants	useful for planting or transplanting small plants; good tool for children
soil knife	small, tap-rooted plants	point penetrates pliable ground easily; serrated blade lets you cut what you can't dig; creates less soil disturbance than trowel
dandelion digger	small, tap-rooted plants	
mattock	deep-rooted plants	requires proper training
Pulaski		a favorite all-purpose tool for many weed workers; useful for grubbing out or cutting down almost any plant; can be used for frilling and girdling; light-weight versions available
hand pick		one-hand tool for smaller scale weed removal
digging bar, rock bar		useful for loosening hard soil and rocks deep below the surface; can bend if used for prying
pry bar		useful for prying up roots

Tool	Target	Considerations
SCRAPING		
McLeod, cultivator fork, other tools with tines	mats of invasive perennials in monoculture, including grasses	McLeods are a good multi-use tool for scraping surface debris from the ground, hacking out small roots, and raking small brush; requires follow-up for resprouts and seedlings; requires some training
pattern hoe	seedlings and small plants	requires basic training
oscillating hoe	seedlings and small plants	can push or pull, providing versatility; requires basic training
CUTTING WOODY PLANTS		
pruners	woody stems <1/2 inch in diameter	anvil pruners (one sharp blade and one flattened one) require less force to cut the same stem than bypass pruners (sharp-ened blade slides past curved blade); inexperienced users can ruin bypass pruners by twisting them in the cut; bypass pruners can make cleaner cut
loppers	woody stems 1/2–2 inches; tree and shrub limbs; stalks of large herbaceous vegetation	loppers come in two basic types too: anvil and bypass (see above); longer handles allow for greater leverage when cutting through woody stems; can be ruined if used inappropriately; requires some basic training
pruning saw	woody stems <10 inches in diameter	some come in a folding version; a favorite tool for many weed workers; can get pinched in large branches if not careful
hatchet, ax	large shrubs, small trees	useful when you don't have access to a pruning saw or chain saw; let the falling weight of the tool do the work; position your feet so that you won't accidentally hit your legs if you miss; dangerous tool in inexperienced hands; also used for frilling and girdling
Pulaski	large herbaceous plants, large shrubs, small trees	can be used like an ax to cut, frill, or girdle, can be used to hoe out root pieces; requires training for both safety and technique
bow saw	woody stems <18 inches in diameter	available in many sizes; useful for sawing through limbs and small trees; used primarily for large blocks of wood like logs; commonly used in trail work
limbing saw	woody stems <18 inches in diameter	mostly used by arborists for small limbs

Tool	Target	Considerations
chainsaw	woody stems	versatile but noisy and requires extensive safety training; helpful and safer to work with a swamper to remove debris and provide assistance when required
brushcutter	woody stems <4 inches in diameter using steel blade	versatile but noisy and requires safety training; helpful and safer to work with a swamper to remove debris and provide assistance when required; should not be used on steep or very rocky slopes

CUTTING HERBACEOUS PLANTS

weed whip	small areas of grasses, herbaceous annuals, or perennials	versatile but noisy and requires safety training; useful for light-duty selective mowing in grasslands
brushcutter	grass or seedlings using nylon string or rigid plastic blades; vines or groundcover using toothed steel blades	versatile but noisy and requires safety training; helpful and safer to work with a swamper to remove debris and provide assistance when required; should not be used on steep or very rocky slopes
mowers	grass or herbs	useful in large, flat areas
machete	almost anything	too dangerous for common use; requires proper training in both sharpening and user technique; must be regularly and expertly sharpened; a dull machete is more likely to cause injury
scythe	grass	not commonly used anymore, but can be a very effective tool, if sharp and used properly, in uniform grasslands; difficult to learn proper techniques for sharpening and use
hand scythe	grass; inflorescence removal before seed dispersal	relatively safe, good for cutting grass in sensitive areas; not appropriate for large-scale control
Swedish brush ax	brush and small woody stems < 4 inches diameter	relatively safe, but any sharp-edged tool entails risk; requires proper training
Japanese sickle		relatively safe, but any sharp-edged tool entails risk; requires proper training
pocket knife	shrubs and small trees	can be used for girdling when no other tool is available; versatile multi-use tool that can come in handy

OTHER

flaming equipment (propane torch and portable tank)	small seedlings, soon after germination	safety an issue; best conducted in wet season; may require multiple treatments in one season as germination is staggered
---	---	--

Tool	Target	Considerations
landscape fabric, black plastic (6 or 10 mil)	clonal mats of vines and grasses	use plastic rather than fabric when moisture barrier is needed; use fabric to allow moisture percolation into the soil; 6 mil breaks down in about a year in sun; 10 mil lasts at least twice as long
wire staples		staples can be used for securing fabric edges when the ground is pliable; otherwise dig a trench and bury the edges; requires long-term commitment of 1–2 years; must be well-fastened to endure weathering 1–2 years; not for use in high-wind environments; aesthetics may be an issue
wheelbarrow, plastic bag, woven polypropylene bag, tarp		all can be used for hauling vegetative material; wheelbarrows can be bulky and unwieldy to handle on pickup trucks; plastic bags rip easily; some prefer to use strong tarps, which can be lifted at the corners and dragged or carried
rake		useful in areas with high visitor use; flexible rakes useful for cleanup; hard rakes useful for piling debris
push broom		useful in areas with high visitor use
hay fork, scooping fork, ensilage fork		great for loading or unloading vegetative material
static kernmantle rope		knowing a few basic knots turns a length of rope into an assist for short climbs, a loop for dragging brush, and a multitude of other uses

WEED WORKERS' TOOLS ILLUSTRATED

(note: drawings are not to scale)

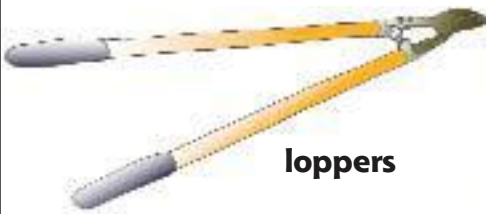
 <p>weed wrench</p>	 <p>McLeod</p>	 <p>oscillating hoe</p>
 <p>round-point shovel</p>	 <p>fire rake</p>	 <p>rake</p>



Pulaski



hand pick



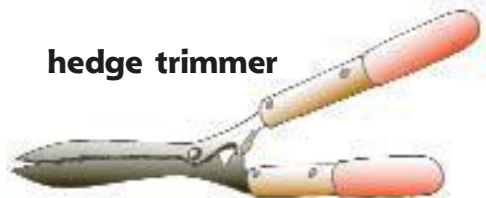
loppers



**small
loppers**



hand saw



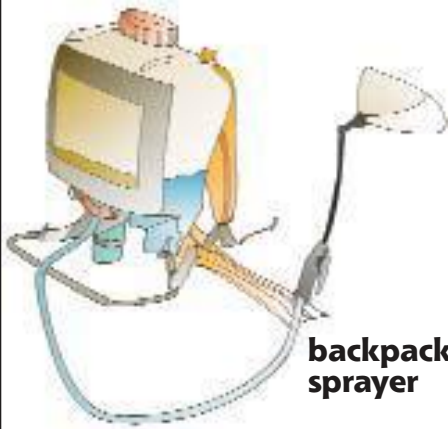
hedge trimmer



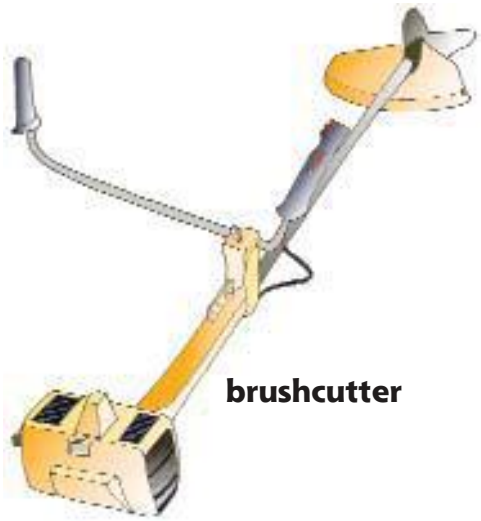
machete



soil knife



**backpack
sprayer**



brushcutter



mower



**weed
flamer**

6

THE PLANTS: HOW TO REMOVE BAY AREA WEEDS



The weeds presented in this chapter are significantly affecting Bay Area ecosystems. Local landowners, conservation organizations, and volunteer weed workers have identified these plants as important to control in Bay Area watersheds. While other weeds also affect local natural areas, we have chosen to provide a comprehensive resource for these species in this book.

Each species account includes a description of the plant and its modes of reproduction, followed by its ecological impact, treatment options for removal, and notes on disposal and follow-up. A wide range of treatment options is presented so that you can select the approaches best suited to your site and resources. (Refer to chapter 5 for detailed descriptions of each of the control treatment options.) Each account also lists key factors of the plant's biology that are important to consider when planning a control program.

Following is a discussion of how biological characteristics—modes of reproduction and life cycles—affect choices and strategies for effective weed control efforts.

REPRODUCTION: HOW IT AFFECTS WEED REMOVAL

By definition, weeds are plants that reproduce very successfully in the habitats they invade. We should note that weediness is not a fixed characteristic of a plant, but a reflection of its impact in a particular environment. Some invasive plants are prolific seeders and early colonizers even in their native range, while others are surprisingly rare in their native range. For these plants, the absence of predators and diseases, recent or historical habitat alteration, or other ecological circumstances enable them to invade where they are introduced. In such cases weed removal may be only one component of habitat restoration. Whatever the factors that enable a plant to become a weed, understanding its modes of reproduction

and its life cycle will help you choose techniques, evaluate progress, and follow up appropriately until you succeed in controlling it.

Some plants reproduce exclusively from seed. Some are equally prolific by sexual and vegetative reproduction. Others reproduce almost exclusively vegetatively, and either rarely produce viable seed, or their seeds rarely encounter the right conditions to germinate. In sexual reproduction, male and female gametes combine and produce genetically different offspring through flowering, pollination, and seed production. In asexual (or vegetative) reproduction, new individuals—clones—can grow from a part of a plant, such as a node or a root.

Sexual Reproduction

Evolution has produced myriad ways by which seeds—those precious packets of genetic information—are dispersed. Some seeds drop close to the parent plant, while others are carried a considerable distance on the wind; some are eaten by birds and dropped even greater distances; others still are transported by flowing water. Perhaps the greatest aid to seed dispersal, however, is the movement of humans. (This is how many weeds were introduced in the first place!) Some seeds are transported by clothing, boots, and vehicles from mountain bikes to earth-moving equipment.

Effective control techniques are linked to these means of seed dispersal. For example, if a seed is transported by water, consider trying to control upstream infestations first to prevent continual re-invasion. If seeds come packaged in fruits that are eaten and dispersed by birds, consider trying to remove the plant before fruits ripen. When you don't have the resources to remove entire plants before seeds are produced, you may choose to remove just the seeds for that season if practical. Another important consideration is seed viability. Knowing how long seeds can persist as a viable seedbank will help you decide how many years you will need to follow up on removing seedlings after the initial removal of an infestation.

Vegetative Reproduction

Plants can produce new individuals by many means other than seed. Vines can cover a lot of ground simply by vegetative growth—not technically reproduction—before they ever flower. Bulbs, rhizomes, stolons, and runners are not roots, but shoot (stem) tissue that can give rise to new plants. Tillers and suckers are shoots that emerge directly from a part of the root, growing adjacent to or at some distance from the main stem of the parent plant. Some plants can produce shoots and roots directly from stem nodes or branch tips that touch the ground. Others can regrow from a cut stump or from parts of roots left in the ground. For our purposes, such regeneration can be considered vegetative reproduction, because without follow-up, it can produce a whole plant.

The amazing array of possibilities for vegetative reproduction gives rise to a long list of considerations for treatment and follow-up. Can the target weed

resprout from a cut stump? If so, you may choose to implement one or more of the following options until the species is controlled: cutting resprouts until energy resources are depleted, covering the stump with landscape fabric, treating with herbicide, or removing the stump and roots entirely. Can a patch continue expanding outward via rhizomes or tillers? If so, you may try to control the perimeter until you can remove the whole patch. Can small fragments of stems that contain a node produce an entire new plant? If so, you may find yourself regarding weed debris as hazardous waste when you contemplate disposal.

Life Cycles

In addition to differences in modes of reproduction, plants have different life cycles: annuals complete their life cycle in one year, biennials in two years, and perennials live for three or more years.

- **Annuals** reproduce exclusively by seed. An example is yellow starthistle, a winter annual that produces copious amounts of seed. (Winter annuals germinate in the fall, overwinter as seedlings, and die in the spring or summer soon after setting seed.) Because individual plants do not persist beyond one year, the main control concern with annuals is preventing seed production to minimize the number of future plants.
- **Biennials** develop strong roots during their first year, storing the energy they need to survive the winter. Bull thistle, like many biennials, overwinters as a basal rosette of leaves. This is a good time to pull plants up by hand as the taproot is relatively weak. In the second year, biennials bolt and flower. By this stage, not only is the taproot stronger and the plant more difficult to pull up, but soon the plant will produce seed.
- **Perennials** often reproduce both sexually and vegetatively, thus requiring a range of treatments to control or remove them. Perennials can be divided into woody perennials (trees, shrubs, and some vines) and herbaceous perennials (forbs, grasses, and some vines). Woody perennials have persistent, hardy stems. Herbaceous perennials often have stems that die back during the winter but roots that persist, with new stems growing from the root crown each spring. Treatments for perennial weeds are often designed to make an impact on their most resilient part—the roots. If the plant can regrow from stumps or roots, the control strategy may also include repeat treatments to exhaust the plant's energy stores.



The species accounts that follow are grouped by growth habit (vines, shrubs, trees). Herbaceous plants are further divided by life cycle (perennial or biennial forbs, annual forbs, perennial grasses, annual grasses.) Within each section, the plants are ordered alphabetically by common name. The illustrations that accompany each description are not to scale.

CAPE IVY

Delairea odorata

(formerly known as German ivy, *Senecio mikanioides*)

Sunflower Family (Asteraceae)

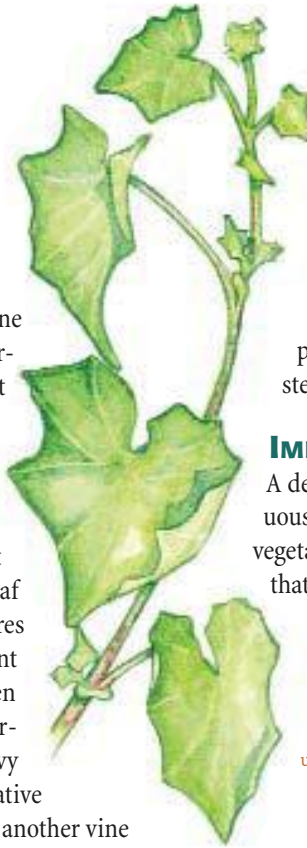
DESCRIPTION

Cape ivy is a climbing perennial vine usually found in coastal and riparian areas and on disturbed moist sites. However, it is a highly adaptable species that will proliferate in a wide range of ecosystems.

Both the leaves and stems store water, making the plant drought-tolerant. A single leaf grows from each node and measures 1–3 inches long. The succulent leaves are smooth and bright green with pointed lobes. The underground stolons are purple. Cape ivy is commonly confused with native wild cucumber (*Marah fabaceus*), another vine with similar leaves. Unlike Cape ivy, however, wild cucumber has thicker stems, spiraling tendrils, hairs on the leaves, white flowers that bloom in spring, and spiny fruits.

REPRODUCTION

Cape ivy grows vigorously, particularly from February to June. It reproduces vegetatively by rooting from stem, stolon, or petiole (i.e., any part of the plant except the leaf blade) that touches the ground. Infestations can be spread by a variety of means, such as machinery or water, which carries fragments downstream. Cape ivy has no taproot, only shallow adventitious roots that grow to 4 inches deep in the soil. In areas with little summer moisture or with frost Cape ivy will experience some dieback, only to resume growth with the fall rains. Small, yellow flowers with green tips bloom between December and February. Cape ivy seeds have a



hairy apex and are wind-dispersed. However, most seeds produced in California appear to be sterile.

IMPACT

A dense, sometimes heavy, and continuous mat of Cape ivy can blanket native vegetation. Cape ivy contains alkaloids that are potentially toxic to fish.

KEY FACTORS

- u Reroots from fragments left in the soil.
- u Frequently grows among poison oak, stinging nettle, and blackberry.
- u Thrives near moisture.

TREATMENT OPTIONS

Removing Cape ivy requires precision, as every little part of the stem needs to be removed. Given the time and resources that controlling Cape ivy demands, practitioners have found it is sometimes advantageous to focus on removing the Cape ivy around the perimeter of a patch, rather than all-out removal. The control method chosen depends on patch size and isolation, the resources available for control, and the threats posed by Cape ivy to valued resources.

- u Cut a containment line by clearing a strip of bare earth around the entire perimeter of a Cape ivy infestation, as if you were cutting a fire break. The strip should be roughly 1 yard wide, depending on site factors such as public visibility and soil moisture. This helps to prevent spread as Cape ivy grows more slowly on bare

soil. Begin from the edge of an area and work your way inward. You can sometimes peel back the edges of an infestation, where the vine is more lightly rooted, and roll the vegetation like a carpet. Tease or dig out stolons with a small Pulaski, fork, McLeod, or hand mattock if needed, following the runners to their source. Many hand tools work well. You can rake the soil surface several inches deep to comb out any remaining stems and roots fragments. Check the line periodically (4–6 times a year at moist sites; at least 2 times a year elsewhere) for Cape ivy spreading.

Some practitioners have used a more intensive approach—especially in riparian and dense scrub habitat—by clearing both native and invasive vegetation to establish initial containment/removal lines and access Cape ivy resprouts. This requires chainsawing limbs off trees and shrubs to about breast height. Make sure limbs are removed from the area as Cape ivy may also reestablish in debris piles. Rakes or McLeods can help to pull loosely attached vines climbing up a tree, or you can cut the vine with loppers and leave the ivy to die in the tree.

Sites cleared of Cape ivy may be vulnerable to erosion or colonization by other invasive species. When working next to a creek or river, work your way from upstream to downstream to prevent recolonization by stem fragments transported by water.

- u **Cut and treat.** Cut climbing vines with loppers and paint stems with herbicide. Because Cape ivy nodes break easily, it may help to place tarps on the ground around trees in order to catch any stem fragments that break as you work.
- u **Graze.** Some land managers have attempted using goats as a pretreatment. Audubon Canyon Ranch grazed 60 small female goats for 1 week on a half-acre site; the goats grazed the foliage but not the stolons.

DISPOSAL

Some practitioners pile the plant material on a tarp to dry out in the sun, making sure no roots touch the ground. The Cape ivy should break down quickly, especially if the piles are turned frequently. However, there is a chance that Cape ivy will sprout even after long drying. Establish and maintain a containment line around larger debris piles. As a final measure you can spray the piled debris with a weak glyphosate solution. Alternatively, bag all parts of Cape ivy and remove them from the site. You may also need to remove parts of native vegetation that have become entwined with the vine. Pile thoroughly cleaned woody debris separately, and chip it for mulch.

FOLLOW-UP

Some practitioners recommend revegetating immediately with low-growing species (if appropriate to your restoration project) in order to deter Cape ivy reinfestation. Return to the site as needed: more frequently for moist sites—approximately every 4–8 weeks—and perhaps as little as every 6 months for dry sites. Small Cape ivy plants can be hard to spot when growing in thick undergrowth and therefore easily overlooked, so check often. The strategy is to be responsive to regrowth and be persistent. Expect an eradication program to require 3–4 years when working on patches of less than an acre.

INTERESTING FACTS

Native to South Africa, Cape ivy was introduced to the US during the 1850s as an ornamental, and has since been used in landscaping and possibly erosion control.

IVY SPECIES

English ivy (*Hedera helix*)

Algerian ivy (*Hedera canariensis*)

Ginseng Family (Araliaceae—some botanists now consider members of this family to be properly classed within the family Apiaceae.)

DESCRIPTION

Both English and Algerian ivy are woody evergreen vines commonly found in moist, shady woodland areas.

Ivy grows as a vine and groundcover for up to 10 years before flowering. English ivy leaves are alternate, dark green, and leathery. They usually have 3–5 lobes, white veins, and aerial rootlets that secrete a sticky substance, enabling ivy to climb up tree trunks.

Older plants capable of flowering can turn increasingly shrubby, with leaves that are more oval and measure 2–4 inches long. Algerian ivy is distinguished from English ivy by its 3-lobed leaves, pink to reddish stems, and white flowers.

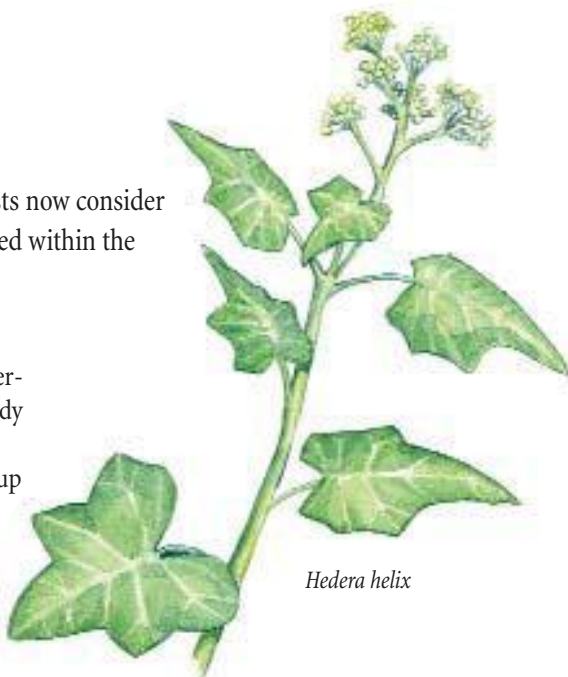
REPRODUCTION

In mature plants, terminal clusters of small, yellowish-green, and inconspicuous flowers appear in fall; blue-black berries appear the following spring.

English ivy spreads primarily by rhizomes, but it can also reproduce from seed. Seeds are disseminated by birds whose digestive tract scarifies the hard seed coat. Algerian ivy is a relatively new invader, so less is known about its reproduction. It is, however, reported to produce a large quantity of viable seed and to have a large root system.

