Palo Alto Foothills Fire Management Plan Update

WILDLAND FIRE RISK ASSESSMENT AND MITIGATION PROGRAM

Submitted to:

City of Palo Alto

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PART A – FIRE HAZARD ASSESSMENT AND FUEL MANAGEMENT PLAN/ PROJECTS

1 EXECUTIVE SUMMARY

The Fire Management Plan update process addresses a broad range of integrated activities and planning documents to address and mitigate the impacts of fire hazards in the Palo Alto Foothills Area. The area of interest includes the areas west of Foothills Expressway to the city limits of Palo Alto. Fire mitigation project areas include the boundaries of Foothills Park and Pearson-Arastradero Preserve within this area of interest.

The Fire Management Plan Update addresses the following key items:

- Fire Hazard Assessment
- Regional Evacuation Routes
- Review of Municipal Ordinances
- Staffing of Station 8
- Wildland Fire Management Recommendations and Mitigations
- Updates to Pearson-Arastradero Trails Master Plan and Foothills Trail Maintenance Plan
- CEQA Documentation
- Implementation Plan and Potential Funding

Community Participation. Community participation in the development of the plan began with the refinement of the scope of work and selection of the consultant team. Three community meetings were held at key points in the planning process to gather continued input from the community. A stakeholder group made up of adjacent jurisdictions, neighborhood associations, special interest groups, volunteers etc. also participated in the planning process. An environmental review in accordance with the California Environmental Quality Act (CEQA) was undertaken by City Staff in conjunction with the plan development.

Fire Hazard Assessment. There are many ways to assess fire hazard. Most utilize the three main factors of fuels, weather, and topography, with possible inclusion of elevation or fire history. Fire behavior was chosen as the means to assess fire hazard since it can identify locations where containment may be easiest, and where access may be precluded during the time of a fire. In addition, fire behavior outputs can identify locations where structures or natural resources may be unduly harmed by a wildfire, as well as locations where fire effects may be inconsequential to natural resources.

Not every area identified as a potential fire hazard can be modified to produce low-intensity fires. Not only would this be too costly, but environmental impacts would also be unacceptable.

Results of Fire Behavior Analysis. Fire behavior was analyzed for the entirety of the Foothills Area, including adjacent neighborhoods, property owned by Midpeninsula Regional Open Space District (MROSD), and Stanford University. Flame length, rate of fire spread and potential for crown fire were three characteristics considered in the analysis. The following are generalities observed:

Flame lengths follow fuel types, with long flame lengths in chaparral and untreated grass, and short flame lengths in woodlands and mowed grass. The largest areas of long flames are located in Foothill Park and Monte Bello Open Space Preserve. Low fire spread rates were predicted in woodlands and forests, and fast

spread rates in untreated grass and chaparral. There is very little active crown fire predicted within the Foothills area, however, the potential for trees to torch is high throughout the treed portion of the Foothills area. Torching is caused by low-hanging limbs, or ladder fuels.

Wildland Fire Management Recommendations and Best Management Practices

Treatments were strategically placed to achieve the following goals:

- Life Safety
- Structure and Infrastructure Protection
- Ignition Prevention
- Fire Containment
- Resource Enhancement

Treatments were identified for 51 project areas. The most visible recommended set of projects will be to conduct roadside treatments along Page Mill Road, Arastradero Road, Los Trancos Road, and Skyline Boulevard. Other projects entail the continuation of mowing along trails and some boundaries, grazing along the selected segments of the perimeter of both Parks/Preserves, treatments to install and maintain defensible space around structures, treatments around barbeques to minimize the chance of ignitions, and treatments to bolster the success of fires containment efforts within the parks. Fuel management treatments can also enhance natural resources, through targeting non-native invasive plants as part of biomass removal – potentially with grazing animals, mechanical mowing and hand labor - and conducting prescribed fires in selected areas under conditions consistent with fire control.

Best management practices are included for each treatment type, based on the sensitivity of the resource. These include practices that consider the timing intensity of the treatment, or selection of the type of treatment methods (e.g., whether the project would entail mowing or grazing, hand labor or mechanical equipment), the strata of treatment (e.g., whether the project would remove lower tree limbs, or instead involve grass mowing), and the scale of the treatment (e.g., to treat small or large patches).

Review Recommendations Regarding Pearson-Arastradero Trails Master Plan and Foothills Trail Management Plan

- Addition of fuel management and fuel reduction zones
- Location of prescribed burns
- Modify fuel break width for performance standards
- Modify roadside treatment standards
- Include fire hazard in regulatory, warning and education signs (especially prescribed fires)

Regional Evacuation Routes

The Palo Alto Police Department has responsibility within City limits for evacuation operations under state law. However, multiple jurisdictions will likely be involved in an event in the Foothills. Evacuation routes

should not be blocked anywhere, regardless of jurisdiction or ownership; this is especially important because most of the regional evacuation routes span multiple cities, ownership categories and protection jurisdictions. The following recommendations will help reach a reasonably safe condition along the regional evacuation routes.

- Formalize agreements with adjacent landowners for ingress and egress routes (from parks) and offsite refuge areas

- Develop partnerships to address regional evacuation routes from residential and public areas (Regional Evacuation Plan, Community Notification (multi-jurisdictional) and Unified Command)

Analysis and Recommendations Regarding Staffing of Station 8

An analysis of the staffing level of Station 8 was conducted that considered the distribution and concentration of fire personnel and equipment in relation to the incidents. The recommendation was to maintain current staffing levels. Response times for incidents are significantly longer from other stations, even when considering mutual aid offered by other jurisdictions. The fire behavior analysis indicates the potential for fast-moving fires of high intensity, further justifying the current staffing levels.

Review of Municipal Ordinances

The existing code is comprehensive; only minor changes are recommended. These include:

- Expand Wildland Urban Interface Fire Area (between Foothill Blvd & Highway 280)

- Fire Protection Planning: Begin early in permitting process

- Expand Defensible Space Requirements: Maintain roof free of materials

- Expand Access Requirements: bridge load limits, parking restrictions

- Additional guidance for Maintenance of Defensible Space

- Ignition Source Control

- Fencing

- Signage

- Mechanical Equipment Ignition Prevention

- Restriction on Smoking at Pearson-Arastradero Preserve

Implementation Plan and Potential Funding for Fire Management Recommendations

Implementation of this plan will be managed by the City of Palo Alto staff, including the Fire Department, the Police Department (evacuation, notification, neighborhood preparedness coordinators), and Open Space (rangers). Volunteer groups, such as Acterra, Friends of Foothills, and other groups should continue to be involved and encouraged to help with the implementation. Further, the City should work with mutual aid government agencies and other stakeholders on an ongoing basis.

Prioritization of Treatments

The following is the priority of treatment types:

1. Life Safety
2. Structure and Infrastructure Protection
3. Ignition Prevention
4. Fire Containment
5. Resource Enhancement

Cost Estimates

The total five-year cost to implement the recommended projects is estimated at slightly less than $700,000. The largest cost, at slightly more than $400,000, is to manage 19 containment areas. The initial treatment for segments of major evacuation routes is estimated to cost almost $178,000. The use of California Youth Authority Crews may offer a means to reduce costs for the hand labor-based treatments. Without volunteers pre-treatment surveys and follow-up may cost $100,000 over the next five years.

2 INTRODUCTION

The Palo Alto Foothills consist of a mix of urban, semi-urban and open space lands on the eastern slope of the Santa Cruz Mountains. Within the city limits of Palo Alto, the Palo Alto Foothills area west of the Foothills Expressway and Junipero Serra Boulevard represents a Wildland Urban Interface area (WUI) with significant impacts to public safety, cultural and economic activities, and environmental and natural resource management. The Palo Alto Foothills Area includes two city-managed areas: Foothills Park and the Pearson-Arastradero Preserve. In an effort to implement an updated Fire Management program for the Foothills, the City of Palo Alto conducted a review of the fire hazards, mitigation activities, and environmental considerations for the area to develop recommendations for wildland fuels and fire management.