IMPACT

Ivy vines form dense carpets of vegetation that can cover native vegetation as well as open soil. This dense groundcover can deprive native plants of light and nutrients and reduce germination of the native seedbank. Eventually even



Hedera helix

large trees can be killed by ivy climbing into their canopies. Algerian ivy is considered more invasive than English ivy because it is rapidly invading relatively undisturbed forest understories. The leaves and berries are toxic.

KEY FACTORS

- u Seed longevity not known, but reported to be quite viable.
- u Shallow root system, but resprouts from cut roots (typically more than a half-inch) left in contact with the soil.

TREATMENT OPTIONS

Removing ivy can increase the potential for erosion on creek banks and slopes, so have an erosion control strategy in place prior to removal.

- u **Pull** vines climbing into trees and along the ground by hand or with rakes and McLeods. Ivy can sometimes be rolled up like a carpet and piled or hauled off-site.
- u **Cut** woody stems with pruners or loppers, and **dig** up the roots with a shovel to prevent resprouting.

- u **Cut and treat** vines that are well established or climbing into trees. Make two cuts to remove a 12- to 16-inch section of the vertical stem. The portion of the vine remaining in the tree, without access to the roots, will eventually die. To prevent resprouting from the lower portion remaining in the ground, the stump can be treated with herbicide (some land managers use a 50 percent solution of glyphosate) or cut out with a Pulaski or shovel.

DISPOSAL

Pulled ivy roots left in contact with soil may reroot. Piles may be left to decompose on a tarp on-site or hauled off-site and disposed of as green waste.

FOLLOW-UP

Check for resprouts or new seedlings 3–4 times a year. These are easy to remove by hand. If piles are in contact with soil, check for rerooting and regrowth.

INTERESTING FACTS

English ivy is native to Europe, was most likely introduced to the US as an ornamental in colonial times, and has been used to control soil erosion. Algerian ivy, as its name suggests, is native to northern Africa and southwest Europe. English ivy has been used since the time of the Ancient Greeks to treat a range of health complaints, including rheumatism, toothache, and even cellulite.

Notes

HIMALAYAN BLACKBERRY

Also known as Armenian blackberry

Rubus discolor

Rose Family (Rosaceae)



DESCRIPTION

This perennial shrubby vine is common in riparian woodlands, disturbed open areas, and along streams.

Himalayan blackberry forms mounds up to 10 feet tall, with arching or trailing, thorny stems that become woody and reach up to 40 feet long. These areas are often impenetrable. The canes (stems) are green to deep red, turning woody with age. The leaves are toothed or serrated along the edges and have a mat of fine hairs underneath that give a whitish appearance. Leaves on flowering stems have 5 leaflets. To distinguish Himalayan blackberry from the native species, look for hooked or curving thorns, 3–5 leaflets, and larger fruits that ripen later than the native blackberries. Native blackberry (*Rubus ursinus*) has just 3 leaflets and fine prickles rather than single thorns. Thornless elm leaf blackberry (*Rubus ulmifolius* var. *inermis*) is another invasive blackberry species to look out for. This species is thornless and produces no fruits, only flowers.

REPRODUCTION

Himalayan blackberry reproduces in a variety of ways. It can spread vegetatively by rooting from the cane tips or from nodes along the canes, from rhizomes or root fragments, and from the root crown. Canes bear fruit in their second year and then die. Every year the crown produces new canes that replace the dead ones. White (or sometimes pinkish) flowers with 5 petals and many yellow stamens bloom from June to August. Bumblebees and honeybees pollinate the flowers. Edible berries ripen and turn black in August to

September. Seeds are viable and tend to be dispersed by mammals or birds whose digestive tracts scarify the hard seed coating and promote germination. Seeds germinate in the spring and fall, but can remain viable for several years. An individual plant can live 25 years.

IMPACT

Once established, the plant's dense mounds displace native vegetation by shading out light. Individual canes are relatively short-lived (2–3 years), so a build-up of dead canes and abundant leaf litter gradually increases the risk of fire. Himalayan blackberry reduces access to water for wildlife, degrades pasture, and is sometimes a nuisance to recreationists seeking access to natural areas.

KEY FACTORS

- u Stout thorns necessitate the use of leather gloves and protective clothing.
- u Abundant seed production.
- u Seeds viable for several years.
- u Fast-growing stems.
- u Resprouts from the crown and root fragments left in the soil.
- u Thrives in moist areas.

TREATMENT OPTIONS

- u Cut stems with loppers close to the ground.
- u Dig out rootball with a Pulaski or shovel, and

remove as much of the root as possible. Interconnecting roots reaching over 30 feet long and 2–3 feet deep make pulling up *all* roots extremely difficult. Realistically, you should aim to remove the main rootball and the large lateral roots. Dense thickets and thorns also make working with blackberry labor-intensive and uncomfortable, so control may be feasible only in sensitive habitat or small infestations working from the outside in.

- u **Brushcut** the canes; use McLeods to clear the vegetation. The best time to do this is when flowers are in bloom but before the fruit sets. Cutting encourages new growth but may be effective if repeated over a number of years.
- u **Cut and treat.** Some practitioners cut stems to about 1 foot and treat stumps with 25–50 percent concentration of glyphosate immediately after cutting. Don't use herbicide on or near plants from which people may pick and eat the berries.

DISPOSAL

Transfer stems and roots to a site where they can be left to decompose, making sure that all berries have been removed. Alternatively, burn the debris or trim it into pieces small enough for bagging and disposal.

FOLLOW-UP

Regardless of the method used, follow-up is essential. Some land managers recommend immediate revegetation with quick-growing shrubs and trees, with periodic visits to the site to check for seedlings or regrowth. After you've removed the canes, one option is to hoe the soil or use a rototiller. This will clear out any roots, but is practical only for small infestations. Goats will also graze on younger plants.

INTERESTING FACTS

Native to Eurasia, Himalayan blackberry was introduced to the US in the late 1800s as a cultivated crop. The berries make great pies and jams!

Notes

PERIWINKLE

Vinca major

Dogbane or Milkweed Family
(Apocynaceae)



DESCRIPTION

Periwinkle is a spreading perennial vine most commonly found in shaded riparian and disturbed areas.

The leaves are opposite, 2–3 inches long, broadly oval in shape, and pointed at the tip. They are glossy, dark green, and have tiny hairs along the leaf margins and a waxy coating. Flowering stems grow erect to about 1.5 feet, while non-flowering stems become long and trailing. The plants can die back in hot, dry weather.

REPRODUCTION

Periwinkle spreads vegetatively by arching stolons that root at the tips, and by vigorous underground growth of stolons. Like Cape ivy, it also roots from fragments of the stem. The roots are fibrous and form shallow-growing mats typically 6–12 inches below the soil surface. This weed can tolerate a range of soils; wet conditions trigger spurts of vegetative growth. Single, blue-purple, tubular flowers with 5 flattened petals bloom between March and July. It is not clear whether periwinkle can produce viable seed in California.

IMPACT

Periwinkle forms a dense carpet of both above-ground vegetation and matted roots that excludes native groundcover species and prevents seedlings of trees and shrubs from establishing. Periwinkle can also contribute to soil erosion along streambanks.

KEY FACTORS

- u Resprouts from root fragments (typically greater than a quarter-inch in diameter) left in the soil.
- u Rapid growth.

TREATMENT OPTIONS

- u **Pull** up the dense vegetation and underlying stolons using a McLeod. Pull the roots up from the base of the stems. If working in clay or dense soils, roots may break off, and follow-up grubbing may be required to ensure removal.
- u **Pull** periwinkle by hand if it is a very small patch in sandy or loamy soil. Generally, this method only works if the roots are within 1–2 inches of the soil surface or if the soil is loose and very moist.
- u **Brushcut** the vines close to the ground and then cover the area with weed fabric, black plastic, or cardboard. Leave for at least 1 year, possibly 2. Some practitioners use a combined treatment by cutting back the aboveground vegetation, grubbing out the roots, and then covering. Weed fabric is expensive and may be practical only for small infestations. You may want to consider using layers of cardboard or carpet instead.
- u **Dig** a trench around the patch, 6 inches deeper than the stolons, and line it with fabric to temporarily contain periwinkle. This will prevent the root system from expanding until the patch can be further controlled.

- u **Foliar spray.** Some practitioners report excellent results with spraying and no cutting. Others cut the plant close to the ground in spring when periwinkle is actively growing, using a brushcutter, scythe, or weed whip, and then, within 1 minute of cutting, spray a 2 percent solution of glyphosate onto the cut stems. The purpose of cutting the vines beforehand is to break up the waxy cuticle and improve absorption of the herbicide. Spring is the most effective time for this treatment.

DISPOSAL

As with Cape ivy, it is important to remove any larger broken stems and root sections from the site as these will resprout. The cut vines can be piled on a tarp and left to decompose. Turn the piles periodically, making sure no stems come in contact with soil or water. Alternatively, bag the vines and dispose.

FOLLOW-UP

Monitor the site at least every 3 months for resprouts, depending on how moist the site is. If you use landscape fabric, check that it is still held firmly in place, and pull up or grub out any escaped plants.

INTERESTING FACTS

Native to Mediterranean Europe, periwinkle's use as a medicinal plant goes back hundreds of years. The leaves have traditionally been used as an astringent and to reduce hemorrhages, and magicians added them to love potions! It was probably introduced to the US as an ornamental.

Notes

BROOM SPECIES

French broom (*Genista monspessulana*)

Scotch broom (*Cytisus scoparius*)

Spanish broom (*Spartium junceum*)

Legume or Pea Family (Fabaceae)

DESCRIPTION

These three broom species are invasive shrubs that grow in grasslands, scrub, and woodland habitats. Once introduced, they can quickly colonize disturbed areas, trailsides, and stream-banks, and sometimes spread into wildlands along roads. Broom species are somewhat shade tolerant, though in general Scotch broom is found in drier, sunnier locations. Individual shrubs have been known to live up to 17 years.

French broom usually grows 6 to 10 feet tall, but can grow as tall as 15 feet. Mature plants are evergreen, especially along the coast. Leaves grow in groups of three. Each leaf is about a half-inch long, or larger in shadier woodlands.

Scotch broom also grows 6 to 10 feet tall. Young plants are easily distinguished from French broom by the flowers (see below) and by the ridges on their dark green stems. Scotch broom leaves are smaller and fewer than French broom, giving the plant a wiry look.

Spanish broom is distinguished from the other types of broom by its smooth, round stems, single leaves, and large flowers. Leaves are shed during summer drought, giving a very stick-like appearance. Its taproot can reach depths of 6 feet, making Spanish broom the hardest of the three brooms to remove.

REPRODUCTION

French broom flowers start to appear in March (earlier in sunny locations) and continue to bloom through May or even July. They are yellow, less than a half-inch in size, and have the familiar pea flower shape with banner, wing, and keel petals. The flowers grow from the main stem in bunches of 4 to 10. In June and July,



Genista monspessulana

inch-long fuzzy green seed pods appear, turning dry and brown in late summer. Each pod bears several to many shiny black seeds.

Scotch broom flowers are similar to those of French broom, but they are larger and deeper yellow. Seed pods are similar, too, except that they have hairs only on their seams, instead of being fuzzy all over.

Broom seed pods, when ripe, burst open explosively and propel seeds up to 12 feet from the plant. Starting in the second year of growth, seed production is prodigious; in a single square-meter plot, researchers have counted more than 6,700 seeds! Furthermore, the seeds persist, remaining viable for at least 5 years and potentially for decades. Broom seeds often germinate with early winter rains, establishing a flush of new seedlings from December through July.

IMPACT

Dense stands of broom change the structure of the invaded plant community, often increasing fire hazards by creating a “ladder” of woody material that can carry fire into trees. Brooms provide poor forage for native wildlife. The leaves and seeds are toxic. As nitrogen-fixing legumes, they can enrich soil nitrogen, which in turn can promote the growth of other weedy plant species once the broom has been removed.

KEY FACTORS

- u Prodigious seed production.
- u Seeds remain viable for many years, potentially decades.
- u Resprouts from stumps and root crown when cut.

TREATMENT OPTIONS

- u **Pull** shrubs by hand or with a Weed Wrench, or **dig** with a Pulaski, pick, or shovel between January and May, when the moist ground makes it easier to remove the roots, and before another generation of seeds has developed. Repeated pulling of successive generations is currently thought to be the single most effective method of removing broom.
- u **Cut** shrubs to just above ground level using a pruning saw, loppers, or brushcutter, ideally during the dry season so that the stumps become more stressed. Cutting, rather than pulling, has the advantage of minimizing soil disturbance. Untreated cut stumps *will* resprout and must be cut repeatedly (see Follow-Up, below.) Alternatively, cut the stems about 2 inches above ground level, then **girdle** the stump by peeling the bark off the stems—like peeling a banana—down to ground level. This reduces resprouting and works best on medium to large French broom plants.
- u **Cut** stems, using loppers, to about 2 inches above ground, and grub out the roots.
- u **Cut and treat** the stumps with herbicide.

- u **Girdle** the trunk of large broom plants with a small hand tool such as a paint scraper. (Warning: while girdling minimizes soil disturbance, standing dead broom will increase, not reduce, fire hazards. Also, broom left standing will be in the way when you return for follow-up.)
- u **Scrape** seedlings with a hula hoe.
- u **Flame** seedlings in monoculture with a propane torch (weed blancher). This is most effective and efficient when the seedlings have only their two seed-leaves, but can also work on seedlings with true leaves, up to a few inches tall. (See Follow-Up for more on flaming.)

FOLLOW-UP

Wherever mature plants are removed, emerging seedlings will also have to be removed for *at least* the next 5–8 years and probably longer. In the first year after removing mature plants, the next generation will be too small to pull, but this dense flush of seedlings is effectively controlled by flaming with a propane torch. A single pass with the torch will wilt and kill seedlings. Controlling broom plants when they are seedlings will spare you a great deal of work in pulling plants the second year after removing mature broom.

Broom is not eradicated from your site until the seedbank is exhausted, so be vigilant to prevent subsequent generations from producing seed. Broom is easiest to spot when the bright yellow flowers are present, but be sure to remove it before the seed pods mature.

Broom resprouts from the base when cut: all except seedlings and old, senescent plants can resprout after cutting if not treated with herbicide. Resprouting stump shoots can be cut or weed-whipped the following year, either in late spring or in the dry season. Repeat this treatment annually until the plants’ energy resources are depleted.

DISPOSAL

Pulled plants that have not produced seed can be piled on-site to decompose. Alternatively, they can be hauled off-site and chipped or recycled as green waste. One innovative use of broom waste has been to bundle the pulled plants to create 8- to 12-inch wattles that can be secured to slopes to prevent erosion.

Plants that have gone to seed should be piled on tarps or bagged to reduce the number of seeds falling to the ground and germinating.

Putting broom-with-seed piles in deep shade will also help inhibit germination. Tarps should be visited annually, and eventually removed when materials have decomposed.

INTERESTING FACTS

French broom originates in the Mediterranean and was reportedly introduced to the Bay Area as an ornamental in the mid- to late 1800s. Scotch broom is native to much of Europe and the foothills of North Africa.

Notes

Notes

COTONEASTER SPECIES

Cotoneaster franchetii

Cotoneaster pannosa

Cotoneaster lactea

Rose Family (Rosaceae)

DESCRIPTION

Cotoneasters (pronounced co-TONE-e-aster) are evergreen shrubs that grow in grasslands, shrublands, forests, and open areas, and can form dense thickets.

They are either sprawling or erect to about 10 feet tall. The branches criss-cross one another. The leaves are simple, elliptic-ovate, dark green to gray-green, and hairy beneath. They grow up to three-quarters of an inch long. The leaves of *C. lactea* are larger.

REPRODUCTION

Clusters of white to pink 5-petaled flowers bloom between June and September, followed by showy crops of orange or red berries September through February. Seeds are produced in great numbers and do not require fertilization. They drop near the parent plant but are readily eaten by many bird species, which increases the distance over which seeds can be dispersed. Seeds germinate during the rainy season. Cotoneaster can also spread vegetatively by root sprouting and by branches rooting at the nodes.

IMPACT

Cotoneaster is thought capable of invading intact ecosystems, where it competes with native vegetation for water, nutrient, and light resources. This is seen particularly in plant communities where the native toyon (*Heteromeles arbutifolia*) is found. The root system grows rapidly, making removal difficult. In addition, the dense shrubs frequently grow under trees and can facilitate the spread of fire by forming a fuel ladder.



KEY FACTORS

- u Produces many stump sprouts after cutting.
- u Root system is extensive and difficult to remove.
- u Abundant seed production and bird-dispersed fruits.
- u Seed longevity is not known, but may be several years.

TREATMENT OPTIONS

- u **Pull** seedlings a half-inch or less in diameter with a mini-Weed Wrench or by hand. Pulling is practical for small plants only, as cotoneaster develops multiple stems from a large root mass, making it difficult to grasp the base.
- u **Cut and treat.** Cut stumps close to the ground during the fall and winter. Practitioners using herbicides apply a 50 percent concentration of glyphosate to the stumps. Painting stumps with glyphosate is effective on large shrubs

but becomes more difficult on the smaller ones, as the many small stems can be hard to see. For smaller plants, it may be preferable to spray the herbicide.

- u **Cut and cover.** Remove all branches of mature shrubs with loppers or a pruning saw, then cut the trunk back to about 1 foot in height. If you cut much shorter, the plant may produce a significant number of sprouts from the root and trunk. Recommendations vary on when to cut, but research suggests cutting just after the shrub has produced fruit (when its energy reserves are at their lowest) but before fruit has dropped, thus minimizing the risk of mature berries germinating. Cover stump and surrounding ground (1–2 feet all the way around the stump) with landscape fabric for at least a year.

FOLLOW-UP

Return to the site at least once a year to check for resprouts and seedlings. If you use landscape fabric, check periodically that it hasn't been moved by animals or hikers. You can also remove the fabric twice a year to cut back any growth that has resulted despite the lack of sunlight. Make sure you reposition the fabric securely.

DISPOSAL

Individual plants can be piled on-site. For larger infestations you might want to chip the debris.

INTERESTING FACTS

Native to China, cotoneaster was introduced to the United States as an ornamental most likely during the mid- to late 1800s.

Notes

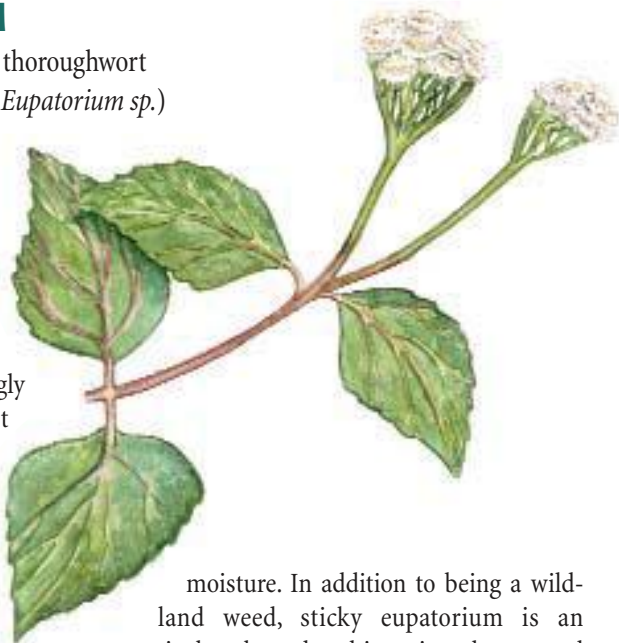
STICKY EUPATORIUM

Also known as Crofton weed, eupatory, thoroughwort
Ageratina adenophora (formerly *Eupatorium* sp.)
 Sunflower Family (Asteraceae)

DESCRIPTION

This perennial herb or semi-shrub is found on moist, exposed slopes and disturbed areas, particularly in riparian habitat and in forest clearings.

Sticky eupatorium often has a straggly appearance and typically grows 3–5 feet tall. The stems are long and dark red with downy hairs, and woody at the base. Sticky eupatorium grows rapidly, its shoots and branches forming dense thickets. Leaves are opposite and triangular-ovate with toothed margins. They are about 2 inches long, dark green, and glossy.



moisture. In addition to being a wild-land weed, sticky eupatorium is an agricultural weed and is toxic to horses and unpalatable to cattle.

REPRODUCTION

Sticky eupatorium spreads primarily by asexual seed production. Small, white or pinkish inflorescences resembling pincushions appear in terminal clusters in March. From April to mid-June each plant produces 7,000–10,000 tiny black seeds, although up to a third of these are not viable. Each seed is topped with fine hairs that aid in wind dispersal. The seeds are easily airborne or dispersed by water, but they can also stick to clothing, footwear, or passing vehicles and animals. Most germination takes place in August and September, and seedlings are capable of reproducing vegetatively within 8 weeks of germination. The plant can also reproduce from the roots and through parts of the stem that touch the ground.

IMPACTS

Sticky eupatorium crowds out native plants after fire disturbance or flooding, and is very competitive with natives in areas with summer

KEY FACTORS

- u Prolific seed production and rapid growth.
- u Seed viability thought to be 2–3 years.
- u Thrives in moist drainage areas.
- u Resprouts from roots and from stems in contact with soil.

TREATMENT OPTIONS

- u **Pull** plants by hand or **dig** them out with a Pulaski when the plant is in flower but before it has gone to seed. Removing sticky eupatorium by hand is time-consuming. Although the root system is shallow, stems break easily, especially on drier soils, so care should be taken to pull from the base of the stems so as not to leave root fragments. In moist drainage areas, you might find yourself pulling up heavy, sodden clumps of root mass and soil. Often you'll find that the roots form a continuous mat. However, it's important to get the root mass, as the plant will otherwise resprout.

- u **Brush cut** sticky eupatorium on dry, steep slopes and in drainage areas, using a rotary slash brushcutter. Some practitioners then follow up by digging out the roots; others, by spraying the cut stems with herbicide. In the Marin Headlands repeated brushcutting at monthly intervals in the drier months has proved unsuccessful in exhausting the root system and preventing the stems from resprouting, perhaps because of the additional moisture supplied by summer coastal fog.
- u **Foliar spray.** Some practitioners have had success by spraying a weak solution of glyphosate in infestations on dry slopes away from water. Spray the tops and undersides of the leaves (either before or just after the plants begin to show buds).

DISPOSAL

Stems will easily reroor in water, so make brush piles well away from wet areas. Piles can be left to decompose on site.