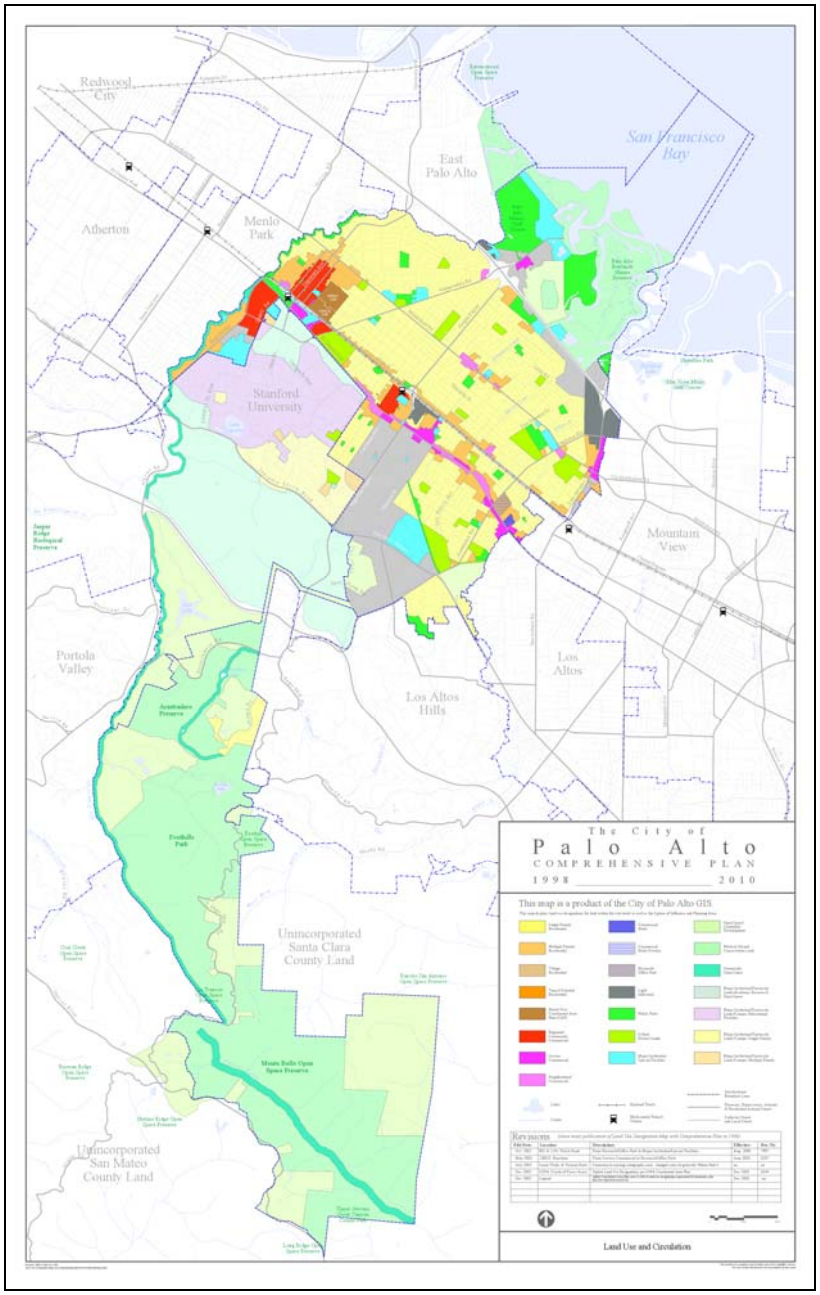

Figure 1: City of Palo Alto Overview.

2.1 Goals and Objectives

The City of Palo Alto developed, maintains, and executes a Fire Management Plan focused on reducing losses from wildland fire. In support of this long-term objective, the City of Palo Alto initiated an update process for the Foothills Fire Management Plan to prepare recommendations for consideration and possible inclusion in future budgets.

This Foothills Fire Management Plan update process focused on the three primary goals:

- Develop recommendations for wildland fuels and fire management to reduce fire hazard in Palo Alto's Wildland Urban Interface west of Foothill Expressway to an acceptable level of risk.
    - Review and incorporate the 1982 Foothills Fire Management Plan and 1997 staff update.
    - Identify appropriate management recommendations to reduce wildland fuel loads in the Pearson-Arastradero Preserve and Foothill Park.
- Maintain ecological and aesthetic values of Foothill Park and Pearson-Arastradero Preserve consistent with fire reduction goals.
- Provide a fuel management plan for Foothills Park and Pearson-Arastradero Preserve that is cost effective and sustainable for the City of Palo Alto.

The Fire Management Plan update process involved a combination of City staff personnel from a wide cross section of city operations, stakeholders from across the Palo Alto area, and members of the Palo Alto community. In order to ensure that the fire management recommendations addressed environmental and cultural conditions that can affect resource and priority decisions, the update process included a series of specific objectives.

- Assess fire hazards within the project area. Develop fuel classification, weather condition assumptions, and other fire hazard inputs used to model the fire hazards for the project area.
- Develop wildland fire management recommendations. Identify both developed and sensitive natural resources at risk and develop treatment and best management practices to protect those resources. Prepare appropriate California Environmental Quality Act (CEQA) document.
- Consider current refuge areas, ingress and egress routes and make recommendations for evacuation from residential and public areas.
- Identify potential funding plans and external funding opportunities.
- Update the Foothills Fire Management Plan incorporating input from the community.
- Review and recommend appropriate revisions to existing City municipal ordinances pertaining to fire prevention.
- Review and make appropriate recommendations to current levels of staffing, equipment and other response resources at Station 8 in Foothills Park.

- Recommend revisions to the Pearson-Arastradero Preserve Trail Master Plan and Foothills Park Trail Maintenance Plan pertaining to firefighting access or vegetation management for fire hazard reduction along trail corridors.

2.2 Planning History

The City of Palo Alto developed a Foothills Fire Management Plan in 1982. The 1982 Plan provides the planning framework for fire control activities for the City and the Palo Alto Foothills Area. The goal of the 1982 Fire Management Plan is "to reduce government costs and citizen losses from wildland fire by increasing initial attack success and/or protecting assets at risk through focused pre-fire management activities."

In 1997, the City of Palo Alto staff developed a draft update to this plan. Although the draft update was not formally adopted, the 1997 Draft Palo Alto Foothills Fire Management Plan provides an updated framework and interim objectives for fire management within the Foothills Area.

The 1997 Draft Palo Alto Foothills Fire Management Plan identified four fire management objectives:

1. Identify fire pre-suppression, suppression and post-suppression activities to maintain or enhance the status quo, and prevent adverse impacts on people, structures and natural resources consistent with Palo Alto Fire Department's fire protection mission.

    a. Prevent or reduce the threat of death or injury to foothills residents and visitors.

    b. Prevent or reduce loss or damage to structures and natural resources.

2. Suppress fire in the Hazardous Fire Area before it gets out of control.

    a. Perform effective initial attack, with Fire Station 8 staffed.

    b. Develop pre-fire suppression plans (initial attack to 4-hour effort).

    c. Incident Command System (ICS) training, focusing on multi-jurisdictional response and enhancing Palo Alto Fire Department (PAFD) skills and abilities in specific ICS positions.

3. Review and update evacuation routes out of the Hazardous Fire Area.

4. When feasible and as part of a regional effort, establish optimal fire frequencies, use pre-suppression control measures (including controlled / prescribed burns) to restore optimal fire regimes and for natural plant communities.

The 1997 draft plan identified several hazard mitigation categories to meet Palo Alto's Fire Management goal and objectives.

- Fuel Management

    - Roadside clearance – Page Mill Road, Arastradero Road, Los Trancos Road and Skyline Boulevard were identified as evacuation routes as well as firebreaks.

    - Fuel Break/ Ignition Control system in Foothills Park and Pearson-Arastradero Preserve

  - Prescribed burning to reduce fuel load, re-establish a normal fire regime and educate and inform the public. High fuel loads, limited burn windows and requirements for pre-burn preparations have limited opportunities to date.

- Pre-fire Actions

  - Foothills Park/ Pearson-Arastradero Preserve practices including visitor safety islands and evacuation plans, fire-safe park maintenance practices, daily weather taking (establish daily Burn Index), annual pre-fire season staff briefing, interagency training, use restrictions during critical fire weather.

  - Cooperative efforts with Midpeninsula Regional Open Space District (MROSD), the Woodside Fire Protection District, and other partner agencies regarding construction of fuel breaks, identification of evacuation routes and interagency training, public information about evacuation pre-planning.

  - Private Dwellings and Open Land including fire codes for new development and public education and code enforcement.

- Suppression and Post Suppression

  - Suppression capability including Foothills Fire Facility (Station 8); Mutual Threat Zone/ mutual aid/ automatic aid contracts; interagency/ ICS training.

  - Suppression Plan including maintenance of response cards, basing response on nationally-recognized fire danger rating indices, use any and all mutual aid resources to confine fires at initial attack, and to follow fire management zone pre-planning documents.

  - Post Suppression Plans.

  - Cultural Resources (no significant cultural resources exist in the City Limits, but potential always exists for discovery of new sites).

The 1997 draft plan strategically divided the Hazardous Fire Area into eight fire management zones (FMZs) to merge individual property and resource concerns with fire control challenges (Figure 2). Each zone has a map showing boundaries, existing control lines and text description of activities to be considered by the Incident Commander, safety precautions and other tactical or site-specific information.

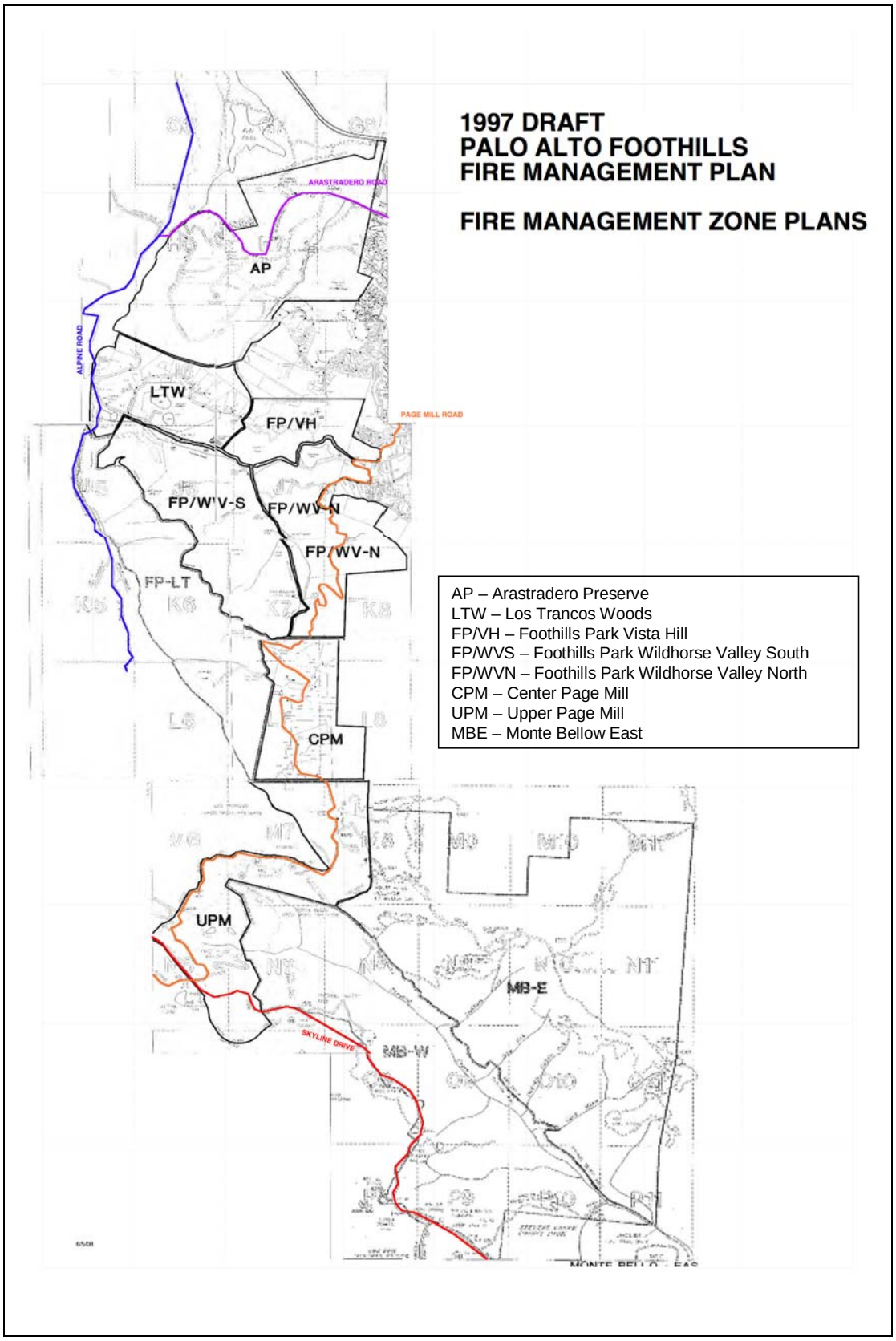

Figure 2: 1997 Fire Management Zones.