FOLLOW-UP

If the infestation is a manageable size, follow brushcutting with removal of the roots. Alternatively, if it is safe to use herbicide, you can wait for lush growth to return after brushcutting and spray the plants in order to finally kill them. Return to the site 2–3 times after the initial visit (at 6-month intervals) to scrape off any new seedlings from the soil surface with a McLeod or hula hoe. Mulching the weeded area with a 1- to 2-inch-thick layer of straw or covering with landscape fabric will help prevent the seedbank from germinating and will make follow-up much easier.

INTERESTING FACTS

Originating in Mexico, sticky eupatorium is considered a major agricultural weed around the world. It may have been introduced to California as an ornamental plant. In India the plant is being used to produce a green commercial dye, while in Nepal the plant juice is applied to cuts and injuries. Studies show that composting sticky eupatorium for approximately 2 months eliminates its toxins.

Notes

ARTICHOKE THISTLE

Also known as cardoon, wild artichoke

Cynara cardunculus

Sunflower Family (Asteraceae)

DESCRIPTION

Artichoke thistle is a perennial herb commonly found in disturbed grasslands where it can form dense stands. It also invades chaparral and riparian woodland habitats.

Growing up to 5 feet tall, its erect stems are thick, coated with downy hairs, and ribbed like celery. The leaves are silvery or grayish-green on the upper surface, and whitish beneath due to the presence of white hairs. The leaf margins have one-eighth to one-quarter inch spines. The leaves form a basal rosette.

REPRODUCTION

Artichoke thistle reproduces primarily by seed but can also resprout from the roots if cut back. One or more flower heads bloom at the tip of stems from April to July and are pollinated by bees. Occasionally flowering occurs in the first year, but more often in the second. One plant can produce up to 15 or so flower heads (or cardoons) with pinkish-purple or blue flowers. A single flower can produce hundreds of seeds. The seeds are brown to black, roughly a quarter-inch long, and have feathery bristles at the tip. Being too large and heavy to travel far by wind, the seeds generally drop near the parent plant. Seed that has travelled farther afield is usually spread by birds, animals, and water. Research suggests that seeds remain viable up to 7 years.

IMPACT

Artichoke thistle competes with neighboring vegetation for moisture and nutrients, and once established will shade out other plants to form monocultures. Thick stands of the plant inhibit the movement of wildlife. The plant is not poisonous but may injure grazing livestock and humans who come into contact with it.



KEY FACTORS

- u The spines necessitate wearing heavy leather gloves, long sleeves, and even protective clothing such as chainsaw chaps when removing this plant.
- u Abundant seed production.
- u Seed longevity reported to be at least 5 years.
- u Prolonged germination period (from first rains to as late as July).
- u Resprouts vigorously from deep taproot (up to 8 feet deep).

TREATMENT OPTIONS

- u **Pull or dig** plants out. In theory, most of the taproot needs to be removed to prevent resprouting, but some land managers have been able to kill artichoke thistle by digging up only 12–18 inches of the root. The taproot's brittleness may make removal difficult, so pulling during the rainy season is best.
- u **Cut and bag** flower stems before they open, to reduce seed production if you do not have time to remove plants. Some practitioners have also found grazing by goats helpful in reducing seed spread.

- u **Cut and treat.** Some weed workers using herbicide prefer to apply it to the base of a cut plant rather than covering the large leaves. They cut the stems close to the base with loppers and apply herbicide to the base.
- u **Brush cut** every 3 weeks between December and March, and then every 4 weeks until the plants died during the summer drought. For heavily infested areas, a tractor with an attached flail mower has been used.
- u **Foliar spray.** Seedlings may need to be sprayed just once, but larger plants may require 3–4 sprays in one season. Some practitioners spray as plants begin to bolt (at the end of the first year of growth).

DISPOSAL

Seed heads should be disposed of (if flowers are developed or seeds are present, place in plastic bags), together with any roots, and taken off-

site. It's important to destroy as much of the root system as possible, either by herbicide or physical removal and proper disposal.

FOLLOW-UP

Return periodically to the site to check for seedlings coming up from the seedbank. Some have also carried out surface tilling as a follow-up treatment after mowing or brushcutting.

INTERESTING FACTS

Native to the Mediterranean, this plant was introduced to the US in the mid-1800s for use as a vegetable (the inner leaf-stalks, taproot, and base of the flower head are edible). It is related to the commercially grown globe artichoke (*Cynara scolymus*), and the two will hybridize. The commercial variety of cardoon has fleshier flower heads, and the leaf lobes and inner flower bracts are without spines.

Notes

BULL THISTLE

Also known as spear thistle

Cirsium vulgare

Sunflower Family (Asteraceae)

DESCRIPTION

Bull thistle is a biennial commonly found on recently disturbed sites and forest clearings, but it also invades native grasslands. It thrives on moisture.

Bull thistle's erect spiny stems and spreading branches reach 2–5 feet. The upper surface of the leaves is grayish-green with short, stiff hairs; the undersides are a woolly gray. The leaves are alternate, stout, and have a winged appearance, with pointed lobes and a long yellow spine at the tip. Bull thistle produces a rosette of low-growing leaves in the first year. A fleshy taproot can grow up to 30 inches long.

REPRODUCTION

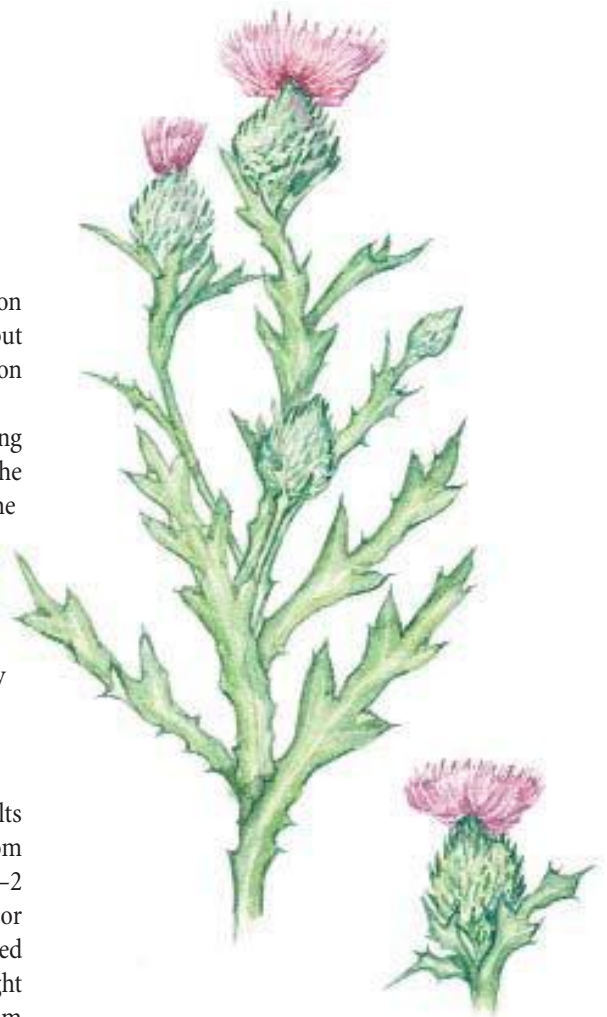
Bull thistle reproduces solely by seed. It bolts and flowers generally in the second year, from June to September. Flowers are terminal, 1.5–2 inches across, and rose-colored to magenta or purple. The base of the flowers is cone-shaped and densely covered with green spines. Light brown, oblong seeds are ripe for release from July to October. Each plant produces seed only once before dying, but can produce thousands of seeds. The seeds are wind-dispersed, although research suggests that most drop within a few feet of the parent plant. Seeds germinate in spring and fall.

IMPACT

Bull thistle can establish in grassland and scrub habitats, quickly colonizing open patches. It also reduces the value of forage lands.

KEY FACTORS

- u Spines necessitate the use of heavy leather gloves when working on this plant.



- u Copious production of wind-dispersed seeds.
- u Seed longevity thought to be at least 10 years.
- u High germination success rate.
- u Resprouts from taproot unless removed from below crown.

TREATMENT OPTIONS

- u Pull bull thistle by hand before the flowers open. To spare yourself the spines, step on the stem so that the thistle leans over to one side before you bend down to pull it. If the ground is hard, loosen the soil with a pick and then pull up as much of the taproot as possible. Clip any flower heads that are beyond the bud stage if population size is small.

- u Cut the stems to at least 1–2 inches below ground with a sharp-edged shovel before the flowers bloom. Remove flower heads when feasible, i.e., in small populations. The plant may continue resprouting if the root is left in the ground, so follow-up is important.
- u Mow after the thistles have bolted but before they flower. A second mowing one month later is usually necessary. Thistles must be cut close to the ground. Yosemite National Park has had some success using this technique.

DISPOSAL

The stems can be left to decompose on-site. Any clipped flower heads should be removed (and bagged, if plants are on the cusp of developing seed), as thistle flowers can mature and produce viable seed even after being cut off the stem.

FOLLOW-UP

Not all bull thistles flower in the second year, so follow up for several years to catch those plants still in the rosette stage. Dig up rosettes each year or chop out 1–2 inches below ground. Replanting the area with native species will discourage bull thistle, which thrives more on open, exposed sites with little competition from other species. There is also evidence to suggest that bull thistle does not tolerate deep shade, so you might have success using a weed fabric barrier in dense patches as a follow-up treatment. Clean equipment before leaving the infested site to prevent the spread of viable seed.

INTERESTING FACTS

Bull thistle is native to Europe, western Asia, and North Africa, and reached the United States as a crop seed contaminant during the colonial era. The taproots at the rosette stage are edible if cooked.

Notes

FENNEL

Foeniculum vulgare

Carrot or Parsley Family (Apiaceae)

DESCRIPTION

Fennel is an erect perennial herb commonly found in annual and perennial grasslands, open, disturbed areas, chaparral, and along watercourses and roadsides.

Fennel grows 4–10 feet tall and smells like licorice. The branching stems are stout, grayish-green, and marked with long vertical grooves. The stems are jointed and sheathed by leaves at the nodes. The leaves are dissected into fine, feathery strands like dill leaves, with each division measuring up to 5 inches long. Fennel has a stout taproot.

REPRODUCTION

Fennel reproduces by seed and, after cutting, by regenerative root crowns. Flowers first appear 1.5–2 years after germination. Small, yellow flowers in umbrella-shaped clusters (umbels) bloom between April and August. Aromatic seeds are produced in pairs during summer until September. These are light green to brown, flattened and ribbed, measuring a half-inch long. Within 2 years, one plant can produce over 100,000 seeds. Seeds are commonly spread by water, or by coming into contact with clothing, animals, vehicles, and machinery. Seeds will germinate at almost any time of the year. Soil disturbance may trigger higher rates of germination.

IMPACT

Fennel can form dense monospecific stands by competing with other plant species for light, water, and soil nutrients. Research suggests it may also have an allelopathic effect on other species.

KEY FACTORS

- u High seed production.
- u Seeds remain viable in the soil for several years.



- u Resprouts from roots when cut.
- u Mowing can stimulate increased growth if performed too early in growing season.
- u Seedlings need light to grow.

TREATMENT OPTIONS

- u **Pull** small seedlings by hand when soil is soft and moist. You can also use hand tools, such as a soil knife or trowel, to uproot seedlings. A thick taproot frequently makes pulling mature fennel impracticable.
- u **Dig** out individual plants with shovels, hand picks, and Pulaskis, preferably when the soil is still moist. If you cannot get the whole root, remove the upper portion of the root crown (generally the top 3–6 inches). Cutting into the root just before the plant sets seed reduces the number of resprouts. If you don't plan to

follow up with herbicides, dig only in light infestations, because the soil disturbance will expose seeds and increase germination. The deep taproot and bulb store the plant's energy and will regenerate quickly if cut. Cutting alone will not kill fennel, so follow up on resprouts frequently to exhaust the roots.

- u **Mow** fennel 4 times a year, about every 3 months, beginning in March–April. Some seed heads lie prostrate and are therefore easier to miss. Mowing *during* seed set encourages seed spread and should therefore be avoided. Mowing too soon before seed set appears to increase vegetative growth. Reports suggest that this repeated mowing technique can eradicate fennel within 4 years.
- u **Mow and Foliar spray.** Some weed workers mow fennel and wait for resprouts to appear, then apply glyphosate to the bushy resprouts.
- u **Foliar spray.** A 2 percent solution of glyphosate can be sprayed on the leaves of green seedlings emerging after dormancy (March–May). Spray before the plant bolts (around June). Repeat application may be needed. For fennel growing near water, use a suitable glyphosate product.

FOLLOW-UP

Remove any ripe seeds from the site by brush-cutting and bagging the flower heads. This is

also a useful stop-gap measure to contain the spread of fennel on sites where elimination is not possible. In chaparral, revegetate with native shrubs immediately to discourage fennel from re-establishing and prevent colonization by other invasive species. Check for seedling growth twice a year, particularly in late winter/early spring, and follow up on resprouts to exhaust energy stored in the roots.

DISPOSAL

Fennel stalks without seed heads can be piled or even composted in large piles on site.

INTERESTING FACTS

Fennel originally comes from the Mediterranean region where the seeds and tuberous roots have been used in cooking at least since the Roman era. There is little information on its introduction to California, but it most likely escaped from cultivation. In medieval times, the seeds were eaten to suppress the appetite, while the raw bulb is still eaten as a digestive in southern Italy. Wild pigs will forage for the roots, which furthers invasion through soil disturbance, while birds and rodents reportedly eat the seeds. Fennel is attractive to Anise Swallowtail butterflies as a source of nectar, but generally speaking, fennel tends to displace other animal species by reducing habitat diversity.

Notes

PERENNIAL PEPPERWEED

Also known as tall whitetop

Lepidium latifolium

Mustard Family (Brassicaceae)

DESCRIPTION

This versatile, rapid-growing perennial herb forms dense stands, commonly in or adjacent to salt marshes and freshwater riparian areas as well as hay meadows and even roadsides.

An erect and branching plant, perennial pepperweed reaches 3 feet or taller in moist conditions. The alternate leaves are lanceolate, toothed or smooth-edged, typically gray-green, and waxy; lower leaves are larger. The thick roots look like weedy parsnips and grow to a length of 10 feet, making removal extremely difficult. Pepperweed often grows near and is confused with *Grindelia*. *Grindelia* stems are reddish, while pepperweed stems are not.

REPRODUCTION

Perennial pepperweed spreads primarily from underground roots, in addition to root fragments, which can float in water for long periods and still sprout. It also spreads from abundant seeds, with a single plant producing thousands of seeds each year. Tiny, white 4-petaled flowers bloom in terminal clusters from June to September. The seed pods, maturing in August and September, are tan to red-brown, rounded, slightly hairy, approximately $\frac{1}{8}$ inch long, and bear 2 tiny, flattened seeds. Seeds are dispersed by water, machinery, and passing animals or people. Their longevity is not known, but is probably no more than 2 years.

IMPACT

Pepperweed tolerates salty soils and can invade intact ecosystems. A vigorous root system allows it to compete for water and nutrients with native species, such as pickleweed, which



the threatened salt marsh harvest mouse requires. Pepperweed also degrades habitat for the California clapper rail. The woody stems can shade out sunlight needed for growth. The roots of pepperweed do not hold the soil well and allow increased erosion on riverbanks after flooding. Pepperweed is also an agricultural weed of hay meadows and is toxic to horses.

Perennial pepperweed is considered one of the most difficult invasive plants to remove. If you see a new infestation, act immediately! Most non-chemical methods are reported to have little impact on controlling this weed once it has become established.

KEY FACTORS

- u Large, deep, and vigorous perennial root system.
- u Resprouts from small root fragments (of less than an inch) left in the soil.

- u Produces thousands of tiny, viable seeds, although they appear to be short-lived.
- u Accumulates thick layer of debris.

TREATMENT OPTIONS

- u **Pull** plants by hand, preferably when the soil is moist and loose, and grub out as much of the root as possible. Hand pulling is feasible only for seedlings of young infestations. There are no easily pulled individual roots, but a continuous mass of deep, interconnecting roots that frequently break. Mechanical removal is not recommended given the plant's ability to spread easily from root fragments, but it will temporarily stop seed from spreading.
- u **Cut and cover.** It may be possible to cut this plant back prior to flowering, and then cover the root system with cardboard or landscape fabric to reduce the plant's ability to resprout, though it may be difficult to hold the covering in place along shorelines.
- u **Mow or brush cut** plants close to the ground when flower buds appear. (Removing only the top growth will stimulate regrowth.) Let the pepperweed grow back and bud again, then mow a second time. Some practitioners have followed this by immediately applying a 2 percent solution of glyphosate to the cut stems. *Note:* glyphosate is not reported to be effective as a foliar application (skipping the step of mowing or brushcutting) because the leaves have a waxy coating. In riparian or wetland habitat, use a suitable glyphosate product—one that is not toxic to aquatic organisms—and apply with a wick-type applicator to prevent herbicide drift.
- u **Graze.** Sheep and goats will graze on perennial pepperweed if the leaves are still young and there is nothing else to eat.

DISPOSAL

Keep roots away from waterways to minimize further infestations downstream. Wash equipment and the tires and undersides of vehicles after leaving the site. Bag and dispose of pulled plants as household garbage or take them to a green waste facility. Alternatively, dispose of the plants through hot compost with grinding (but not ordinary compost, as very small fragments will reroot).

FOLLOW-UP

Regular follow-up is essential as the roots can lie dormant underground for several years. Return to the site in early spring and late summer to check for regrowth and to remove rosettes. Scrape litter from the soil surface to allow other species to grow. Soil remediation may be required before planting native species. Any revegetation should be carried out as soon as possible. Natives with creeping perennial roots may be best.

INTERESTING FACTS

Perennial pepperweed is thought to originate in southwest Asia and to have spread to Europe many centuries ago. It came to California sometime in the 1930s, possibly as a contaminant of shipped seed. It seems likely that in ancient times the young leaves were served as a spicy salad green. In medieval Britain the seeds were “poor man's pepper” and the roots were a substitute for horseradish. Perennial pepperweed has been used to treat medical conditions such as skin disorders and painful joints, and may contain insecticidal properties. The flowers are still used in dried flower arranging.

POISON HEMLOCK

Conium maculatum

Carrot or Parsley Family (Apiaceae)

Warning! Poison hemlock can kill humans if eaten and may cause dermatitis, nausea, and headaches if touched or inhaled after continual cutting or mowing!

DESCRIPTION

Poison hemlock is an erect biennial, sometimes perennial, related to fennel, often found in scrub, riparian areas, and wetlands, as well on open slopes, disturbed sites, and roadsides.

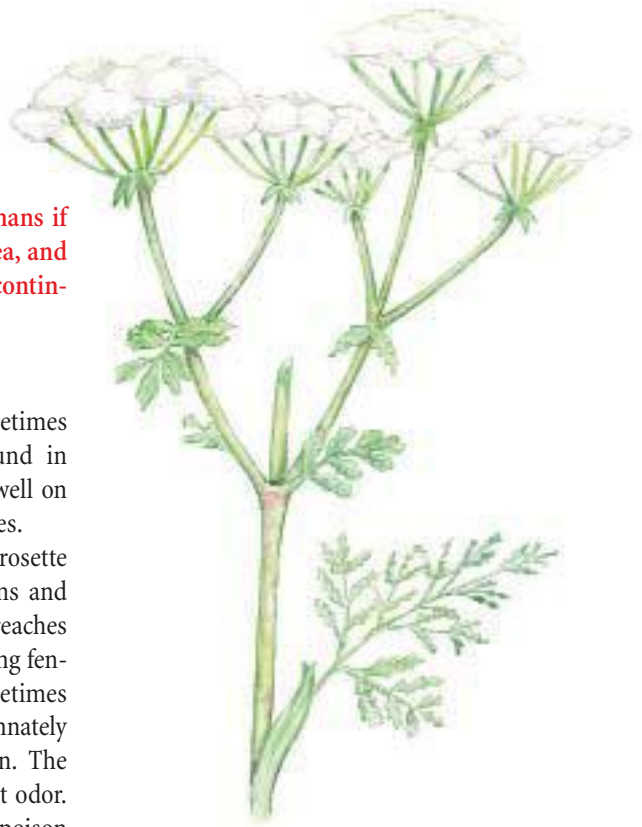
Poison hemlock grows from seed to a rosette in the first year, then develops tall stems and flowers in the second year. It generally reaches 3–8 feet in height. The stalks—resembling fennel—are tall, ribbed, hollow, and sometimes purple-spotted. Leaves are opposite, pinnately compound, triangular, and bright green. The foliage, when crushed, has an unpleasant odor. Unlike wild carrot (Queen Anne’s lace), poison hemlock has no hairs on its leaves and stems.

REPRODUCTION

Poison hemlock reproduces by seed only, with each plant producing roughly 1,000 of them. Small, 5-petaled, white flowers appear in umbels mainly in June–July, although there are reports of poison hemlock flowering almost year-round in the East Bay. Fruits generally set in August–September. The seeds are spread most effectively by birds, animals, and water, but passing machinery and vehicles also aid seed spread. Dispersal occurs between September and February, and germination takes place from late summer to early spring.

IMPACT

A fast-growing species, poison hemlock can reduce native plant cover by shading other species. It is poisonous to wildlife and can cause paralysis and death in livestock.



KEY FACTORS

- u Poison hemlock is toxic to the skin and respiratory system, so wearing gloves and a mask is advised. One recommendation is to take frequent 5-minute breaks because of the potential for irritation. Some people feel ill even with protective gear!
- u Usually a biennial, so no need to remove entire root system.
- u Seeds are thought to be viable for up to 5 years.
- u Grows best in rich soils in moist conditions.

TREATMENT OPTIONS

- u Practitioners have reported difficulty in removing large stands of poison hemlock by hand and have tended to focus on small infestations. Some practitioners advise removing hemlock before seed set, while others remove poison hemlock year-round.

- u **Pull** plants by hand, preferably during the rainy season when moist soils allow you to get more of the root. (You can use a soil knife or trowel to minimize direct handling of the plant.) Large clumps can be dug with a shovel.
- u **Cut** using a hand pick to hit below the root crown and remove the upper portion (as opposed to the whole root).
- u **Mow** to height of 3–4 inches in early April and then repeat a month later to follow up on any regrowth and new seedlings. Repeat for several years. Mowing won't eradicate poison hemlock, but it will help reduce the size of infestations by weakening the plant. It can deplete the seedbank if pursued regularly.

FOLLOW-UP

Some practitioners have reported little success with mulching in areas where plants have been pulled, as large seedlings can bolt straight

through. Others recommend laying a thick mulch (about 4 inches deep). Follow up on any regrowth, pulling seedlings by hand or with hand tools. Flaming with a propane torch during the rosette stage is another technique that deserves experimentation.

DISPOSAL

Cut vegetation may be left on-site. However, cut and wilting hemlock plants can be palatable to wildlife and yet remain poisonous. Some attention to disposal or fencing may be necessary to protect deer and other animals.

INTERESTING FACTS

Native to Europe, West Asia, and North Africa, poison hemlock was introduced from Britain as an ornamental in the late 1800s. It is a plant traditionally associated with European witchcraft. The Ancient Greeks used poison hemlock to execute political prisoners, including Socrates.

Notes

ITALIAN THISTLE

Also known as slender thistle
Carduus pycnocephalus
 Sunflower Family (Asteraceae)

DESCRIPTION

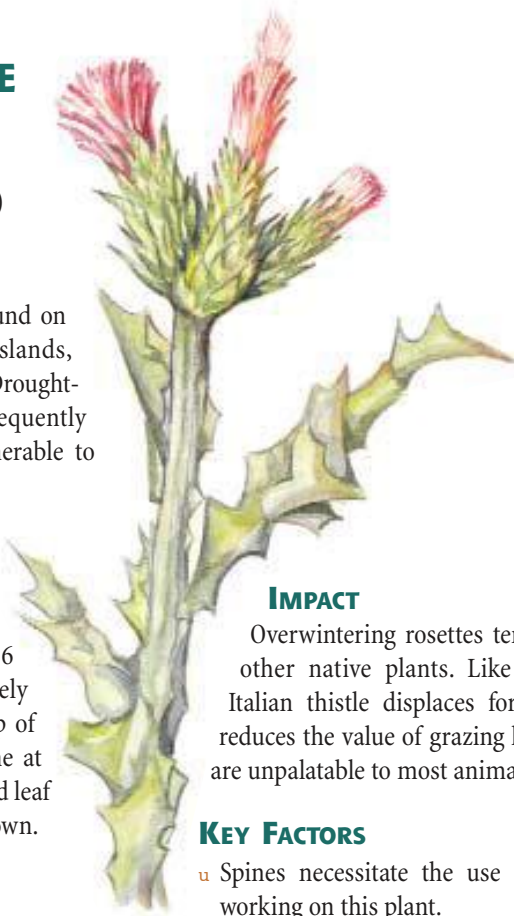
Italian thistle is commonly found on disturbed sites, annual grasslands, pastures, and riparian areas. Drought-stressed, overgrazed, and frequently disturbed sites are more vulnerable to Italian thistle invasion.

Italian thistle is a winter annual or biennial broadleaf plant. It grows 1–6 feet tall and has erect, spiny-winged stems. The leaves are lanceolate, up to 6 inches long, and pinnately divided, with a spine at the tip of each lobe and the largest spine at the tip of the leaf. The stems and leaf undersides have a cobwebby down.

REPRODUCTION

From September to December, pink to purple (but rarely white) flowers bloom in composite inflorescences borne terminally in clusters of 2–5. Italian thistle inflorescences measure only a half-inch across, smaller than those of bull or artichoke thistle.

Italian thistle reproduces only by seed. Inner (disk) seeds are cream-colored, sticky at first, striped, and have bristles. Outer (ray) seeds are yellowish to brown, smooth, and have no bristles. Most disk seeds are wind-dispersed and can travel several hundred feet. Disk seeds also have a thin gummy coating, which allows them to attach to animals and machinery. The germination rate is high, and germination typically takes place in the fall. Ray seeds generally remain in the flower head until it drops. These seeds persist in the soil for up to 10 years.



IMPACT

Overwintering rosettes tend to shade out other native plants. Like many thistles, Italian thistle displaces forage plants and reduces the value of grazing land. The spines are unpalatable to most animals.

KEY FACTORS

- u Spines necessitate the use of gloves when working on this plant.
- u Very high seed production.
- u Seed longevity up to 10 years.
- u High germination rate.
- u Resprouts from root portions left in the soil if not cut below root crown.

TREATMENT OPTIONS

- u Unless you have a lot of volunteers to help, controlling Italian thistle by hand methods (pulling, digging, cutting) may be feasible only for small infestations. Digging is reported to be effective at killing Italian thistle, but will cause considerable soil disturbance, often resulting in seed germination or recolonization.
- u Pull individual plants by hand once the flowering stems have bolted but before flowers are produced.

- u **Dig** the plants out with a pick or shovel.
- u **Cut** just below the crown with a small pick or trowel. This is a useful option in summer when the ground is too hard for pulling stems by hand.
- u **Brush cut** or **weed whip** before the thistles begin to flower. Repeat the treatment into early summer to ensure energy reserves have been reduced.
- u **Graze.** Sheep and goats will graze on thistles, especially in the early spring when they have reached 4–6 inches in height. Graze the animals for roughly 2–3 weeks in large numbers.
- u **Foliar spray.** Some practitioners apply glyphosate to the plants before they go to seed, generally around mid-spring.

DISPOSAL

Seed heads should be removed from the site and bagged or burned. The stems can be composted.

FOLLOW-UP

Whichever treatment you choose, return to the site at least twice a year for a period of several years to monitor seedling growth and prevent further seed production.

INTERESTING FACTS

Native to the Mediterranean, Italian thistle appeared in California in the 1930s, but it is not clear how it was introduced.

Notes

MUSTARD SPECIES

Black mustard (*Brassica nigra*)

Field mustard (*Brassica rapa*)

Mustard Family (Brassicaceae)

DESCRIPTION

Black mustard and field mustard are annual or biennial herbs that can reach up to 6 feet tall. The leaves are slightly hairy. The taproot is white and fleshy in maturity.

REPRODUCTION

Mustards produce bright yellow, 4-petaled flowers from March to June. The small seeds are brown to black.

IMPACT

Mustards grow profusely and reportedly produce allelopathic chemicals that inhibit germination of native plants.

TREATMENT OPTIONS

See wild radish, below.

Note: Mowing is reported to be ineffective at eradicating mustard.

INTERESTING FACTS

Both mustard species are thought to be native to Eurasia, where they have been in cultivation for thousands of years. Black mustard may have been introduced to the US as a contaminant of cereal grain. Field mustard is the wild ancestor of turnip, and its roots are often fed to livestock. Mustard greens are highly nutritious, and have been used in traditional medicine for cancer. The flowers are edible but may be allergenic to some people.



Brassica rapa

WILD RADISH SPECIES

Cultivated radish or wild radish (*Raphanus sativus*)

Wild radish (*Raphanus raphanistrum*)

Mustard Family (Brassicaceae)

DESCRIPTION

These two radish species are herbaceous annuals (sometimes perennials) that frequently invade grasslands and open, disturbed areas, including roadsides. Wild radish, *Raphanus raphanistrum*, may also be found in wetland areas.

Although both species grow wild and both are commonly called wild radish, *Raphanus sativus* is the (escaped) cultivated plant, while *R. raphanistrum* is its wild relative. (*Sativus* means “cultivated” in Latin.)

Both species can grow to 3 feet or taller. The plants are erect, with branching stems that typically give mature plants a bushy appearance. The leaves are alternate, with lower leaves pinnately compound.

REPRODUCTION

Raphanus sativus has 4-petaled flowers that range from white to pink, and bloom mostly between April and June, or almost year-round in the East Bay. *R. raphanistrum* has 4-petaled pale yellow and white flowers with dark veins, and blooms later in the year. The flowers are pollinated by bees and butterflies. Seed pods (siliques) are dark green or occasionally dark red, ribbed, and either smooth or downy. *R. sativus* may have only up to 5 seeds per pod, but *R. raphanistrum* pods contain up to 10 seeds. The seeds are dark, oval, and hard.

Wild radishes reproduce only by seed. Seeds can remain viable for at least 5 years and reportedly up to 20 years. Seeds are generally wind-dispersed, but are also spread by water and machinery. Germination takes place in spring and fall.



Raphanus sativus

IMPACT

Wild radishes are capable of excluding native plant species. Both radish species are also agricultural weeds. *R. raphanistrum* seeds in large quantities may be poisonous to livestock.

KEY FACTORS

- u High seed production.
- u Long seed dormancy.

TREATMENT OPTIONS

- u Pull individual plants by hand or with a Weed Wrench before seed pods develop. Given the stout taproot, it's best to do this after a heavy rain. The taproots in mature plants make hand removal more difficult.
- u Cut plants below the root crown with a pick or shovel before seed pods develop.

- u **Mow or brush cut** wild radish if it covers a large area. It's important to do the first mowing before any seed pods develop. Mow as close to the ground as feasible, as the plants often resprout.
- u **Foliar spray.** Some weed workers spray a 1 percent solution of glyphosate on the leaves before the plant flowers. However, wild radishes are reportedly developing resistance to several herbicides. Glyphosate application might best be reserved for follow-up spot treatment.

DISPOSAL

Plants with seed should be bagged and removed from the site whenever feasible or composted on-site in a small area that will be maintained (for example, by follow-up weeding). Plants without seed can be left to decompose on-site.

FOLLOW-UP

Given the high seed production and long seed viability of wild radishes, it is important to return to the site several times a year to check for seedling germination.

INTERESTING FACTS

Radishes are native to the Mediterranean.

Notes

YELLOW STARHISTLE

Centaurea solstitialis

Sunflower Family (Asteraceae)

DESCRIPTION

This winter annual (or sometimes biennial) is considered to be California's worst rangeland weed.

It is also found on disturbed sites and annual grasslands, and affects access to recreation areas.

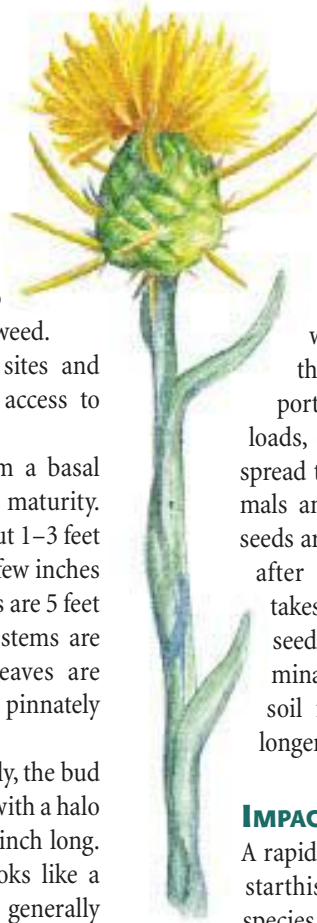
Yellow starthistle plants form a basal rosette as juveniles, then bolt in maturity. Flowering plants are usually about 1–3 feet tall, though some may be only a few inches and single-stemmed while others are 5 feet tall and branching. Leaves and stems are downy and gray-green. The leaves are alternate, 2–3 inches long, and pinnately lobed with triangular tips.

The flowers develop terminally, the bud appearing like a small scaly ball with a halo of stiff yellowish spines up to 1 inch long. The composite inflorescence looks like a fuzzy ball of tiny petals. Flowers generally bloom from May to September, but in the Bay Area a few plants bloom at any time of year.

REPRODUCTION

Yellow starthistle reproduces solely by seed. The plants produce two kinds of seeds: plumed and plumeless, both measuring roughly a quarter-inch. Most seeds are plumed with a tuft of soft, white bristles that aid in wind dispersal. These seeds are pale (cream to tan) and develop on the inner (disk) part of the flower. The plumeless, outer (ray) seeds are darker brown. They remain attached to the flower head until it drops on the ground.

Large plants can produce as many as 1,000 composite flower heads which together can pro-



duce almost 75,000 seeds in a single season. Most seeds are wind-dispersed, but they spread the greatest distance by being transported in contaminated hay or seed loads, or attached to vehicles. They are spread to a lesser degree attached to animals and humans. About 90 percent of seeds are ready to germinate immediately after release. Germination frequently takes place after the first fall rains, as seeds need moisture and light to germinate. Seeds can remain viable in the soil for 3 years and possibly much longer.

IMPACT

A rapidly growing taproot enables yellow starthistle to outcompete native plant species, including purple needlegrass, for summer soil moisture. Yellow starthistle may also produce allelopathic compounds that give it another competitive edge. The current level of infestation in California (estimated at 22 million acres) has brought agricultural and economic loss by reducing the quality and yield of forage. It can be fatally poisonous to horses and its spines deter other livestock from grazing.

KEY FACTORS

- u High seed production.
- u Seed longevity is at least 3 years.
- u Fast-growing and deep taproot.
- u Seedlings are somewhat shade-intolerant.

TREATMENT OPTIONS

u **Pull or dig** individual plants by hand in May–June, when plants are bolting or as soon as possible afterwards. (Rosettes often break off from roots, which resprout.) Grasp the plant at the base and pull steadily, straight up. Where several plants grow close together, digging or pulling smaller ones often makes it easy to pull others. Cutting lateral roots and loosening the soil around the base also make it easier to pull. If you cannot pull up the plant, cut it or twist it off at the base.

Hand pulling is often difficult if plants have stems more than a quarter-inch in diameter. Use a narrow spade, soil knife, or other tool to help free or cut the root. Given that this weed is an annual, most of the taproot can be left in the soil, especially if you manage to get a quarter- to a half-inch of the root below the root crown.

Continue to recheck and pull emerging plants through August, preferably even later. Hand-pulling can be done in conjunction with mowing: mowing can keep plants from setting seed until you have time to pull.

Heavy leather gloves are a must! Working with yellow starthistle, the chemicals eventually soak into skin and can be tasted. Although the toxins are not known to harm humans, wash hands after working with this plant.

u **Mow** (or cut with a hand scythe, brushcutter, or any cutting tool) after the plants have bolted and a small fraction of the buds (about 2 percent) have started to bloom. Make sure you mow close enough to the ground to get the lowest buds. Aim to leave 1–2 inches above ground. You may need to mow a second or even a third time at 4–6 week intervals.

Mowing too early can encourage greater seed production, so it's crucial to time the removal carefully. If there are no buds, it's too early, but if the flowers have mostly bloomed and are losing their bright yellow color, it's too

late. Occasionally starthistles bolt sideways with flower heads much closer to the ground, or mowed plants may rebloom very low. You can take the tops off these with a shovel, hoe, or mattock, if in small numbers. Cutting is most effective on dry soil, otherwise a repeat treatment is necessary roughly 4 weeks later.

u **Graze** with cattle, goats, and sheep to help contain plants and reduce seed production. Cattle don't eat mature spiny plants, but goats and sheep are less picky! Best results come from intensive grazing by a large number of animals for a short period of time, preferably from the end of May to June, just after plants have bolted. Research suggests grazing at the rosette stage is counterproductive, leading to an increase in yellow starthistle. This weed is toxic to horses.

u **Foliar spray.** A 1 percent dilution of glyphosate can be sprayed on plants at the bolting stage. You might use this for spot application.

DISPOSAL

Some practitioners advise leaving the clippings from each mowing on-site (as long as they do not contain seeds) to protect the soil from reinfestation by other invasive species, and also to discourage yellow starthistle seedlings by providing extra shade. Plants with only buds and young, pale yellow flowers can be left on the ground. Once flowers turn darker yellow, pulled plants should be bagged, as they may produce viable seed. Dispose of the bags off-site where seeds can't disperse elsewhere. East Bay Regional Park District uses clear plastic bags and leaves the plants in them for a few years.

FOLLOW-UP

A removal program should last at least 3 years and probably longer, though at lower intensity. Watch for new infestations in nearby areas. Mulching may be helpful in shading out seedlings. Some experiments show that a 5-inch

layer of wheat straw (or rice straw) stops all regrowth. This level of coverage might be expensive, however, and therefore only an option for small patches.

INTERESTING FACTS

Native to the Mediterranean, yellow starthistle was introduced to the US in the mid-1800s, probably as part of a shipment of contaminated grain or other crop seed. Beekeepers find it to be a valuable source of nectar for honeybees, which account for a large proportion of the thistle's pollination.

Notes

EHRHARTA

Also known as panic veldt grass

Ehrharta erecta

Grass Family (Poaceae)

DESCRIPTION

Ehrharta is a slender, clumping perennial grass found in both disturbed sites and wildlands, particularly in moist, shady areas. It tolerates a variety of soil types.

Ehrharta has semi-erect stems up to 2 feet tall. The leaf blades are broad, green, flat, and 2–5 inches long. The fibrous root system has filaments that sprawl downwards. Fire and drought may spur additional growth. The plant can die back during the dry season, leading to an accumulation of leaf litter.

REPRODUCTION

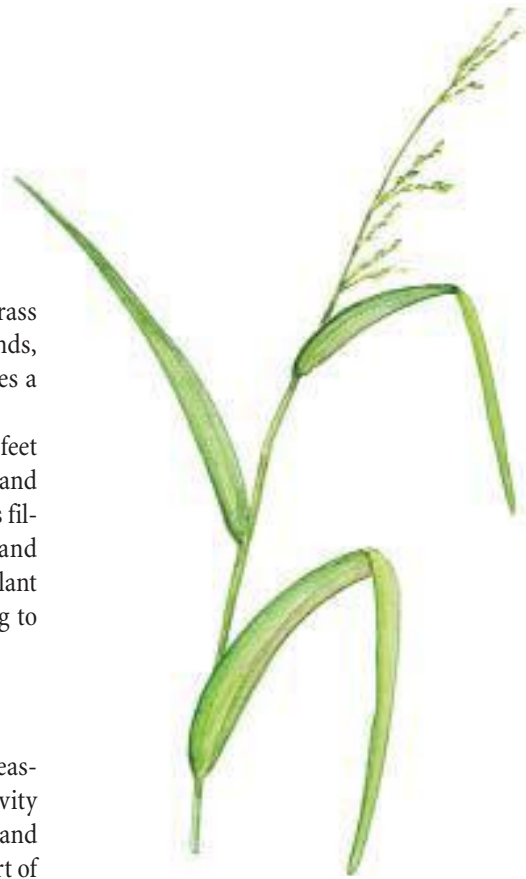
Ehrharta reproduces by tiny seeds that are easily dispersed by wind, water, human activity (e.g., gardening equipment or clothing), and possibly birds. Seeds germinate with the start of the winter rains and into late spring. Ehrharta can also spread vegetatively by tillers.

IMPACT

Ehrharta competes with native grass species, such as Torrey's melic, which has a similar appearance. It can form a continuous carpet of vegetation in moist soil, preventing establishment of other species, particularly annual wildflowers and grasses.

KEY FACTORS

- u The same plant can reseed repeatedly throughout the growing season.
- u High seed production.
- u Seedbank thought to persist for several years.
- u Resprouts from stem nodes and tips.



TREATMENT OPTIONS

- u **Pull** individual plants and clumps by hand 4–6 times a year, starting at the onset of the rainy season when seedlings first emerge, and continuing until the start of the dry season. (Before pulling, you can flag outlying individuals that could be easily overlooked. Some practitioners have found that as Ehrharta is difficult to see under larger plants, one option is to trim shrubs to expose those grasses growing near the base.) Grasp firmly, making sure you pull below the nodes. If part of the root crown breaks off, dig out the remaining portion.

If hand removal is your main approach, make sure you get the entire root and all the stems. Hand pulling is feasible in light or patchy infestations, where native species remain. It can be a successful technique if carried out persistently over several years, but may work best in conjunction with other treatments.

- u **Cover** dense patches with weed fabric (preferably a permeable barrier to reduce water runoff on slopes) to suppress germination of seedlings.
- u **Foliar spray.** Herbicide may be the best option for dense stands of Ehrharta. Given the plant's tendency to grow under other species, make sure you choose a selective herbicide so you don't kill the overlying vegetation.

Several experimental treatments for mature Ehrharta are underway at Audubon Canyon Ranch in Marin County. These include hand pulling clumps of grasses before the grass starts to flower; covering the infestation with a black polyethylene tarp to solarize the weeds; or applying 1–2 percent glyphosate during senescence (after seeds have set and when the grass is dying back). Initial results suggest glyphosate is effective on mature grasses without prior cutting, although an even weaker concentration may be equally successful. Experimental methods to kill

seeds and seedlings include mulching; flaming with a torch; or the use of pre-emergent herbicide. Results are not yet conclusive.

DISPOSAL

Ehrharta seeds germinate readily on contact with water or moist soil, so any seed heads should be bagged immediately and removed from the site.

FOLLOW-UP

Success lies in persistent follow-up, whichever treatment you choose. New seedlings grow very densely and can be tilled with an oscillating hoe. Scrape seedlings off the soil surface and leave them to dry out. If you are covering the Ehrharta, you can cut holes in the tarp and plant native species.

INTERESTING FACTS

Ehrharta is native to South Africa. It became established in California during the 1930s.

Notes

GIANT REED

Also known as arundo grass, bamboo reed

Arundo donax

Grass Family (Poaceae)

DESCRIPTION

Giant reed is a tall perennial grass that typically forms dense stands on disturbed sites, sand dunes, riparian areas, and wetlands.

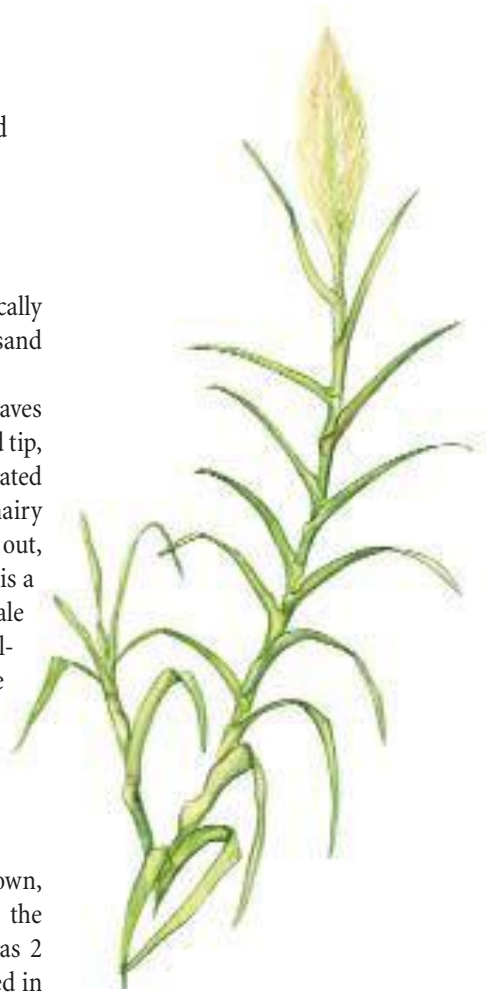
Giant reed grows up to 30 feet tall. The leaves are alternate, up to 1 foot long with a tapered tip, slender, and smooth, but with coarsely serrated margins. They are gray-green and have a hairy tuft at the base. The leaves point straight out, droop, or lie folded, and at the base of each is a hairy tuft. As the leaves dry, they turn pale brown like papyrus. The hardy stalks are hollow, about 1 inch in diameter, and resemble bamboo canes. The roots are tough and fibrous and form knotty, spreading mats that penetrate deep into the soil.