2.3 Scope of the Plan

The Fire Management Plan update process addresses a broad range of integrated activities and planning documents to address and mitigate the impacts of fire hazards in the Palo Alto Foothills Area. The area of interest includes the areas west of Foothills Expressway to the city limits of Palo Alto. The fire mitigation project areas include the boundaries of Foothills Park and Pearson-Arastradero Preserve within this area of interest.

The Fire Management Plan Update addresses the following key items:

- Fire Hazard Assessment
- Regional Evacuation Routes
- Wildland Fire Management Recommendations and Mitigations
- Recommendations for the Foothills Park Trails Maintenance Plan and the Pearson-Arastradero Trails Management Plan
- Review of Municipal Ordinances
- Staffing of Station 8
- Implementation Plan and Identification of Potential Funding

2.4 Planning Process

The process used in developing the Update to the Foothills Fire Management Plan involved several departments of the City and many stakeholders. The consultants and City held three meetings with the stakeholders between April and September 2008.

Invited Stakeholders included:

- Acterra
- Arrillaga Property: 500 Los Trancos Road
- CAL FIRE
- Friends of Foothills Park
- Los Altos Hills Fire District
- Los Altos Hills: ARES/RACES
- Los Trancos Water District
- Los Trancos Woods Neighborhood
- Menlo Park Fire District
- Midpeninsula Regional Open Space District
- PA Protect Our Open Space
- Palo Alto Hills Neighborhood Assoc
- Pony Tracks Ranch
- Portola Pasture Stables
- San Mateo County FireSafe Council

- San Mateo County Sheriff
- Santa Clara County Fire Dept
- South Skyline Association
- Stanford Community Residential Leaseholders (SCRL)
- Stanford University
- Town of Los Altos Hills
- Vista Verde Community Association
- Woodside Fire Protection District

There were also three meetings with the community during the same time period. The meetings were held at the Interpretive Center at Foothills Park and at the Palo Alto Hills Golf and Country Club in Palo Alto.

3 EXISTING CONDITIONS

3.1 Fire Hazard

There are many ways to assess fire hazard. Most utilize the three main factors of fuels, weather, and topography, with possible inclusion of elevation or fire history. Fire behavior was chosen as the means to assess fire hazard since it integrates the effects of fuels, weather, and topography. Hazard assessments developed by the State and the California Fire Alliance were evaluated for potential use. However, the assessments were larger scale than appropriate for the purposes of this plan. The decision was made to use a more detailed, site-specific hazard assessment.

Fire behavior predictions identify locations where containment may be easiest, and where access may be precluded during the time of a fire. In addition, fire behavior outputs can identify locations where structures or natural resources may be unduly harmed by a wildfire, as well as locations where fire effects may be inconsequential to natural resources.

3.1.1 Vegetation and Fire Fuels

The Palo Alto Foothills contains a mix of potential wildland fire fuel regimes that, combined with the topography and weather for the regime, pose a potential risk for wildland fire (Figure 3).