REPRODUCTION

The inflorescence is cream to yellowish brown, and appears from March to September in the form of upright, feathery plumes as long as 2 feet. Giant reed does not produce fertile seed in California. Instead, it reproduces vegetatively, by underground rhizomes. Riparian flooding dislodges clumps of giant reed and transports it downstream, where it can root from broken stem nodes and rhizomes. Fire appears to stimulate new growth.

IMPACT

Giant reed is threatening California's riparian ecosystems by outcompeting native species, such as willows, for water. Its rapid growth and high water uptake allow it to outcompete native vegetation and form monocultural stands. Noxious alkaloids contained in the plant deter wildlife from feeding. Stands of dry leaves and canes are flammable.



KEY FACTORS

- u Resprouts from roots and 2-noded stem fragments left in moist soil.
- u Roots can reach as deep as 10 feet.
- u Rapid growth.

TREATMENT OPTIONS

- u Giant reed can be successfully removed only by completely killing the root system, either by thorough physical removal or with herbicide. Pulling and cutting can both be effective techniques if *all* of the rhizomes and above-ground vegetation are removed. Herbicides are often applied as a follow-up to pulling or digging, but the more thoroughly the rhi-

zomes are removed, the less follow-up herbicide will be needed.

- u **Pull or dig** plants, from seedlings to 6 feet tall, ideally after heavy rains loosen the soil. It is important to pull up and remove the roots.
- u **Cut** the stems of larger plants with a chainsaw or brushcutter, and dig up the roots with a shovel, pickax, or Swedish brush ax. Alternatively, use heavy equipment, such as an excavator.
- u **Cut** the stems as close to the ground as possible in May, and cover the clump with a very thick tarp or with several tarps for an entire growing season. This should prevent light from reaching the plant (reducing its ability to photosynthesize), and keep resprouts from tearing the tarp. The lack of light will eventually deplete the plant's energy reserves and it will die back.
- u **Foliar spray.** Some practitioners have sprayed a 2–5 percent dilution of glyphosate onto the leaves after the plant has flowered but before summer dormancy.
- u **Cut and treat.** As an alternative to foliar spraying, a stronger concentration of glyphosate can be applied to stems immediately after cutting. Make sure that where necessary, you choose an herbicide product suitable for use near water.

DISPOSAL

Both treated and non-treated stems can be left on-site to decompose, although they break down very slowly. If left to compost, the essential point to remember is to keep the debris well away from water. For stems that have not been chemically treated and in areas where it is feasible, the debris can be burned. Otherwise, the canes can be chipped into very small pieces for mulching. The stems are easier to chip when dry, and you will need a heavy-duty chipper to handle the plant's tough fibers. Chipped material can be disposed of either in green waste containers, or spread out to dry and possibly sprayed with herbicide if any regrowth occurs from chipped debris. Stem pieces that have no nodes or only one node won't reproduce.

INTERESTING FACTS

Thought to originate from the Indian subcontinent, giant reed was introduced to California from the Mediterranean in the 1820s for roofing material and erosion control along drainage ditches. It has been cultivated on other continents for thousands of years. Ancient Egyptians wrapped their dead in the leaves. The canes contain silica, perhaps the reason for their durability, and have been used to make fishing rods, walking sticks, and paper. Giant reed is still used to make reeds for woodwind instruments. It continues to be planted for ornamental purposes and erosion control.

Notes

HARDING GRASS

Phalaris aquatica

Grass Family (Poaceae)

DESCRIPTION

Large clumps of Harding grass can be found growing in coastal areas, open sites such as grasslands and rangelands, and watercourses. It also moves into disturbed sites such as roadsides and trails.

Harding grass is an erect, tufted perennial with short rhizomes around the base. The gray-green, hairless leaf blades grow to 15 inches long, and the stems are hollow. Its deep roots allow it to tap into water reserves and withstand drought.

REPRODUCTION

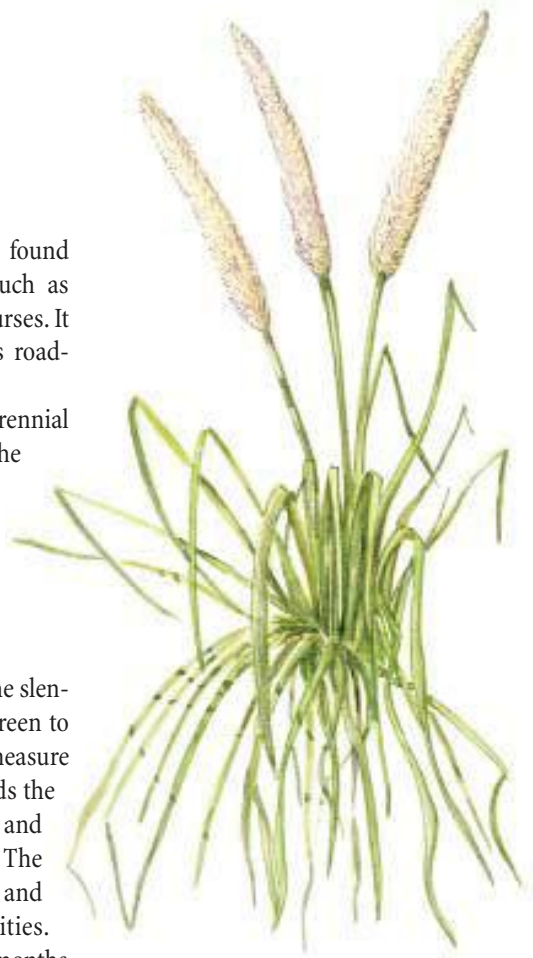
Flowering stems grow up to 4 feet tall. The slender, compact inflorescences turn from green to creamy white in May and June. They measure 2–5 inches long and taper slightly towards the tip. Seed production tends to be high, and occurs between May and September. The seeds are carried short distances by wind and animals and farther by human activities. Seeds can remain dormant for 1–4 months before germinating. Harding grass also spreads vegetatively by sending out tillers or shoots.

IMPACT

Growth is slow at first, but once established, Harding grass can form dense patches and deprive native species of water and nutrients. During summer drought, the dormant grass increases the risk of fire. Prolonged grazing on Harding grass can cause the potentially fatal staggers disease in sheep.

KEY FACTORS

- u Seed longevity is thought to be 1–3 years.
- u Removal is easier before large stands are established (the seedlings are less aggressive



- and do not compete well with other species).
- u Resprouts from roots left in the soil.

TREATMENT OPTIONS

- u **Cut** around the base of the clump with a Pulaski and dig out the roots. All roots longer than 2 inches must be removed, or the plant could reestablish. Then **mulch** with a thick layer (about 6 inches) of rice straw to discourage resprouts.
- u **Mow** close to the ground late in the growing season (generally late spring). Alternatively, mow repeatedly (at least 3 times), ensuring that plants do not flower. Cutting when the grass is at the flowering stage suppresses shoot formation.

Research points to greater success with repeated mowing, although there's no clear consensus on when during the active growth period this should take place. Multiple mowings weaken the grass and reduce the seedbank, but other methods are needed to prevent new growth; mowing alone will prevent expansion but will not kill Harding grass. However, some land managers believe mowing can actually spread seed; instead, they are disking and reseeding with natives.

- u **Brush cut** small patches and **cover** with landscape fabric. Check the fabric monthly to ensure that it is still tightly secured. Alternatively, after brushcutting, **mulch** with a 6-inch layer of rice straw, and pull any emerging plants the following year.
- u **Mow and treat.** After mowing the grass close to the ground, some practitioners have experimented with applying 1–2 percent glyphosate using a wick-type applicator after plants have begun to grow back.

DISPOSAL

Bag and dispose of the debris, especially any seed heads, or pile for composting.

FOLLOW-UP

After mowing and covering with landscape fabric, some practitioners have planted native shrubs and trees into the fabric to shade out any Harding grass resprouts that come through.

INTERESTING FACTS

Harding grass is native to Mediterranean Europe. It may have been introduced to the US from Australia for grazing. Its high protein content makes it a valued source of forage for livestock. However, it contains quantities of DMT, a hallucinogen federally classified as a controlled substance. This may explain the sometimes fatal illness it causes in sheep. It has also been used for post-fire revegetation.

Notes

PAMPAS GRASS AND JUBATA GRASS

Cortaderia selloana

Grass Family (Poaceae)

Cortaderia jubata

DESCRIPTION

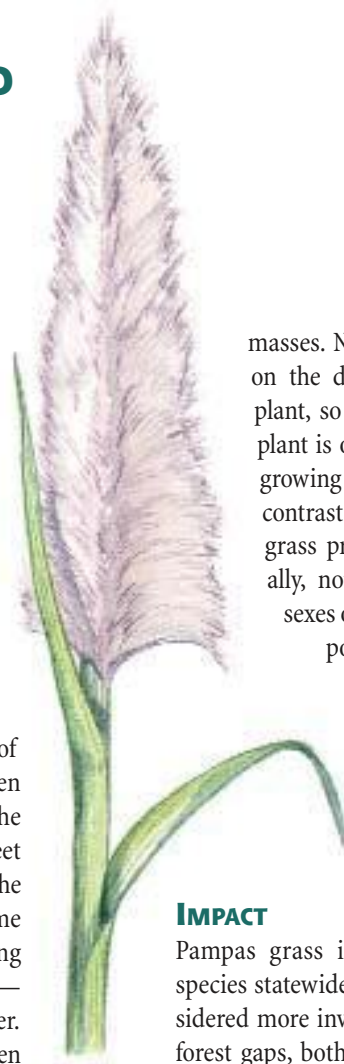
Pampas grass is a common name used for both *Cortaderia* species. For clarity in this discussion, *Cortaderia jubata* will be called jubata grass, while pampas grass will refer only to *C. selloana*. Both species are rapid-growing perennials that form large clumps. Jubata grass is found only in coastal areas, but pampas grass also infests more inland locales. Both are found in disturbed areas, slopes and cliffs, coastal scrub, and forest clearings.

Jubata grass leaves reach a height of 5–7 feet at maturity. The dark green leaves have sharply serrated margins. The flowering stalks can tower up to 20 feet above the mass of spreading leaves at the base. The inflorescence—a showy plume ranging from pink to violet, turning creamy white or golden in maturity—typically appears from July to September.

Pampas grass leaves are gray-green and narrower than those of jubata grass. The leaves tend to curl at the tips. The flower stalks grow only a little taller than the mound of leaf blades, giving pampas grass a more rounded appearance than jubata grass. The plumes are paler (generally pale pink to silvery white) than those of jubata grass.

REPRODUCTION

Female jubata grass plants produce seed asexually by apomixis. Thousands of seeds that are genetically identical to the parent plant are then wind-dispersed. Plants live for over a decade, and within their lifetime will develop huge root



masses. New seedlings often grow on the dead mass of the parent plant, so what appears to be one plant is often several generations, growing one on top of the other. In contrast to jubata grass, pampas grass produces seeds only sexually, not apomictically, so both sexes of plants are necessary for pollination and seed production. Both grasses can spread vegetatively from tillers or fragments of a mature plant that root in moist soil.

IMPACT

Pampas grass is the more widespread species statewide, but jubata grass is considered more invasive in coastal areas. In forest gaps, both species can prevent the growth of saplings by limiting available water and nutrients. Both readily establish in disturbed areas including landslides, road cuts, and cliff faces. Seeds are wind-dispersed and populations expand quickly in coastal areas, significantly reducing grassland, scrub, and rocky outcrop habitats. The sharp, sawtooth-edged leaves can cut human skin. Both grasses increase the risk of fire when leaves dry out or die back.

KEY FACTORS

- u Serrated leaves require the use of gloves and protective clothing.

- u Resprouts from roots left in contact with soil.
- u Thrives in moist areas: keep pulled vegetation away from water.
- u High seed production.
- u Seeds remain viable approximately 9–12 months.

TREATMENT OPTIONS

- u **Pull** seedlings by hand or with the help of a pick, Pulaski, or shovel.
- u **Cut** larger plants and remove the root mass. First, carefully cut and dispose of all seed plumes, including immature ones that have yet to emerge from their sheath, because they may be able to mature.

Next, cut stems and leaf blades to near ground level with a Pulaski, Swedish brush ax or chainsaw. Some practitioners prefer to use a chainsaw to remove the mass of leaves, while others caution that this is dangerous (the chainsaw user must kneel and cannot see the blade) as well as slow (the grass quickly clogs the chainsaw guard). An expertly sharpened machete is also effective, but like a chainsaw, is an appropriate tool only for experienced professionals.

Finally, remove the root mass. If it is very large, use the ax side of the Pulaski to chop it into 4- or 5-inch squares, then use the flat side of the Pulaski to hoe out the pieces.

- u **Pull** very large plants with a truck hitch. This is possible if the pampas or jubata grass is near a road and a strong truck is available. Place a choker cable around the plant, digging it into the ground a little behind the plant so it won't slip off. Secure the cable to the truck hitch, and pull the plant out easily. This is very impressive to volunteers!
- u **Cut** the plumes of plants you are unable to remove, as a temporary containment measure. Cut the plumes while they are still pink or

purple (prior to producing seeds)—typically August to October near the coast, earlier inland and in hotter areas. Note, however, that cut plumes can produce another seed plume from the same stalk in as little as 1–2 weeks.

- u **Foliar spray** 2 percent glyphosate on all green growth during the active growth period (November–July, or even August–September along the Central Coast). Spraying minimizes soil disturbance, but the herbicide must contact the entire leaf surface, a difficult task for large plants. An additional caution: plants that appear dead soon after spraying may survive and regrow the following year.
- u **Cut and treat.** As an alternative to foliar spraying, you could cut away the stems and leaves and then apply herbicide to the cut stems near the root mass. Practitioners report mixed results with this technique.

DISPOSAL

To prevent resprouting, turn the whole uprooted mass upside down and leave it in place to dry out. Small, stringy roots left in the soil will not regrow, but all parts of the main root mass must be at least several inches away from the ground.

Place the cut plumes on top of cut grass leaves. To prevent any seeds from being blown away, make a “pampas sandwich” by covering the seed heads with a second layer of foliage. Some practitioners bury the seed plumes under something more substantial than the leaves, as they can dry out and blow away—with the seeds! Finding a way to leave the plumes behind means you won't have to haul heavy bags off-site, especially in steep, remote areas. Given that jubata grass seeds don't need to be pollinated, it's important to cover or remove them as soon as possible.

FOLLOW-UP

Check for resprouts twice a year.

INTERESTING FACTS

Pampas grass and jubata grass are native to South America. No one knows quite when and how jubata grass was introduced to California, but pampas grass was introduced to the state in

the mid-1800s. Both grasses were widely planted as ornamentals and have been used to prevent erosion on slopes. *Cortaderia* comes from the Spanish for “cutter” and refers to the plant’s sharp leaf margins.

Notes

PERENNIAL RYEGRASS

Lolium perenne

Grass Family (Poaceae)

DESCRIPTION

Perennial ryegrass is similar in appearance to annual ryegrass, *Lolium multiflorum*. To distinguish the two grasses: perennial ryegrass lacks awns (short bristles) on its florets; annual ryegrass has awns on its florets. Perennial ryegrass leaves are folded in the bud, but annual ryegrass leaves are rolled in the bud. Perennial ryegrass has more spikelets than annual ryegrass.

IMPACT

Perennial ryegrass contains alkaloids that appear to become more toxic when under drought stress. In Australia, prolonged grazing of perennial ryegrass can be fatal to sheep and cattle, and cause a form of staggers disease that is different from that caused by other invasive grasses.

TREATMENT OPTIONS

See Harding grass. Brushcutting and covering is especially appropriate for perennial ryegrass as it is a softer grass and thus less likely to push off the landscape fabric.



Notes

PURPLE VELVET GRASS

Also known as London fog, Yorkshire fog

Holcus lanatus

Grass Family (Poaceae)

DESCRIPTION

Purple velvet grass is a distinctive perennial grass that forms clumps in disturbed areas and, in particular, in moist or mild coastal areas.

The soft, flat, gray-green leaves with velvety hairs grow up to 2 feet tall. The roots are fibrous.

REPRODUCTION

Seed production begins in the plant's second year of growth and tends to be prolific. Dense, purple-tinged inflorescences, reaching up to 3 feet, bloom from May to August. The spikes fade to white once the seeds have ripened, and the grass may go dormant after flowering. The wind-dispersed seeds germinate quickly and seedlings grow rapidly. Purple velvet grass also reproduces vegetatively by producing tillers in late summer.

IMPACT

Purple velvet grass appears to contain allelopathic compounds that inhibit native plant species. It also has cyanide compounds and may produce an allergic reaction in susceptible people. It dominates an area by forming dense roots that reduce the space available for other species to take up nutrients and water. It also produces significant amounts of thatch.

KEY FACTORS

- u Prolific seed production with most seeds germinating rapidly.
- u Seeds are not thought to be long-lived.
- u Rapid growth.
- u Cutting stimulates tillers.

TREATMENT OPTIONS

Except for small, isolated populations, it may be extremely difficult to remove purple velvet



grass. Many practitioners have found prescribed burning, brushcutting, and grazing to be ineffective against purple velvet grass.

- u **Pull** clumps by hand before seed set, or **cut** them out from around the base with a paring knife. Near Tomales Bay, Audubon Canyon Ranch has had success using these techniques between January and April, prior to when the plant sets seed. The roots are 1½–2 inches on young plants, but can become deep and wide in maturity. Removing seedlings is preferred, because larger roots are more likely to break, especially when soil is dry.
- u **Scrape** larger infestations, or chop below the root crown, using the blade end of a McLeod.

Weed whipping the grass first may make scraping easier. Scraping is a control method to discourage seed production, so do it before the grass blooms. Regrowth and new inflorescences will grow close to the ground, so cut the grass as short as you can (1–2 inches off the ground) and be sure to follow up with repeat treatments.

- u Mow starting in late March before seed set and then repeat monthly until July. Friends of San Bruno Mountain use a high-wheel mower and a string trimmer to crop grasses close to the ground.
- u Cut small patches of grass back in early spring before bolting and mulch with 4–6 inches of rice straw, removing resprouts as they emerge.

DISPOSAL

Bag any hand-pulled grasses and dispose off-site.

FOLLOW-UP

Without constant vigilance, treated areas often become reinfested, so check frequently for seedling growth. Reseed or plant with native perennials: fast-growing bunchgrasses or forbs.

INTERESTING FACTS

This ornamental grass is thought to be native to southwest Europe. It was probably introduced to the States either accidentally as a forage contaminant or deliberately as part of a seed mix for meadows. The flowers are used in both dried and fresh flower arrangements. *Lanatus* is Latin for “woolly” and refers to the texture of the leaves.

Notes

ANNUAL RYEGRASS

Also known as Italian ryegrass

Lolium multiflorum

Grass Family (Poaceae)

DESCRIPTION

Fast-growing but short-lived, annual ryegrass is a cool-season grass found particularly in wetlands, grasslands, and disturbed sites.

Annual ryegrass is an erect grass that grows to 3 feet tall. The flat leaf blades are bright green and glossy, taper gradually to a sharp point, and feel slightly rough at the edges. They measure up to 8 inches long and a quarter-inch wide, and display prominent ridges along the upper surface. Stems often have a reddish tint at the base. A collar is formed where the leaf blade joins the stem. Two sets of roots develop: the first set, deriving from the seed, are short-lived; the second set, which grows closer to the soil surface, comes from tillers. The roots are usually shallow and fibrous, but can grow deep in drier soils. The grass dies back by midsummer, turning dry and yellow.

REPRODUCTION

The inflorescence appears at the top of the stem as a single spike up to 16 inches long made up of alternate, pale yellow spikelets. The seeds are small and have a high rate of germination. Seeds germinate within 10 days—usually with the onset of the rainy season. Seed dormancy develops only in cooler, moist areas. Annual ryegrass also spreads by seed and vegetative shoots or tillers.

IMPACT

Annual ryegrass reportedly contains allelopathic compounds that inhibit the germination of some species of neighboring plants, while its rapid growth deprives them of water. At the Edgewood Natural Preserve, a serpentine grassland in San Mateo county, annual ryegrass has displaced



much of the native dwarf plantain (*Plantago erecta*), the main food source for the native bay checkerspot butterfly. During summer dormancy it accumulates thatch that presents an added fire hazard. It is also a weed in cereal crops, particularly wheat.

KEY FACTORS

- u Root system can reach 3 feet or deeper on dry sites.
- u Seeds germinate quickly, so there is usually no seedbank build-up.
- u Tillers profusely.
- u Seedlings are shade-intolerant.
- u May be developing resistance to certain herbicides, including glyphosate.

TREATMENT OPTIONS

- u **Mow** to about 6 inches using a weed-whacker prior to bolting in the spring. This prevents reinfestation of annual ryegrass by depleting the seedbank, and promotes the survival of native perennial grasses and other species. Timing of mowing varies. At the Tina Baumgartner restoration site in Tilden Park, Berkeley, Shelterbelt mows *repeatedly* (2–3 times) at monthly intervals to remove biomass and developing seeds just as they are beginning to ripen. At the Edgewood Preserve in San Mateo, a *single* mowing is performed in early May before the annual ryegrass seeds ripen but after the annual forbs set seed. Both sites have had considerable success with mowing annual ryegrass (unlike other invasive grasses), with reduction rates at 50–80 percent.
- u **Graze** goats on the seed heads. Cattle will also graze on annual ryegrass.

DISPOSAL

Cut grasses can be left on-site to decompose, as long as they have been mowed before they go to seed. Some practitioners rake mowed grasses from an area if they contain viable seed.

FOLLOW-UP

Projects need to be maintained over several years. Research suggests that planting coastal scrub species and native trees may help to control annual ryegrass in chaparral and oak woodland habitat, as the seedlings do not grow well in shade.

INTERESTING FACTS

Native to southern Europe, annual ryegrass was introduced to the States for its ability to provide high-quality forage. It is still sown to prolong the grazing season and reduce soil erosion. Research in the South Bay suggests nitrogen deposition from freeway pollution enables annual ryegrass to invade otherwise resistant, naturally nutrient-poor, serpentine soils.

Notes

RIPGUT BROME

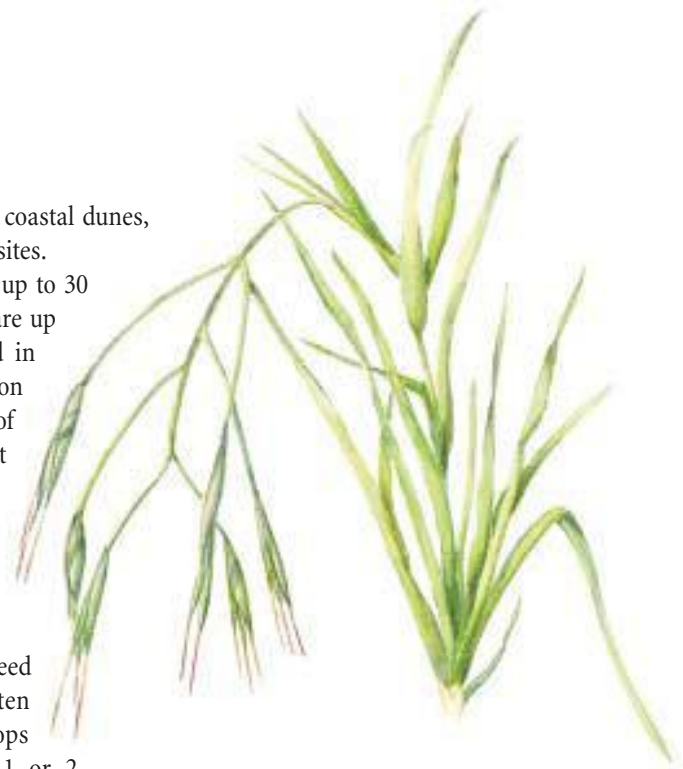
Bromus diandrus

Grass Family (Poaceae)

DESCRIPTION

Ripgut brome frequently infests coastal dunes, grasslands, and open, disturbed sites.

The slender stems can grow up to 30 inches tall. The flat leaf blades are up to a quarter-inch wide, covered in fine hairs, and slightly jagged on the margins. The swollen nodes of the stems distinguish ripgut brome from the native purple needlegrass. Ripgut brome has fibrous roots.



REPRODUCTION

Ripgut brome reproduces by seed only. The branched and often drooping inflorescence develops March–June, and consists of 1 or 2 spikelets with stiff, reddish or purple-tipped awns up to 2 inches long. Seed production is high, with a single plant capable of producing up to a thousand seeds. Seeds are usually wind-dispersed and can travel long distances, but they can also become attached to clothing. Germination occurs between November and April. Seeds can persist for up to 5 years.

IMPACT

Dense stands of dead plant material make this grass very prone to fire during summer drought. In addition, the long, stiff awns are known to cause injury to wildlife. Like many invasive annual grasses, ripgut brome prevents native perennial species from becoming reestablished. For example, research indicates that it outcompetes native oak seedlings for water stored in the soil by means of early germination, sheer volume of numbers, and deep roots.

KEY FACTORS

- u High seed production.
- u Seed longevity up to 5 years.

TREATMENT OPTIONS

- u Pull individual plants or small patches by hand in early spring before seeds are ripe. The optimum time for this is when seeds are hanging but while they still contain a milky substance.
- u Mow or weed whip larger infestations. Cut the grass to about 2 inches, making sure you take off the bolting crown. Mowing is usually done from late March to early April before seeds mature.

FOLLOW-UP

Practitioners report considerable success using manual and mechanical methods to eradicate ripgut brome, but sites previously infested by this grass are vulnerable to invasion by species

such as annual fescue (*Vulpia bromoides*), a very dominant grass that goes to seed quickly. Therefore follow-up not only includes removing any overlooked seedlings but also checking for new invasive species.

DISPOSAL

Pulled or cut vegetation can be piled on-site as long as the seeds are still immature and produce

a milky substance. Alternatively, the grass can be composted.

INTERESTING FACTS

Ripgut brome is native to parts of Europe, including the Mediterranean, and is thought to have become widely established in California as early as the late 1800s. Cattle will eat the grass early in the season when leaves are still tender.

Notes

ACACIA SPECIES

Blackwood acacia (*Acacia melanoxylon*)

Green wattle acacia (*Acacia decurrens*)

Legume or Pea Family (Fabaceae)

DESCRIPTION

Blackwood acacia and green wattle acacia are both typically found in disturbed areas and roadsides. Both grow well in moist soils but can tolerate drought.

Blackwood acacia is an evergreen tree that reaches 20–40 feet in height. It has a single trunk with rough, gray bark, and forms a dense pyramidal canopy. Juvenile leaves are finely bipinnately compound, but adult leaves are simple. They are alternate, narrow, straight to sickle-shaped, smooth, and leathery. The leaves measure up to 4 inches long and become a dull, dark green.

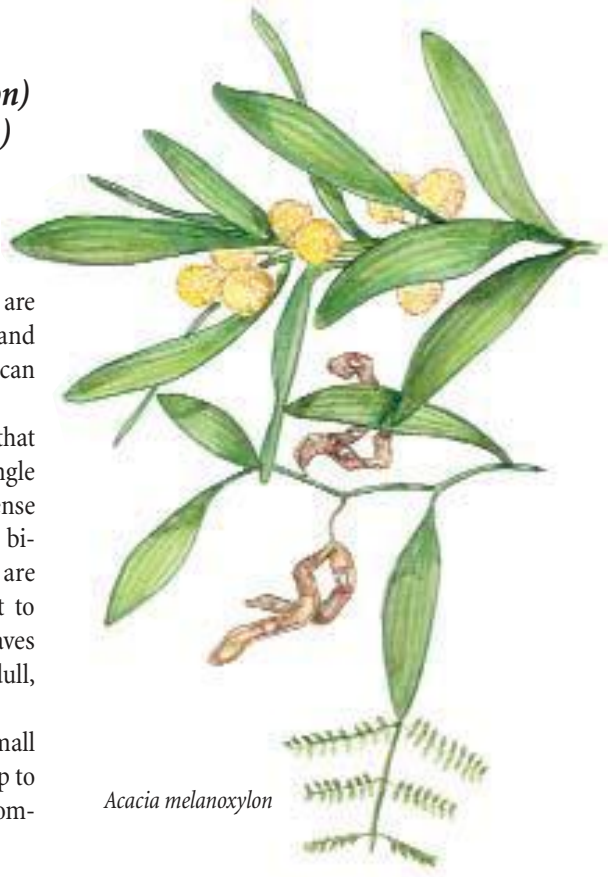
Green wattle acacia is a fast-growing small tree or tall shrub that forms dense thickets up to 45 feet tall. The leaves are bipinnately compound, flattened, and dark green.

IMPACT

Blackwood acacia reportedly has an allelopathic effect, altering soil chemistry and inhibiting germination of native plants. Like many leguminous plants, acacias are nitrogen-fixers, enabling them to establish in nutrient-poor soils. Acacias form dense, monotypic thickets and produce a thick accumulation of leaf litter.

REPRODUCTION

Blackwood acacia reproduces from seed as well as by root suckers and stump sprouting. The roots spread vigorously. Seed production generally begins between 2 and 4 years of age. Clusters of fragrant, pale yellow flowers resembling small pompons appear in January to February. Brown, twisted seed pods, up to 4 inches long, develop in late summer and drop in the fall. Each pod holds 6–10 seeds attached to the pod by pink or red



Acacia melanoxylon

funicles. The seeds themselves are oval, black, and shiny, about a quarter-inch long, and can remain viable for years in the ground. An individual plant can produce 100,000 seeds per year. Seed germination appears to be particularly high following fire.

KEY FACTORS

- u High seed production.
- u Seeds reported viable for 15–20 years.
- u Can sprout from roots and from cut stumps.

TREATMENT OPTIONS

- u Pull seedlings and small saplings by hand or with a Weed Wrench, preferably when the soil is moist.
- u Cut and treat with herbicide larger saplings and mature trees.

- u Cut to 1 foot and cover stump with black plastic or fabric shade cloth.
- u Cut to 1 foot and macerate stump.
- u Girdle or Frill.
- u Drill and inject with herbicide.

DISPOSAL

Remove seed pods from the site when feasible. The wood can be cut for firewood.

FOLLOW-UP

Return to the site to check for seedling growth and resprouts at least twice a year. Dig out or cut and treat the resprouts.

INTERESTING FACTS

The genus *Acacia* is one of the largest in the world, comprising around 1,000 species. Blackwood acacia is native to Tasmania, an island south of Australia, where marsupials eat the seedlings. Heights of 130 feet have been recorded, while the oldest tree is 230 years old. It produces lumber of commercial value if grown on suitable sites. In some parts of the world, green wattle acacia is used in cosmetics for skin conditioning, while the bark is used to tan leather. Many *Acacia* species can be highly allergenic.

Notes

BLUE GUM EUCALYPTUS

Eucalyptus globulus

Myrtle Family (Myrtaceae)

DESCRIPTION

Blue gum eucalyptus is found throughout California, particularly in cooler coastal areas. It requires moist soils, access to shallow groundwater, or coastal fog drip.

Blue gum frequently reaches 100 feet or more in height. The smooth, straight trunk can grow to a diameter of 7 feet or more. The pale gray-brown bark peels in long, papery strips to expose a smooth, pale yellow sub-surface. Mature leaves are alternate, lance- or sickle-shaped, and 4–10 inches long. They have a leathery texture and are dull green with a yellow primary vein. In contrast, juvenile leaves are opposite, shorter, and more oval in shape. They are waxy and bluish green, and are nearly sessile (with very short petioles) on sharply squared branches. The bluish green leaves give the blue gum its common name, and the drooping foliage together with the peeling bark and irregular crown give blue gum a distinctive appearance. Blue gum is distinguished from red gum (*Eucalyptus camaldulensis*) by having wider leaves and larger fruits.

REPRODUCTION

Blue gum reproduces both from seed and vegetatively from roots and stumps. Dormant buds produce new shoots from the base of a cut stump. At 4–5 years of age blue gum starts to produce yellowish white flowers, about 2 inches wide, between December and May. These develop into fruits almost a year later. The fruit is a conical, woody capsule roughly 1 inch across. It contains numerous dark brown seeds, which are wind-dispersed and capable of germinating within a few weeks.



IMPACT

Blue gum can form monospecific stands through superior competition for moisture from the soil and water table and by establishing a dense layer of bark and leaf litter on the ground. Blue gum leaves contain phenolic compounds that are thought to alter soil chemistry and inhibit the germination of native plant species. With their abundant leaf litter, peeling strips of bark, and volatile oils in the leaves, blue gum stands are highly flammable, as was witnessed in the Oakland Hills fire of 1991.

KEY FACTORS

- u Vigorously resprouts from cut stumps.
- u Seed longevity not known.

TREATMENT OPTIONS

Given its sheer size and persistence, blue gum eucalyptus can be very difficult to control. Removing larger trees is dangerous and often requires a professional arborist. However, blue gum can be temporarily managed by containment until volunteer groups have the resources to remove larger trees and stands. The goal of containment is to keep trees from spreading by removing those on the perimeter of the stands.

- u **Pull** small saplings by hand or with a Weed Wrench.
- u **Cut and treat.** Cut the stump flat and as low to the ground as possible. Practitioners report using a 25–50 percent dilution of glyphosate. Herbicide must be applied within 5 minutes, and preferably within 1 minute after cutting, while the cambium can still transport the herbicide into the roots. Some people find that the higher the cut is made above the main stem, the greater the chance of resprouts growing below the cut.
- u **Cut and cover.** Mature trees up to 8 inches diameter at breast height can typically be cut with a hand saw. Larger trees require a chainsaw. Cover the cut trunk and the surrounding ground 3 feet out from the base of the trunk with landscape fabric and leave for 6–12 months. Check periodically to ensure that the fabric is still tightly secured.
- u **Cut and grind or macerate.**

DISPOSAL

Blue gum eucalyptus can be cut for firewood, but when burned it can deposit oily soot in the chimney. Allowing the wood to dry thoroughly makes it easier and cleaner to burn. The wood hardens as it ages, becoming exceptionally difficult to cut, so cutting for firewood should be done within 2 weeks of felling the tree.

FOLLOW-UP

Check for resprouts for at least 3 years or more. Those using herbicide cut any resprouts at the base and treat the cambium a second time, or cut the entire stump and treat again. If a new shoot originates from a point high on the stump, the stump can be cut below it, but if the shoot sprouts from near the ground or from roots, it must be cut and treated directly.

INTERESTING FACTS

Native to Australia and Tasmania, blue gum was introduced to California as an ornamental in the 1850s, and was then widely planted for timber, windbreaks, and fuel. Its timber proved unpopular as it twists in the drying process. Nevertheless, blue gum eucalyptus makes good firewood and paper pulp. Glands on the leaves produce the volatile eucalyptus oil, which can be used as a decongestant. The smell is similar to that of camphor or menthol.

Notes

TREE OF HEAVEN

Ailanthus altissima

Tree of heaven Family (Simaroubaceae)

DESCRIPTION

Tree of heaven is a deciduous tree most commonly found in riparian areas and disturbed inland areas.

Tree of heaven grows 30–65 feet tall, while its trunk can reach 2–3 ft in diameter. It has a broad, dome-shaped crown. The bark is gray and smooth, becoming darker and more scarred with age. The twigs are stout and pale chestnut-brown with rounded buds. The leaves are alternate, pinnately compound, and 1–3 feet long. Each compound leaf comprises 11–25 smaller lance-shaped leaflets, which have 2–4 rounded auricles (“ears”) near the base. The leaves have an unpleasant odor when crushed.

REPRODUCTION

Tree of heaven reproduces both from seed and by sprouting vegetatively from stumps and roots. Trees reach reproductive maturity between 10 and 20 years of age. Clusters of small, yellow-green flowers appear in June near the branch tips. Female trees bear winged fruits in September and October. The flat, twisted, papery fruits turn from pink to red-brown with age and hang in large clusters that can last through the winter. Measuring 1–2 inches long, each fruit bears a single seed. A single tree can produce over 300,000 seeds in a year. Seeds are wind-dispersed, but can also spread by water, birds, and machinery. Individual trees live to about 50 years, but new root sprouts often prolong the tree’s life span.

IMPACT

Tree of heaven often forms dense monocultures. The bark and leaves reportedly produce allelopathic chemicals that accumulate in the soil and



can cause mortality in other vegetation. The foliage is unpalatable to browsing wildlife.

KEY FACTORS

- u Rapid growth and spread from lateral root suckers.
- u Persistent resprouts from cut stumps.
- u Copious seed production.
- u Seeds viable for no more than 1 year.
- u Seedlings somewhat shade-intolerant.

TREATMENT OPTIONS

- u **Pull** seedlings before a taproot is established (roughly 3 months after germination) while the soil is moist and loose. If a taproot has already formed, **dig** around the base of the plant to completely remove the root system and prevent resprouts. Grubbing out the taproot can be an effective way of killing the plant, but is a slow method best used to control small infestations. Make sure you remove the entire root, as any portion left in the soil can produce a new plant.
- u **Cut** stems of mature trees (up to 12 inches in diameter) early in the spring. Cut a second time at the end of the growing season around June or July. This strategy aims to prevent

seed production with the first cut and to exhaust the plant's energy reserves with the second cut.

- u **Cut and treat** trunks or stems with a chain-saw, preferably during the growing season, and before trees have begun to flower. Some practitioners have had success by painting a 50 percent glyphosate solution on the stump immediately after cutting.

DISPOSAL

Slash from trees that have not produced seed can be piled for wildlife cover. Any seeds present are best collected, bagged, and disposed of. If not, you will need to return to the site to pull any seedlings that have germinated.

FOLLOW-UP

You'll need to cut resprouts repeatedly for 3–4 years to eventually kill off the plant's root system. New seedlings and root suckers can be either

pulled or cut and treated with herbicide. Establishing a thick shade over tree of heaven seedlings will slow down their growth.

INTERESTING FACTS

Tree of heaven is native to China and was introduced to America in the late 1700s as an ornamental species. It resembles certain trees native to the East Coast, such as sumacs, ash and black walnut. The wood is weak and of little commercial value, although it can be used to produce paper pulp. It has long been used in Chinese medicine for reproductive disorders and to calm spasms. In France, tree of heaven leaves are fed to the *Ailanthus* moth caterpillar, which yields a silk cheaper and stronger than the fine mulberry silk of China. Invasive in urban areas, tree of heaven was the tree of fame in the book *A Tree Grows in Brooklyn*.

Notes

Resources

There is a wealth of information available to weed workers. The following is but a brief introduction to the organizations and publications that deal with invasive plants.

BAY AREA WEED MANAGEMENT AREAS

Weed Management Areas (WMAs) are county-based groups composed of diverse stakeholders interested in weed control. Their work focuses on three areas: mapping, education, and on-the-ground control projects. Each has an official memorandum of understanding with the state's Department of Food and Agriculture. Most are coordinated by county agricultural departments. WMAs are often the best place to start when looking for local expertise on weed issues.

Alameda/Contra Costa County WMA: (925) 646-5250

Solano County WMA: (707) 421-7465

Marin/Sonoma County WMA: (415) 499-6700

San Francisco County WMA: (415) 668-4392

San Mateo County WMA: (650) 363-4700

Santa Clara County WMA: (408) 224-7476 x822

Santa Cruz County WMA: (831) 763-8080

General Weed Info

tncweeds.ucdavis.edu

A collaboration between UC Davis and the Nature Conservancy, this site includes detailed information on many invasive species, tools, control methods, events, and a listserv.

wric.ucdavis.edu

The Weed Research and Information Center at UC Davis carries out research and disseminates information on weed management to benefit agriculture and natural areas.

www.cal-ipc.org

The California Invasive Plant Council (Cal-IPC) works to protect California wildlands from invasive plants through research, restoration, and education.

www.thewatershedproject.org

The Watershed Project offers outreach programs on creeks, wetlands, and watersheds to the public and educators in the San Francisco Bay Area.

plants.usda.gov

The US Department of Agriculture has a national plant database that includes invasive species.

www.invasivespecies.gov

This site lists invasive species activities and programs at the federal and state level.

www.ice.ucdavis.edu/nrpi

Co-managed by UC Davis and the California Biodiversity Council, the Natural Resource Project Inventory (NRPI) is a database of noxious weed control projects in California.

Species-Specific Info

ceres.ca.gov/tadn

Team Arundo del Norte is a forum of organizations dedicated to controlling *Arundo donax* (giant reed) in Central and Northern California. Its Web site provides comprehensive information on ways to remove giant reed.

www.noivyleague.com

A Web site dedicated to the control of English ivy.

www.ipm.ucdavis.edu

UC Davis' online IPM web site provides detailed information on removing yellow starthistle, invasive blackberries, and other weeds.

Print Publications

www.cdfa.ca.gov

Noxious Times is a quarterly magazine published by the California Department of Food and Agriculture with information on noxious weed control throughout California.

www.cal-ipc.org

Cal-IPC News is published four times a year by the California Invasive Plant Council.

Tools & Equipment

www.lampdesign.com

The Root Talon is designed for pulling up small tree saplings.

www.canonbal.org/weed.html

The Weed Wrench is suitable for pulling up broom.

www.flameeng.com/Vapor_Torch_Kits.html

The Vapor Torch can be used to kill thistles at the rosette stage.

Organizations

In addition to the few organizations listed below, there are many local groups doing weed removal projects.

www.sercal.org

The California chapter of the Society for Ecological Restoration is dedicated to restoring California's damaged ecosystems and offers conferences, workshops, and educational activities.

www.cnps.org

The California Native Plant Society (CNPS) promotes the preservation of California's native flora. Several local chapters in the Bay Area offer events, including weed removal activities: Yerba Buena (for San Francisco and northern San Mateo County), Napa, Marin, East Bay, Santa Clara Valley, and Santa Cruz.

www.acterra.org

Acterra is a Palo Alto-based environmental group that aims to protect and restore the local natural environment through stewardship, information, and leadership. Web site features a calendar of events for the Bay Area.

www.weedcenter.org

The Center for Invasive Plant Management's Web site includes funding opportunities for groups interested in developing a weed management area.

Agencies

www.nps.gov/goga

The Golden Gate National Recreation Area is the largest urban national park in the United States, and offers many education and volunteer opportunities.

www.parks.sfgov.org

The San Francisco Recreation and Park Department has a Natural Areas Program that offers ongoing volunteer opportunities in habitat restoration.

www.ebparks.org

The East Bay Park Regional District works to increase public awareness of the regional parks system. Volunteer opportunities include invasive weed removal.

www.openspace.org

The Midpeninsula Regional Open Space District seeks to acquire and preserve a regional greenbelt of open space land within the Bay Area for future generations. Volunteer opportunities are available.

www.parks.ca.gov

California State Parks aims to preserve the state's biological diversity and protect its natural and cultural resources.

www.cdffa.ca.gov/wma

Weed Management Areas (WMAs) are local organizations that bring together landowners and managers to coordinate efforts against invasive weeds. WMAs exist in most of the Bay Area counties. The Web site lists weed control projects in each WMA.

www.cdpr.ca.gov

The California Department of Pesticide Regulation's Web site features links on integrated pest management, pesticide licensing, pest management grants, and general pesticide information.

Workshops/Trainings

www.merrittlandhort.com

The Department of Landscape Horticulture at Merritt College, Oakland, offers classes in weed identification and control.

www.thewatershedproject.org

The Watershed Project offers workshops based on this handbook.

Glossary

Terms in **bold print** within definitions are themselves defined in the glossary. Refer also to separate sections on Leaf Terms and Flower Terms at the end of the general section below.

Achene—a dry, non-fleshy fruit that contains a single seed and does not break open when ripe.

Adventitious roots—roots originating aboveground on a stem and growing into the ground.

Alkaloid—any of a large number of pharmacologically active, potentially toxic, nitrogen compounds produced by plants.

Allelopathic—producing substances (allelochemicals) that are toxic to or inhibit the growth of other plants.

Annual—a plant whose entire life cycle (germination, growth, flowering, setting seed, death) occurs within one year (contrast **biennial**, **perennial**).

Apomixis—production of viable seeds without fertilization having occurred; **asexual** production of seeds.