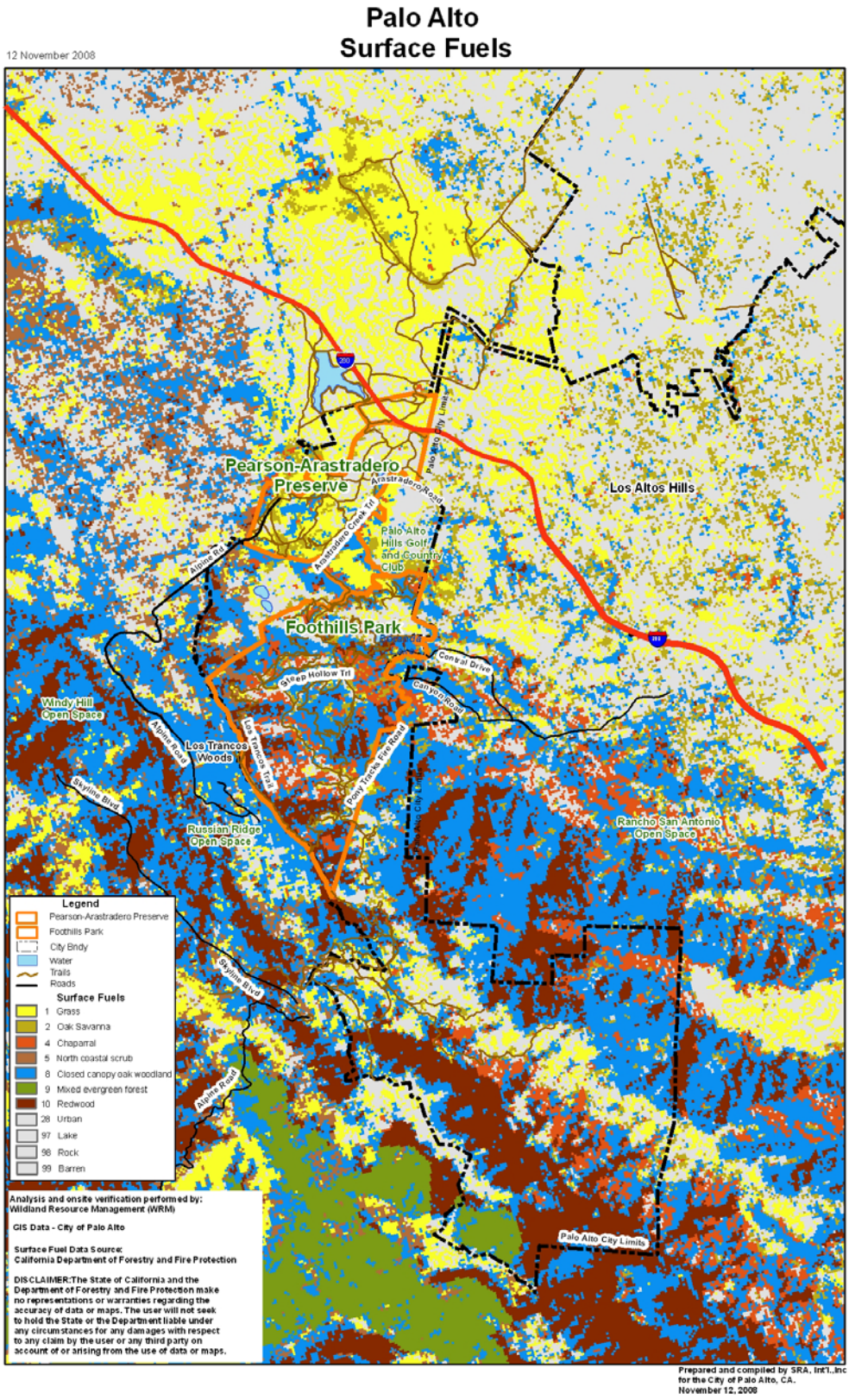

Figure 3: Wildland Surface Fuels.

3.1.2 Fire Behavior

3.1.2.1 Fire Behavior Modeling

FlamMap is particularly well suited for the Foothill Fire Management Area fire assessment. FlamMap generates a spatial depiction of simulated fire behavior that may be used to assess relative hazards throughout the area.

FlamMap is a computerized fire behavior prediction model developed by the USDA Forest Service at the Intermountain Forest Fire Research Laboratory.[1] FlamMap was developed to predict fire behavior characteristics across a landscape. The first such landscape analysis of fire behavior characteristics was performed for the San Francisco Public Utilities Commission Bay Area watersheds, then applied across the East Bay Hills after the Oakland Hills Fire. FlamMap is currently in the public domain.

The heat transfer formulas in FlamMap are based on the software program, BEHAVE, which has been used in wildfire prediction since the 1970's. FlamMap uses the same heat transfer algorithms as BEHAVE along with numerous other algorithms to predict crown fire potential, ember distribution, effects of terrain on wind, direction and slope, and more.

FlamMap allows prediction of fire behavior on a spatial basis, by modeling the locations of flame length, heat release, and rate of spread along with type of fire (crown fire, surface fire, or a fire that torches individual trees) throughout an entire area. FlamMap simulations assume the entire area is aflame under the same conditions at the same time to determine spatial differences in fire behavior.

3.1.2.2 Spatial Input Files

The spatial data inputs to FlamMap characterize the terrain, weather, and fuels on the site with eleven different data layers. The spatial input data files are described in Figure 4.

Figure 4: Spatial Data Required for Fire Behavior Modeling.

Level	Purpose	Source
Elevation (feet above sea level)	This is necessary for adiabatic adjustment of temperature and humidity between elevations and for conversion of fire spread between horizontal and slope distances.	USGS digital elevation models
Slope (Percent of inclination from the horizontal)	Slope is used to compute steepness effects on fire spread and solar irradiance.	USGS digital elevation models
Aspect (Azimuth values degree clockwise from north)	Aspect is used to compute effects on fire spread and solar irradiance.	USGS digital elevation models
Fuel Model	Fuel models, organized and described according to the	FRAP

[1] (FlamMap is available from Systems for Environmental Management, PO Box 8868, Missoula, MT, 59807, or from https://www.firelab.org/project/flammap)

Level	Purpose	Source
	Fire Behavior Prediction System in terms of fuel volume, structure, and chemistry. The fuel models were mapped by CalFire in the Forest Resource Assessment Program (FRAP).	
Canopy Cover	Canopy cover is necessary to compute shading and wind reduction factors. Canopy cover was mapped for the LandFire Program.	LandFire Program
Tree Height	Tree height is used to compute spotting distance and crown fire characteristics. Decision rules regarding tree heights were applied to FRAP surface fuels.	Crosswalk from FRAP surface fuels
Crown Base Height or Height to Live Canopy	Crown base height is an important parameter for determining the transition from surface fire to crown fire. This value incorporates the effects of ladder fuels in increasing vertical continuity and assisting transition to crown fire. Crown base height was mapped for the LandFire Program.	LandFire Program
Weather and Wind	Weather is important to determine environmental conditions during the simulation. The weather data theme describes the maximum and minimum temperatures and relative humidity, and the time in which the maximum and minimum temperature occurs in order to dry and moisten fuels accordingly. Weather data that CalFire based fire-related policy decisions (defined as "average-bad" conditions) was used for this project.	CalFire-defined weather for average bad fire danger

Figure 4: Spatial Data Required for Fire Behavior Modeling.

3.1.2.3 User-Defined Inputs

The model allows the user to customize fuel models or fuel moisture with special files[2].

Custom Fuel Model Files - custom fuels can be used to more accurately describe the types of fuel models found on the site. Custom fuel models use a standard fuel model as a base. In cases where especially flammable vegetation are present (eucalyptus and pines), the heat content of the dead and live fuels could be raised. In cases where the foliage are expected to be moister, the initial fuel moisture of the living material can be raised. Fuel volumes and heights in grazed grasslands can also be reflected in a custom model. For the Palo Alto hazards assessment no custom fuel models were used.