Asexual—occurring without sexual union, as in **apomixis** or, more commonly, **vegetative reproduction**.

Biennial—a plant that lives two years, flowering and setting seed in the second year (contrast **annual**, **perennial**).

Biomass—informally, a volume (not mass) of living or dead organic material (for the purposes of this book, all that “stuff” a weed worker must deal with).

Technically, *biomass* refers to the weight of all living matter per given unit area. Weight of dead organic material is most properly called *necromass*.

Bolting—rapid elongation of a shoot just before flowering.

Bract—reduced leaf-like structure at the base of a flower or **inflorescence**.

Bulb—fleshy underground shoot that stores carbohydrates and is capable of **vegetative reproduction**.

Bunchgrass—a **perennial** grass that cannot spread vegetatively; all of the buds are located at ground level, at the base of the stems.

Cambium—a layer of living tissue between the xylem (water-conducting tissue) and phloem (food-conducting tissue); in a tree, cambium is found in the current (outermost) year’s growth ring. It is the tissue that one severs when girdling a tree.

Chaparral—vegetation type dominated by evergreen shrubs, found beyond the zone of direct coastal influence.

Coastal scrub—vegetation type dominated by shrubs and found at the coast.

Containment—a control strategy short of **eradication** aimed at preventing or limiting the spread of an invasive species.

Eradication—complete elimination of a species, including seeds, from a given area; local extinction.

Foliar—pertaining to leaves (foliage). Foliar application of an herbicide means the herbicide is sprayed on the leaves.

Forb—any herbaceous plant that is not grass-like (i.e., not a grass, rush, or sedge).

Funicle—the stalk of an ovule or seed.

Germination—sprouting of a seed or spore.

Herbaceous—adjective describing non-woody plants, whether **annual**, **biennial**, or **perennial** (noun form: herb).

Hybridize—to interbreed with different species or sub-species.

Invasive plant—a successfully reproducing species of plant that is, or has the potential to become, unacceptably abundant in a particular plant community. Invasive plants in native ecosystems may alter plant community composition, structure, and function, and diminish habitat value.

Lateral roots—underground roots spreading outward rather than downward (contrast **taproot**).

Monospecific—single-species; e.g. a stand of a single plant species containing no other plant species (or, containing very few other plant species—the term is often used somewhat loosely, rather than strictly literally).

Native plant—a plant species or sub-species that evolved in its present location or dispersed to its present location unaided by humans.

Naturalized plant—a **non-native plant** species that reproduces successfully and is

thoroughly established in its introduced range. Plants considered “naturalized” are usually not considered “**invasive**.” They may have minimal ecological impact, or be restricted to disturbed habitats such as lawns and roadsides, rather than able to spread into relatively undisturbed habitat.

Nectar—sweet fluid, attractive to pollinators, secreted by many plants in glands at the base of the flower.

Nitrogen-fixing—incorporating nitrogen gas from air into inorganic nitrogen compounds usable by plants; carried out by soil bacteria, especially by bacteria associated with the roots of legumes (Fabaceae, pea-family plants).

Non-native plant—a plant found outside the evolved or historic range of its species; not all non-native plants are **invasive**. *Note:* plants and seeds may be dispersed to new locations over long distances by wind, water, and birds. Such newcomers could be considered non-native unless and until they survive, reproduce, and over generations, co-evolve with their new ecosystem. For the purposes of this book, non-native plants are those introduced by humans, whether deliberately or unintentionally.

Perennial—a plant that lives more than one year (contrast **annual**, **biennial**).

Phenolic compounds—secondary metabolic compounds produced by plants; these compounds may attract pollinators or seed dispersers, defend against predators, or be poisonous to competitors.

Photosynthesis—the process by which plants produce sugars (photosynthate) from water and carbon dioxide in the presence of chlorophyll using light energy.

Pollination—transfer of pollen from an anther to a stigma (receptive surface of a

flower); required for fertilization and **sexual reproduction** in plants.

Rhizome—a horizontal stem growing below the soil surface; may store carbohydrates or function in **vegetative reproduction** (compare **stolon**, **runner**).

Riparian—pertaining to or growing along watercourses.

Rootball—a non-technical term referring to the major bulk of a compact root system, (e.g., the dense mass of roots of *Cortaderia spp.* excluding the slender roots extending from the main mass).

Root crown—a non-technical term referring to the top portion of the underground root system.

Rosette—growth form characterized by a cluster of leaves radiating from a central point, usually close to the ground at the base of the stem (basal rosette); a common growth form of **biennial** plants in their first year.

Runner—a slender **stolon** that roots at the **nodes** or tip, effecting **vegetative reproduction**.

Seedbank—viable seeds in the soil.

Semi-shrub—a generally **herbaceous**, **perennial** plant capable of developing woody stems.

Senescence—late life stage of a plant (shortly after reproduction in **annuals**) characterized by loss of vigor and gradual death (from the Latin *senex*, old man).

Sensitive habitat—areas of special concern due to the presence of rare, threatened, or endangered species, or of vulnerable features such as watercourses.

Serpentine—soil derived from weathered serpentinite rock, which is low in the nutrients nitrogen, phosphorous, and calcium, and high in magnesium, nickel, and chromium; also refers to the unusual vegetation found on serpentine soils.

Sexual reproduction—process by which new plants arise from seeds which developed from ovules fertilized by pollen (contrast **vegetative reproduction**).

Shrub—a woody, usually multi-stemmed plant, generally smaller than a tree.

Stolon—a stem that creeps along the ground and produces roots at the **nodes** or tip, giving rise to a new plant through **vegetative reproduction**.

Sucker—a shoot originating from below ground, e.g., from a root.

Taproot—a larger, main root, usually vertical, from which smaller roots branch out; typically found in dicots and not in grasses.

Tiller—an erect shoot originating underground; (verb:) to reproduce vegetatively through tiller production.

Vegetative reproduction—process by which new plants arise without **sexual reproduction** occurring, e.g., from **bulbs**, **stolons**, **runners**, **tilers**, or **suckers**.

Viability—ability of a seed to germinate. *Note:* the length of time a seed remains viable varies widely between species and depends on environmental conditions affecting the seed. Plants producing seeds that remain viable for many years in the soil are said to have high **seedbank** longevity.

LEAF TERMS

Alternate—leaf arrangement in which a single leaf emerges from each **node** on alternating sides of the stem (compare **opposite**).

Bipinnate—twice **pinnate**; the primary pinnae (**leaflets**) are also pinnately **divided**.

Compound leaf—a leaf composed of multiple **leaflets** (compare **simple leaf**).

Divided—cut into distinct parts to the midrib or base.

Elliptic-ovate—leaf shape intermediate between elliptic (the shape of an ellipse, a narrow oval) and ovate (egg-shaped, wider at the stem end).

Lanceolate—lance-shaped leaf: longer than it is wide, with the widest point below the middle of the leaf.

Leaflet—single division of a **compound leaf**.

Lobe—rounded segment of a leaf; a leaf may be deeply lobed and yet not truly **divided**.

Node—a joint of a stem; a place where leaves and branches join a stem.

Opposite—leaf arrangement in which two leaves emerge from each **node** on opposite sides of the stem (compare **alternate**).

Pinnate—leaf arrangement of a **compound leaf** with **leaflets** (pinnae) opposite each other like a feather.

Serrate—saw-like leaf margin; having a sharply toothed leaf margin with teeth pointing forward (compare **toothed**).

Sheathed—partly surrounded by another organ, as a stem partly surrounded by the base of a leaf.

Simple leaf—undivided; not composed of multiple **leaflets** (compare **compound leaf**).

Toothed—leaf margin with teeth pointing outward rather than forward (compare **serrate**).

Triangular-ovate—leaf shape more sharply three-angled than strictly ovate (egg-shaped, wider at the stem end).

FLOWER TERMS

Awn—a slender bristle at the tip or on the dorsal (back) surface.

Floret—a small flower; an individual flower within a cluster (e.g., within a **spikelet** of a grass).

Inflorescence—a cluster of flowers on a plant; a reproductive structure with multiple flowers.

Panicle—an **inflorescence** structured as **racemes** that are themselves branched, extending from a central axis.

Plume—an **inflorescence** that appears feather-like.

Raceme—a branched **inflorescence** arranged with flowers attached individually by pedicels (stalks) to a central axis; lower flowers mature earliest.

Spike—an **inflorescence** arranged with flowers attached individually as in a **raceme**, but without pedicels (unstaked).

Spikelet—a small **spike**; the smallest flower cluster of a grass.

Terminal—at the tip, or terminus.

Umbel—an **inflorescence** structured as a condensed **raceme** with elongated pedicels; the flowers form a flat-topped or convex shape like an umbrella (characteristic of the family Apiaceae).

Bibliography

- Bossard, Carla, John Randall, and Marc Hoshovsky, eds. *Invasive Plants of California's Wildlands*. University of California Press, 2000.
- Bradley, Joan. *Bringing Back the Bush: The Bradley Method of Bush Regeneration*. Australia: Lansdowne Press, 1997.
- Brenzel, Kathleen Norris, ed. *Sunset Western Garden Book*. California: Sunset Publishing Corporation, 2001.
- Brown, Kate, & Kris Brooks. *Bushland Weeds: A Practical Guide to Their Management*. Australia: Environmental Weeds Action Network (Inc), 2002.
- Danielsen, Charli. *Vegetation Management Almanac for the East Bay Hills*. [Available at Tilden Park Visitor Center.]
- DiTomaso, Joseph, and Evelyn Healy. *Aquatic & Riparian Weeds of the West*. University of California Press, 2003.
- Golden Gate National Recreation Area data. *Removal and Disposal of Exotic Plant Species*. Unpublished.
- Hickman, James, ed. *The Jepson Manual: Higher Plants of California*. University of California Press, 1993.
- Moore, Ken. *A Plague of Plants: Controlling Invasive Plants in Santa Cruz County*. Wildlands Restoration Team, 1998.
- Randall, John, and Janet Marinelli, eds. *Invasive Plants: Weeds of the Global Garden*. New York: Brooklyn Botanic Garden, 1997.
- Royer, France, and Richard Dickinson. *Weeds of the Northern U.S. and Canada*. University of Alberta Press/Lone Pine Publishing, 1999.
- Wayne, Lisa, Kristin Bowman, et al. *Native Habitat Restoration: A Guide for Citizen Involvement in San Francisco Natural Areas*. San Francisco Recreation and Park Department, Natural Areas Program, 1999.
- Whitson, Tom D., et al. *Weeds of the West*. University of Wyoming Press, revised 1992.

Acknowledgments

Many weed workers were consulted during the preparation of this handbook. The authors gratefully acknowledge the following individuals, who either made suggestions at the book's inception, provided information for the species accounts, or reviewed portions of the manuscript.

Doug Allshouse, Friends of San Bruno Mountain
Maria Alvarez, Golden Gate National Recreation Area, National Park Service
John Anderson, Hedgerow Farms
Andy Baker, Golden Gate National Parks Conservancy, National Park Service
Peter Brastow, Golden Gate National Recreation Area, National Park Service
Junko Bryant, Urban Creeks Council
Joe Cannon, California Native Plant Society/San Bruno Mountain Stewardship Project
Kim Cooper, Point Reyes National Seashore, National Park Service
Charli Daniels, Native Here Nursery
Tom Dudley, University of California, Berkeley
Tom Elliott, Golden Gate National Parks Conservancy
Jennifer Erskine, University of California, Davis
Katie Etienne, Audubon Canyon Ranch
Bob Flasher, East Bay Municipal Utility District
Paul Furman, Friends of Edgemoor Mountain Park
Karen Gaffney, Circuit Rider Productions
Sue Gardner, Golden Gate National Parks Conservancy
Dan Gluesenkamp, Audubon Canyon Ranch
Ellen Hamingson, Golden Gate National Recreation Area, National Park Service
Mark Heath, Shelterbelt Builders
Lisa Hokholt, US Department of Agriculture, Natural Resources Conservation Service
Matt Horowitz, Natural Resources and Employment Program
Tim Hyland, Santa Cruz District, California State Parks
Marilyn Latta, Save the Bay
Cinda MacKinnon, Environmental Consultant
Ken Moore, Wildlands Restoration Team
Brad Olson, East Bay Regional Park District
An Peischel, Goats Unlimited
Mary Petrilli, California Native Plant Society/San Bruno Mountain Stewardship Project
Mike Pitcairn, California Department of Food & Agriculture
Liz Ponzini, Golden Gate National Parks Conservancy
Brianna Richardson, California Invasive Plant Council and Midpeninsula Regional Open Space District
Susan Schwartz, Friends of Five Creeks
Jake Sigg, California Native Plant Society
Frank Starkey, Catalina Island Conservancy
Katrina Strathmann, Golden Gate National Recreation Area, National Park Service
Joel Trumbo, California Department of Fish & Game
Stuart Weiss, Creekside Center for Earthside Observations
Peter Warner, Mendocino District, California State Parks
Eric Wrubel, Shelterbelt Builders

APPENDIX G

*Visual Simulations of Recommended Treatments
for Select Areas*

APPENDIX G



Simulation 1 – Existing Condition: North Oakland Regional Sports Field, area above dirt access road within the recommended 30-foot roadside treatment area.



Simulation 1 – Simulated Condition: Area treated to remove all but the dominant tree trunk for multi-trunk trees and achieve an average 10-foot spacing between retained tree canopies. Subsequent treatments would be necessary to achieve desired 25-foot spacing between retained trees. Surface vegetation treated to remove ladder fuels and retain some shrubs and native non-pyrophytic trees (note retained oak tree in foreground).
Note: eucalyptus stand in background not treated for this simulation, which focuses on 30-foot road buffer area.

APPENDIX G



Simulation 2 – Existing Condition: Grizzly Peak Open Space, area along Grizzly Peak Boulevard, looking west.



Simulation 2 – Simulated Condition: Area treated to thin brush density, remove flashy fuels (grasses/weeds) along the roadside, remove some pyrophytic trees, and provide horizontal (ladder fuels) and vertical separation between well-spaced retained trees.

APPENDIX G



Simulation 3 – Existing Condition: Shepherd Canyon Park, area along the west side of Shepherd Canyon Road, looking west.



Simulation 3 – Simulated Condition: Area treated to remove broom understory, apply surface mulch, prune select lower limbs to remove ladder fuels, and mow weeds along roadside edge. Also treated to remove select trees to achieve an average 10-foot spacing between retained tree canopies. To achieve a desired 35-foot spacing between retained trees, future treatments would be necessary. The depicted interim treatment will allow for retained trees to become more wind-firm before additional thinning occurs.

APPENDIX H

*Best Management Practices for General
Operations, Vegetation Management, and
Protection of Biological Resources*

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
<i>General Management Practices</i>		
GEN-1	Work Windows	<ul style="list-style-type: none"> ▪ Hand pruning and hand removal of vegetation may occur year round, except when wheeled or tracked equipment needs to access a site by crossing a creek, ponded area, or secondary channel. ▪ Herbicide applications (if selected as a vegetation management technique) will occur between June 15 and November 15, with an extension through December 31 or until the first occurrence of local rainfall greater than 0.5 inch is forecasted within a 24-hour period following planned application events.
GEN-2	Minimize Area of Disturbance	To minimize impacts to natural resources, the area of ground disturbance will be limited to the minimum footprint necessary to meet the goals and objectives of the vegetation management activity.
GEN-3	Erosion and Sediment Control Measures	<ul style="list-style-type: none"> ▪ Upland soils exposed by maintenance activities will be seeded and stabilized using erosion control fabric or hydroseeding. Channel beds and areas below the ordinary high water mark (OHWM) are exempt from this BMP. ▪ Erosion control fabrics will consist of natural fibers that biodegrade over time. No plastic or other non-porous material will be used as part of a permanent erosion control approach. Plastic sheeting may be used to protect a slope from runoff temporarily, but only if there are no indications that special-status species would be affected by the application. ▪ Erosion control measures will be installed according to manufacturer's specifications. ▪ Appropriate measures include, but are not limited to, the following: <ul style="list-style-type: none"> – silt fences – straw bale barriers – brush or rock filters – storm drain inlet protection – sediment traps – sediment basins – erosion control blankets and mats – soil stabilization (e.g., tackified straw with seed, jute, or geotextile blankets, broadcast and hydroseeding) ▪ All temporary construction-related erosion control methods (e.g., silt fences) shall be removed at the completion of the project.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
		<p>The following California Stormwater Quality Association (CASQA) Construction BMPs provide guidance and specifications on implementation of the erosion control measures listed above (see also www.casqa.org/resources/bmp-handbooks/construction):</p> <ul style="list-style-type: none"> – SC-3. Sediment Basins – SC-4. Straw or Sand Bag Barriers – SC-5. Sediment Traps – SC-6. Silt Fences – SS-1. Erosion Control Blankets, Mats, and Geotextiles – VR-1. Brush or Rock Filters – VR-4a. Temporary Outlet Protection – VR-4b. Storm Drain Inlet Protection – WD-1. Earth Dike – WD-1. Slope Drain – WD-3. Temporary Drains and Swales
GEN-4	Staging	<ul style="list-style-type: none"> ▪ To the extent feasible, staging will occur on access roads, surface streets, or other disturbed areas that are already compacted and support only ruderal vegetation. Similarly, all vegetation management equipment and materials (e.g., road rock and project spoils) will be contained within the existing service roads, paved roads, or other pre-determined staging areas. Staging areas for equipment, personnel, vehicle parking, and material storage will be sited as far as possible from major roadways.
GEN-5	On-Site Hazardous Materials Management	<ul style="list-style-type: none"> ▪ An inventory of all hazardous materials used (and/or expected to be used) at the work site and the end products that are produced (and/or expected to be produced) after their use will be maintained by the worksite manager. ▪ As appropriate, containers will be properly labeled with a “Hazardous Waste” label and hazardous waste will be recycled or disposed of properly off-site at an appropriate hazardous waste facility. ▪ Contact of chemicals with precipitation will be minimized by storing chemicals in watertight containers or in a storage shed (completely enclosed), with appropriate secondary containment to prevent any spillage or leakage.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> ▪ Petroleum products, chemicals, cement, fuels, lubricants, non-storm-drainage water, and water contaminated with the aforementioned materials will not contact soil and will not be allowed to enter surface waters or the storm drainage system. ▪ All toxic materials, including waste disposal containers, will be covered when not in use and located as far as possible from any direct connection to the storm drainage system or surface water. ▪ All trash that is brought to a project site during maintenance activities (e.g., plastic water bottles, lunch bags, cigarettes) will be removed from the site daily.
GEN-6	Existing Hazardous Materials	<ul style="list-style-type: none"> ▪ If previously unknown hazardous contaminants, including oil, batteries, or paint cans, are encountered during vegetation management work, City personnel will cease activity and will contact the Alameda County Public Health Department to determine what measures need to be implemented to address the hazardous materials and ensure that the work site is safe for people and the environment. As directed by the Alameda County Public Health Department, City personnel will carefully remove and dispose of hazardous materials. ▪ City personnel will wear proper protective gear when handling hazardous materials. All contaminated materials will be stored in appropriate hazardous waste containers for transport and disposal at a permitted hazardous waste facility.
GEN-7	Spill Prevention and Response	<ul style="list-style-type: none"> ▪ City personnel will prevent the accidental release of chemicals, fuels, lubricants, and non-storm-drainage water into channels by following these measures: <ol style="list-style-type: none"> 1. New City field personnel will be trained appropriately in spill prevention, hazardous material control, and cleanup of accidental spills. 2. Equipment and materials for cleanup of spills will be available on site at all times, and spills and leaks will be cleaned up immediately and disposed of at a hazardous waste facility. 3. City field personnel will ensure that hazardous materials are handled properly and natural resources are protected by all reasonable means. 4. Spill prevention kits will always be in close proximity when City personnel are using hazardous materials (e.g., at crew trucks and other reasonable locations). All City field personnel will be advised of these locations. 5. City personnel will routinely inspect the work site, vehicles, and equipment to verify that spill prevention and response measures are implemented and maintained properly. All leaks will be repaired promptly. Drip pans will be used to catch leaks until repairs are made. ▪ For small spills on impervious surfaces, absorbent materials will be used to remove the spill, rather than hosing it down with water. For small spills on pervious surfaces such as soil, the spill area will be excavated