Fuel Moisture Files - defines the initial fuel moisture for each size class of fuels, for each fuel model. The moisture content of live woody fuels and live herbaceous fuels are similarly defined for each fuel model. This file specifies the moisture in the fuels of various sizes, and specifies how much moisture is in leaves. Based on this information, the weather files either dry out or add moisture to fuels depending on ambient conditions. The fuel moisture file used for the Palo Alto hazard assessment portrays the "average worst" fire danger as defined by CalFire. The "average worst" generally applies to the conditions that exist fewer than 10 percent of the time. It is also known as the 90th percentile weather conditions.

[2] User-defined inputs could capture the effects of Sudden Oak Death through development of a custom fuel model and associated reduced fuel moisture.

3.1.2.4 FlamMap Results

Fire behavior was analyzed for the entirety of the Foothills area, including adjacent neighborhoods, property owned by Midpeninsula Regional Open Space District and Stanford University. Three factors are especially pertinent for prioritizing locations of high fire hazard: crown fire activity, flame length and rate of spread.

Crown Fire Potential - Crowning activity indicates locations where fire is expected to travel through and likely consume the crowns. When a fire burns through tree crowns, countless embers are produced and are distributed, sometimes at long distances. These embers can start new fires, which can each grow and confound the finest fire suppression forces. For management purposes, prediction of torching or crown fire is highly correlated with fire severity. Crown fire activity is of concern wherever it occurs because of its impacts and the containment challenges.

There is very little active crown fire predicted within the Foothills area, however, the potential for trees to torch is high throughout the treed portion of the Foothills area. Torching is caused by low-hanging limbs, or ladder fuels (Figure 5). The Crown Fire Potential across the Palo Alto area of interest is depicted in Figure 6.

Figure 5: Comparison of Torching and Active Crown Fire.

Flame Length - Flame length closely corresponds to fire intensity, which can predict fire severity. This factor most influences probability of house damage and ease of fire control. A flame length of eight feet is usually looked at as a cut-off point for decisions whether to attack the fire directly, or instead attempt control through indirect methods.

Fire intensity was determined to be the most important factor in many studies of structural damage from fire. Flame lengths are often used as a proxy for fire intensity because they are highly correlated to fire intensity. Long flame lengths may justify treatment where they occur near sensitive values-at-risk.

Flame lengths follow fuel types, with long flame lengths in chaparral and untreated grass, and short flame lengths in woodlands and mowed grass. The largest areas of long flames are located in Foothill Park and Monte Bello Open Space Preserve. Predicted Flame Length is depicted in Figure 7.

Rate of Spread - The rate of spread is most closely associated with the ability to contain a fire. Rates of spread analyses point to the needs for increased access, detection, reporting, and fuel management to slow fire spread in strategic locations.

Low fire spread rates were predicted in woodlands and forests, and fast spread rates in untreated grass and chaparral. Predicted Rate of Spread is depicted in Figure 8.