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
		<p>and properly disposed of rather than being buried. Absorbent materials will be collected and disposed of properly and promptly.</p> <ul style="list-style-type: none"> ▪ All significant spills of hazardous materials, including oil, will be reported immediately. To report a spill: 1) Dial 911 or your local emergency response number; and 2) Call the Governor’s Office of Emergency Services Warning Center, (800) 852-7550 (24 hours).
GEN-8	Vehicle and Equipment Maintenance	<ul style="list-style-type: none"> ▪ All vehicles and equipment will be kept clean. Excessive buildup of oil and grease will be prevented. ▪ Incoming vehicles and equipment (including delivery trucks and employee and subcontractor vehicles) will be checked for leaking oil and fluids. Leaking vehicles or equipment will not be allowed on-site. ▪ No heavy equipment will operate in a live stream. ▪ No equipment will be serviced in the creek channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated (i.e., pumps and generators). ▪ If necessary, servicing of equipment at the job site will be conducted in a designated, protected area to reduce threats to water quality from vehicle fluid spills. Designated service areas will not connect directly to the ground, surface water, or storm drain system. The service area will be clearly designated with berms, sand bags, or other barriers. Secondary containment, such as a drain pan, will be used to catch spills or leaks when removing or changing fluids. Fluids will be stored in appropriate containers with covers, and recycled or disposed of properly off-site. ▪ If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be conducted in the channel or floodplain. ▪ Equipment will be cleaned of any sediment or vegetation before being transferred and used in a different watershed, to avoid spreading sediment, pathogens, or exotic/invasive species. ▪ Vehicle and equipment washing can take place on-site only as needed to prevent the spread of sediment, pathogens, or exotic/invasive species. No runoff from vehicle or equipment washing will be allowed to enter water bodies, including creek channels and storm drains, without being subjected to adequate filtration (e.g., vegetated buffers, hay wattles or bales, and silt screens). The discharge of decant water from any on-site wash area to water bodies or areas outside of the active project site is prohibited.
GEN-9	Vehicle and Equipment Fueling	<ul style="list-style-type: none"> ▪ No fueling will be done stream channels (top-of-bank to top-of-bank) or immediate floodplain. ▪ All off-site fueling sites (i.e., on access roads above the top-of-bank) will be equipped with secondary containment and avoid a direct connection to soil, surface water, or the storm drainage system.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> ▪ For stationary equipment that must be fueled on-site, secondary containment, such as a drain pan or drop cloth, will be used to prevent accidental spills of fuels from reaching soil, surface water, or the storm drain system.
Vegetation Management		
VEG-1	Routine Pruning Measures	<ol style="list-style-type: none"> 1. Pruning will be performed according to the most recently published National ANSI A300 Pruning Standards and ISA BMPs for Tree Pruning, which include guidance on pruning practices, pruning objectives, pruning methods (types), palm pruning, and utility pruning. 2. Pruning activities will follow National ANSI Z133.1-2006 Standards for safe operation of tree care machinery, and safety equipment such as carabiners, helmets, and arborist ropes will be used to ensure the safety of tree climbers.
VEG-2	Standard Herbicide Use Requirements	<ul style="list-style-type: none"> ▪ Hand or mechanical vegetation removal will be used in areas within 0.25 mile of schools. Herbicides (if selected as a vegetation management technique) will be applied only if hand or mechanical vegetation removal is not feasible. ▪ Only herbicides and surfactants that have been approved for aquatic use by the U.S. Environmental Protection Agency (USEPA) and are registered for use by the California Department of Pesticide Regulation (CDPR) will be used for vegetation control activities. ▪ Herbicide application will be consistent with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label instructions and use conditions issued by USEPA, CDPR, and the Alameda County Agricultural Commissioner. ▪ Herbicides will not be applied in upland areas within 48 hours of predicted rainfall. ▪ The lowest recommended rates of herbicides and surfactants that achieve project objectives will be utilized to achieve desired control. ▪ An indicator dye may be added to the tank mix to help the applicator identify areas that have been treated and to better monitor the overall application. ▪ Herbicides will not be applied in open water or to plants whose bases are submerged in a stream channel or other water body. Application of herbicides to plants growing directly in water or within a stream channel (top-of-bank to top-of-bank) or its riparian corridor (drip line of trees growing on the top-of-bank) is not covered under this Plan and requires additional authorizations according to state and local regulations.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
Biological Resources		
BIO-1	Minimize Impacts to Nesting Birds via Site Assessments and Avoidance Measures	<ul style="list-style-type: none"> ▪ For activities occurring between February 1 and August 31, project areas will be checked by a qualified biologist, for nesting birds within 2 weeks prior to starting work. If a lapse in project-related work of 2 weeks or longer occurs, another focused survey will be conducted before project work can be reinitiated. ▪ If nesting birds are found, a buffer will be established around the nest and maintained until the young have fledged. Appropriate buffer widths are 250 feet for raptors, herons, and egrets; 25 feet for ground-nesting non-raptors; and 50 feet for non-raptors nesting on trees, shrubs and structures. A qualified biologist may identify an alternative buffer based on a site specific-evaluation. No work within the buffer will occur without written approval from a qualified biologist, for as long as the nest is active. ▪ The boundary of each buffer zone will be marked with fencing, flagging, or other easily identifiable marking if work will occur immediately outside the buffer zone. ▪ All protective buffer zones will be maintained until the nest becomes inactive, as determined by a qualified biologist. ▪ If monitoring shows that disturbance to actively nesting birds is occurring, buffer widths will be increased until monitoring shows that disturbance is no longer occurring. If this is not possible, work will cease in the area until young have fledged and the nest is no longer active.
BIO-2	Protection of California Red-legged Frogs from Herbicide Use	<ul style="list-style-type: none"> ▪ In accordance with BMP VEG-2, only herbicides approved for use by USEPA and registered for use by CDRP will be used for vegetation management, and approved herbicides will be applied in accordance with federal, state, and local regulations. ▪ In accordance with BMP VEG-2, no herbicides will be applied in open water. ▪ In project areas identified as providing suitable habitat for the California red-legged frog, the City shall ensure that any applications of sprayable or dust formulations of herbicides will: <ol style="list-style-type: none"> 1. be applied only when the air is calm or moving away from red-legged frog habitat; 2. begin in the portion of the work area nearest the suitable habitat and proceed away from the habitat; and 3. not be conducted within 40 yards upwind of suitable habitat when air currents are moving toward the habitat.
BIO-3	Avoid Special-Status Plant Species	If ground-disturbing equipment, such as a masticator, is to be used for vegetation management, the fuel management areas will be pre-surveyed for pallid manzanita (<i>Arctostaphylos pallida</i>), Oakland star-tulip (<i>Calochortus umbellatus</i>), Presidio clarkia (<i>Clarkia franciscana</i>), western leatherwood (<i>Dirca occidentalis</i>),

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
Biological Resources		
		<p>Tiburon buckwheat (<i>Eriogonum luteolum</i> var. <i>caninum</i>) and bristly leptosiphon (<i>Leptosiphon acicularis</i>). To avoid and/or minimize potential impacts on special-status plants, the following actions will be taken:</p> <ol style="list-style-type: none"> 1. Pre-maintenance surveys of the work area for special-status plant species will be conducted by a qualified biologist during the appropriate blooming period, within 2 years before commencement of work. 2. If special-status plant species are present at the work site, the qualified biologist will minimize impacts on them by implementing one or more of the following measures: <ol style="list-style-type: none"> A. Flag or otherwise delineate in the field the special status plant populations and/or sensitive natural community to be protected; B. Allow adequate buffers around plants or habitat; the location of the buffer zone will be shown on the maintenance design drawings and marked in the field with stakes and/or flagging in such a way that exclusion zones are visible to maintenance personnel without excessive disturbance of the sensitive habitat or population itself (e.g., from installation of fencing).; and C. Time construction or other activities during dormant and/or non-critical life cycle period.
BIO-4	Protection of California Red-legged Frogs and Western Pond Turtles	<p>A qualified biologist shall review vegetation treatment areas to confirm whether the area provides suitable habitat for California red-legged frogs or western pond turtles. The biologist shall refer to Table 3 of the Biological Resources Report and conduct additional desktop analysis to determine whether the specific treatment areas provide suitable habitat or connectivity to suitable habitat for these species. Additional site visits may also be needed to confirm habitat for these species.</p> <p>In vegetation treatment areas identified as providing suitable habitat for California red-legged frogs or western pond turtles, a qualified biologist will conduct one daytime survey for these species within 48 hours before commencement of vegetation management activities.</p> <ol style="list-style-type: none"> 1. If no California red-legged frogs or western pond turtles are found within the activity area during the survey, the work may proceed. 2. If a California red-legged frog or western pond turtle, or the eggs or larvae of either of these species, are found within the activity area during the survey or during project activities, the qualified biologist will implement the following measures: <ol style="list-style-type: none"> A. For vegetation management activities that will take less than 1 day, conduct a survey for red-legged frogs and western pond turtles on the morning of and before the scheduled work.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
<i>Biological Resources</i>		
		<ul style="list-style-type: none"> I. If no California red-legged frogs or western pond turtles are found, the work may proceed. II. If eggs or larvae of either species are found, a no-disturbance buffer zone will be established around the location of the eggs/larvae. Work may proceed outside of the buffer zone; however, work within the buffer zone will be postponed until the eggs have hatched and/or larvae have metamorphosed. The monitoring biologist will determine the buffer size based on the specific site conditions and type of vegetation management. III. If an active western pond turtle nest is detected within the vegetation management area, a 25-foot buffer zone around the nest will be maintained during the breeding and nesting season (April 1–August 31). The buffer zone will remain in place until the young have left the nest, as determined by a qualified biologist. IV. If adults or non-larval juvenile California red-legged frogs or western pond turtles are found, the qualified biologist will implement one of the following two procedures: <ul style="list-style-type: none"> a.) If, in the opinion of the qualified biologist, the individual(s) are likely to leave the work area on their own, and work can be feasibly rescheduled, a buffer zone will be established around the location of the individual(s). Work may proceed outside of the buffer zone. Work within the buffer zone will be postponed until the individual(s) have left the area, as determined by the qualified biologist. The monitoring biologist will determine the buffer size based on the specific site conditions and type of vegetation management. b.) If, in the opinion of the qualified biologist, capture and removal of the individual to a safe location outside of the work area is less likely to result in adverse effects than leaving the individual in place and rescheduling the work (e.g., if the species could potentially hide and be missed during a follow-up survey), the individual will be captured and relocated by a qualified biologist (with USFWS and/or CDFW approval, depending on the listing status of the species in question), and work may proceed. B. For vegetation management that will take more than 1 day, the qualified biologist will conduct a survey for California red-legged frogs and western pond turtles each morning before the scheduled work commences. <ul style="list-style-type: none"> I. If eggs or larvae of either species are found, a buffer zone will be established around the location of the eggs/larvae and work may proceed outside of the buffer zone. Work within the buffer zone will be postponed until the eggs have hatched and/or larvae have

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
<i>Biological Resources</i>		
		<p>metamorphosed. The monitoring biologist will determine the buffer size based on the specific site conditions and type of vegetation management.</p> <p>II. If an active western pond turtle nest is detected within the vegetation management area, a 50-foot buffer zone around the nest will be established and maintained during the breeding and nesting season (April 1–August 31). The buffer zone will remain in place until the young have left the nest, as determined by a qualified biologist.</p> <p>III. If adults or non-larval juvenile California red-legged frogs or western pond turtles are found, the individual(s) will be captured and relocated by a qualified biologist (with USFWS and/or CDFW approval, depending on the listing status of the species in question), and work may proceed.</p>
BIO-5	Protection of Alameda Whipsnake	<ol style="list-style-type: none"> 1. Prior to implementing vegetation treatments in Alameda whipsnake habitat, personnel involved in vegetation removal and earth-disturbing activities shall participate in an Environmental Awareness Training. Under this plan, workers shall be informed about Alameda whipsnake and their habitat, conservation goals, identification, and procedures to follow in the event of a possible sighting. 2. Any scrub habitat present within a vegetation treatment area shall be inspected by a qualified biologist prior to treatment to determine the presence or potential presence of Alameda whipsnakes. 3. To the maximum extent practicable, vegetation clearing activities in coastal scrub habitats will be scheduled to avoid the breeding period for the Alameda whipsnake (March 15 through June 15). 4. A qualified biological monitor will monitor vegetation removal and ground disturbance within Alameda whipsnake habitat, or other activities that may result in take of Alameda whipsnake. The biological monitor will have the authority to stop any work that could result take of Alameda whipsnake. 5. The biological monitor will inspect the treatment area for Alameda whipsnake each day before work begins by checking debris piles, and also beneath vehicles/equipment before it is moved. 6. If erosion control is needed, plastic monofilament netting or similar material containing netting will not be used, as Alameda whipsnake may become entangled in this material. Coconut coir matting or tackified hydroseeding compounds may be used instead.
BIO-6	Grazing	<ol style="list-style-type: none"> 1. Livestock will generally be excluded from riparian areas. 2. Livestock will be excluded from known locations of special-status plant species.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
<i>Biological Resources</i>		
		3. Livestock will be monitored to ensure over-grazing of treatment areas does not occur. Grasslands should not be grazed to less than 4 inches.
BIO-7	Trash Removal	The contractor will be required to keep all waste and contaminants contained and remove them daily from the work site. Wildlife-proof trash receptacles will be used. Uneaten human food and trash attracts predators of the California red-legged frog and Alameda whipsnake. A litter control program will be instituted at each vegetation treatment site. All workers will ensure their food scraps, paper wrappers, food containers, cans, bottles, and other trash are deposited in covered or closed trash containers. The trash containers will be removed from the vegetation treatment site at the end of each working day.
BIO-8	Protection of Bat Colonies	<p>To minimize impacts on special-status bats (e.g., pallid bat, western mastiff bat, and western red bat) and large colonies of non-special-status bats, the City will implement the following restrictions on tree trimming and removal activities:</p> <ol style="list-style-type: none"> 1. If high-quality habitat for roosting bats (i.e., large trees with cavities of sufficient size to support roosting bats, as determined by a qualified bat biologist) is present, within 2 weeks before the commencement of work activities, a qualified bat biologist will conduct a survey to look for evidence of bat use. If evidence is observed, or if high-quality roost sites are present in areas where evidence of bat use might not be detectable (such as a tree cavity), an evening survey and/or nocturnal acoustic survey may be necessary to determine if a bat colony is present and to identify the specific location of the bat colony. 2. If no active maternity colony or non-breeding bat roost is located, work can continue as planned. 3. If an active maternity colony or non-breeding bat roost is located, work will be redesigned to avoid disturbance of the roosts, if feasible. 4. If an active maternity colony is located and work cannot be redesigned to avoid removal or disturbance of the occupied tree or structure, disturbance will not take place during the maternity roost season (March 15–July 31), and a disturbance-free buffer zone (determined by a qualified bat biologist) will be observed during this period. 5. If an active non-breeding bat roost is located and work cannot be redesigned to avoid removal or disturbance of the occupied tree or structure, the individuals will be safely evicted between August 1 and October 15 or between February 15 and March 15. Bats may be evicted through exclusion after notifying CDFW. Trees with roosts that need to be removed will first be disturbed at dusk, just before removal that same evening, to allow bats to escape during the darker hours.

APPENDIX H

Best Management Practices for General Operations, Vegetation Management, and Protection of Biological Resources

BMP Number	BMP Title	BMP Description
<i>Biological Resources</i>		
BIO-9	Protection of dusky-footed woodrats	<ol style="list-style-type: none"> 1. If a woodrat nest is identified in a work area, the City will attempt to preserve the nest and maintain an intact dispersal corridor between the house and undisturbed riparian habitat. 2. If the woodrat nest cannot be avoided, a qualified biologist shall deconstruct the nest by hand and relocate the nest materials to the nearest undisturbed suitable riparian habitat.
BIO-10	Seeding with Native Species	<p>The City shall reseed exposed soil resulting from Plan activities as follows:</p> <ol style="list-style-type: none"> 1. Sites where vegetation management activities result in exposed soil will be stabilized to prevent erosion. Disturbed areas shall be seeded with native seed as soon as is appropriate after vegetation management activities are completed. An erosion control seed mix may be applied to exposed soils, down to the OHWM. 2. The seed mix should consist of California native grasses (e.g., <i>Hordeum brachyantherum</i>, <i>Elymus glaucus</i>, and <i>Festuca microstachys</i>) or annual, sterile seed. 3. Temporary earthen access roads may be seeded when site and horticultural conditions are suitable, or may have other appropriate erosion control measures in place.

APPENDIX I

Draft Protected and Endangered Species Policy and Procedures



OAKLAND FIRE DEPARTMENT POLICY AND PROCEDURES



APPROVED:

REFERENCE: Fire Prevention Bureau
NUMBER: TBD
EFFECTIVE: TBD
REVISED:

PROTECTED AND ENDANGERED SPECIES

I. PURPOSE:

To establish a uniform procedure for the protection of state- and federally-listed Endangered or Threatened species of flora or fauna, and non-listed species otherwise protected by state and/or federal statutes (collectively “Protected Species”), when identified as being present on or within areas of City responsibility or ownership while conducting vegetation and fuels management practices within the designated Very High Fire Hazard Severity Zone of the City of Oakland.

II. DEFINITIONS:

- A. FIRE HAZARD SEVERITY ZONE (FHSZ): An area that has been evaluated by the California Department of Forestry and Fire Protection (Cal Fire) on several factors, including: fuel, slope and fire weather, and was ultimately determined by Cal Fire to have varying degrees of a fire hazard (i.e. moderate, high and very high).
- B. PROTECTED SPECIES: state- and federally-listed Endangered or Threatened species of flora or fauna, and non-listed species otherwise protected by state and/or federal statutes.

III. POLICY:

- A. Supervisor & Inspectors assigned to the Vegetation Management Unit shall refer to the City’s adopted Vegetation Management Plan for guidance when drafting contracts for roadside clearance abatement, City owned vacant lot clearance abatement, parks and open space grazing, and fuel reduction abatement.
- B. When necessary, the City shall utilize qualified biological consultants to ensure that Protected Species are avoided during its vegetation management activities. Consultants authorized by the City shall have demonstrated past experience conducting biological assessments for Protected Species and developing and implementing avoidance strategies for such species. Upon completion and subsequent implementation of its Vegetation Management Plan, the work of consultants shall be guided by the Plan.
- C. When appropriate, the City shall contract with and utilize qualified biological consultants (Environmental Consultant) to ensure that Protected Species are avoided during its vegetation management activities. Consultants authorized by the City shall have demonstrated past experience conducting biological assessments for Protected Species and

developing and implementing avoidance strategies for such species.

- D. Prior to the initiation of any vegetation management activities, the contracted Environmental Consultant shall review and compile species location data from recognized resource agency databases (California Natural Diversity Database [CNDDDB] from the California Department of Fish and Wildlife [CDFW], IPaC from U.S. Fish and Wildlife Service [USFWS], etc.) relevant to the area in which such activities will occur. Any locations of Protected Species on City-owned parcels and adjacent to roadways (within 50 feet) where vegetation management will occur will be provided to the City.
- E. In areas where vegetation management activities are proposed and in which Protected Species may occur based on the review of the agency species location database and/or on the presence of suitable habitat, the Environmental Consultant shall conduct a site visit, during the appropriate blooming (plants) and breeding (animals) period of the target Protected Species, to determine presence/absence of Protected Species. If Protected Species are observed, occupied areas will be “flagged” for visual recognition with “Fire Line, Do Not Cross” marking tape to prevent intrusion and disturbance of the Protected Species by abatement crews. The avoidance area will be determined by the Environmental Consultant and will consider the nature and extent of the vegetation/fuel management activity, time of year, and species being protected. If the species is state- or federally-listed as Threatened or Endangered, consultation with the appropriate resource agency may need to occur prior to initiation of vegetation management activities.
- F. Abatement contracts released for competitive bid shall identify which Protected Species are present (if applicable) and a detailed map provided which will advise the awarded abatement contractor of the locations “flagged” as described in Item D above. These locations shall not be intruded upon or disturbed.
- G. In situations where Protected Plant Species must be allowed to “go to seed” for propagation (native bunch grasses and flowering plants), contracts for vegetation removal or grazing shall be suspended until such time that the flora has completed its growth cycle and can safely be cut or grazed over. These locations may be fenced or flagged, and the adjacent vegetation removed if conditions dictate that surrounding overgrowth be abated in the interest of public safety and fire prevention and would not result in adverse impacts to any Protected Species.
- H. In situations where Protected Wildlife Species are breeding (e.g., nesting birds), contracts for vegetation removal or grazing shall be suspended until such time that the young of the species has fledged or is otherwise not dependent upon the nest, burrow, or other breeding substrate for survival and the vegetation can safely be cut or grazed over. These locations may be fenced or flagged, and the adjacent vegetation removed if conditions dictate that surrounding overgrowth be abated in the interest of public safety and fire prevention and would not result in adverse impacts to any Protected Species.
- I. If take of any state- or federally-listed Protected Species is expected to occur, the City shall obtain an Incidental Take permit from the appropriate agency (CDFW or USFWS). Such permit(s) will be secured by the City’s Planning Department / Environmental Services Division in accordance with the California Endangered Species Act, section 2081, California Code of Regulations Title 14, section 783 or Section 10 (a)(1)(B) of the federal

Endangered Species Act prior to the initiation of any vegetation/fuel management activities. Any unintended incidental take of a listed Protected Species during the course of approved vegetation management activities shall be reported to the Supervisor of the Vegetation Management Unit for documentation and reported to the appropriate resource agency (CDFW or USFWS).

- J. Fire Prevention Bureau staff assigned to the Vegetation Management Unit shall communicate with City of Oakland Parkland Resources Supervisor(s) when drafting contracts for fuels abatement within designated City Parks and Open Spaces to confirm locations of proposed fuel breaks and to identify any Protected Species of both flora and fauna which may be present and impacted by such abatement measures to ensure habitat preservation and protection of Protected species. In such cases, abatement practices shall be modified as needed.

IV. PROCEDURES:

A. Plants

If ground-disturbing equipment, such as a masticator, is to be used for vegetation management in areas known to support or potentially support Protected Plant Species, the fuel management areas will be pre-surveyed for Protected Plant Species. To avoid and/or minimize potential impacts on these species, the following procedures will be taken:

1. Pre-maintenance surveys of the work area for Protected Plant Species will be conducted by the Environmental Consultant during the appropriate blooming period within 2 years before commencement of work.
2. If Protected Plant Species are present at the work site, the Environmental Consultant will minimize impacts by implementing one or more of the following measures:
 - a. Flag or otherwise delineate in the field the plant populations and/or sensitive natural community to be protected;
 - b. Allow adequate buffers around plants or habitat; the location of the buffer zone will be shown on the maintenance design drawings and marked in the field with stakes and/or flagging in such a way that exclusion zones are visible to maintenance personnel without excessive disturbance of the sensitive habitat or population itself (e.g., from installation of fencing); and
 - c. Time construction or other activities during dormant and/or non-critical life cycle period.

B. Wildlife

If ground-disturbing equipment or pruning or other tree/shrub modification activities will occur in areas known to support or potentially support Protected Wildlife Species, the fuel

management areas will be pre-surveyed for Protected Wildlife Species. To avoid and/or minimize potential impacts on these species, the following procedures will be taken:

1. The Environmental Consultant will conduct pre-activity surveys for nesting birds during the nesting season (typically March through August). If active nests are found within or adjacent to fuel management areas, an appropriate buffer, as determined by the Environmental Consultant, will be established and fuel modification activities will not be conducted within these buffer areas until the nest is inactive as determined by the Environmental Consultant.
2. The Environmental Consultant will conduct pre-activity surveys for non-avian Protected Wildlife Species during the appropriate breeding season. If located, appropriate measures will be taken to avoid/minimize adverse impacts to such species. Such measures can include, but would not be limited to, the installation of exclusion fencing, monitoring during fuel modification activities, establishment of protective buffers, and trapping and relocation of potentially affected animals.

C. General

1. Favor thinning techniques that do not result in substantial ground disturbance (such as hand thinning, thinning using a chainsaw, mowing, or mastication) over techniques that result in ground disturbance (such as grapple piling or blading), whenever this can be done with no loss of fuel management effectiveness.
2. If feasible, rather than using heavy equipment for thinning, explore the use of alternative mechanized equipment with greater reach or less ground pressure exerted per square inch to reduce soil compaction and/or total area disturbed.
3. When fuel reduction measures necessitate ground disturbance and soil exposure or removal of substantial ground cover and canopy, cover and reduce exposure of bare ground using on-site chipping or woody debris from mastication.