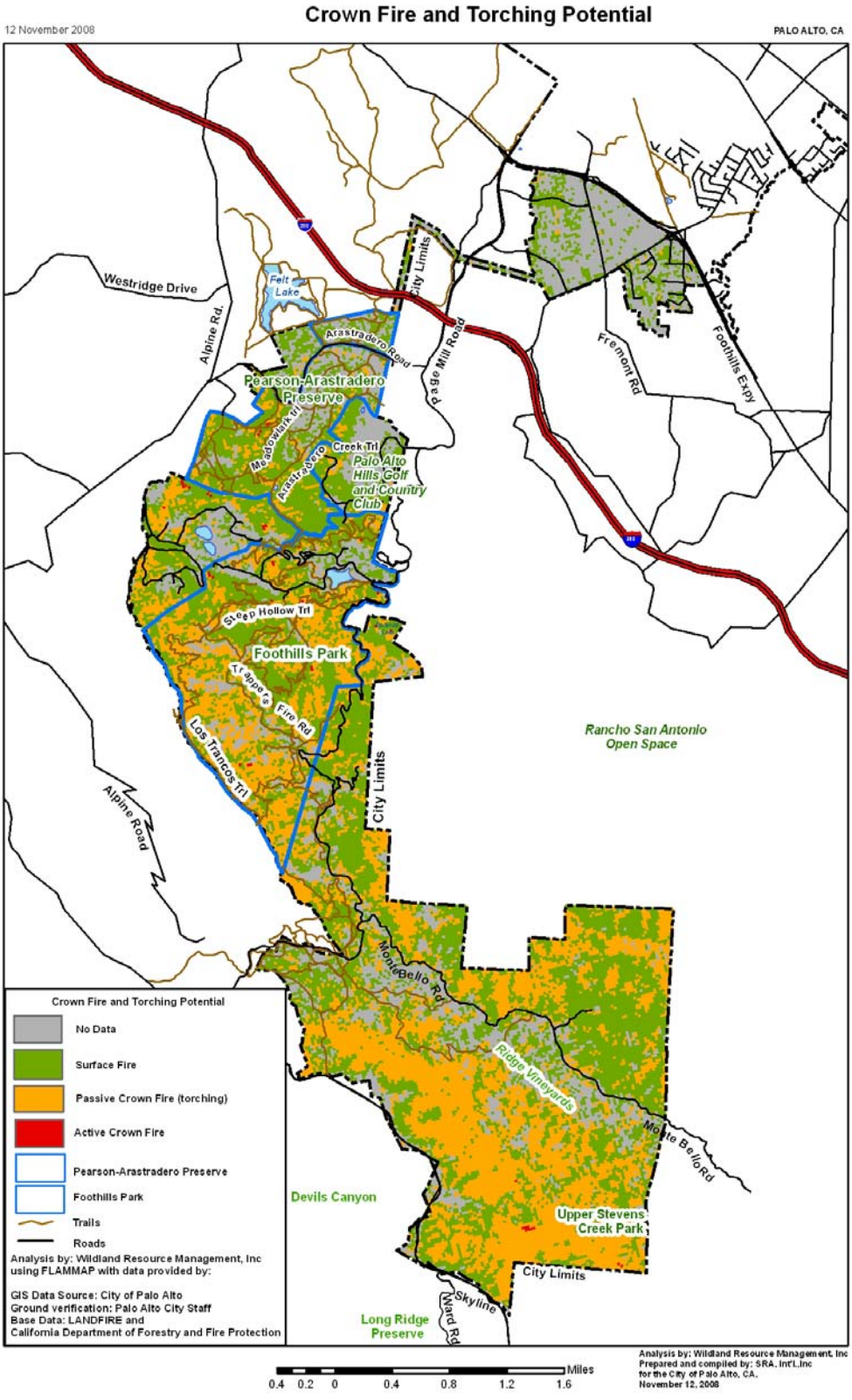

Figure 6: Crown Fire and Torching Potential.

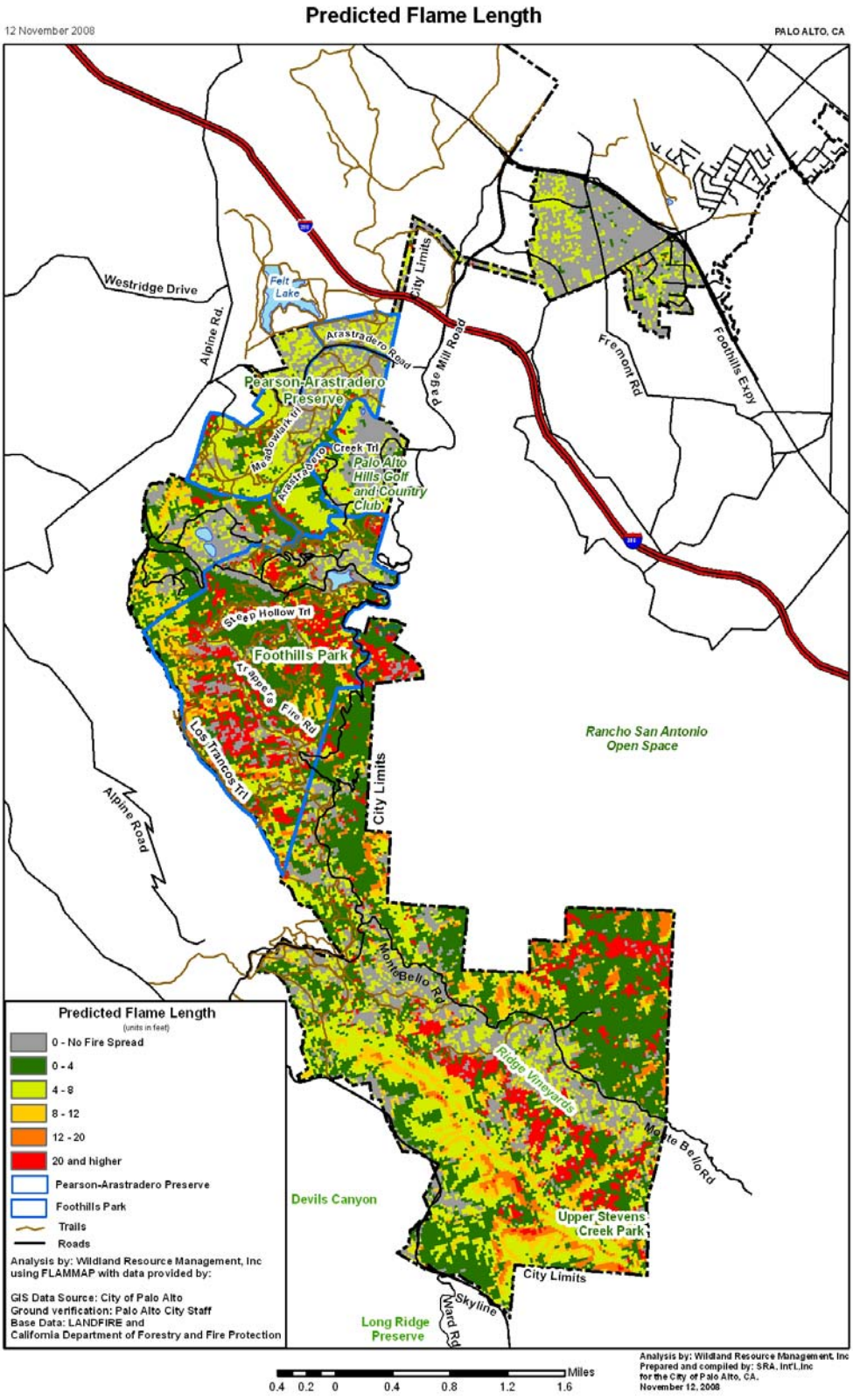

Figure 7: Predicted Flame Length.

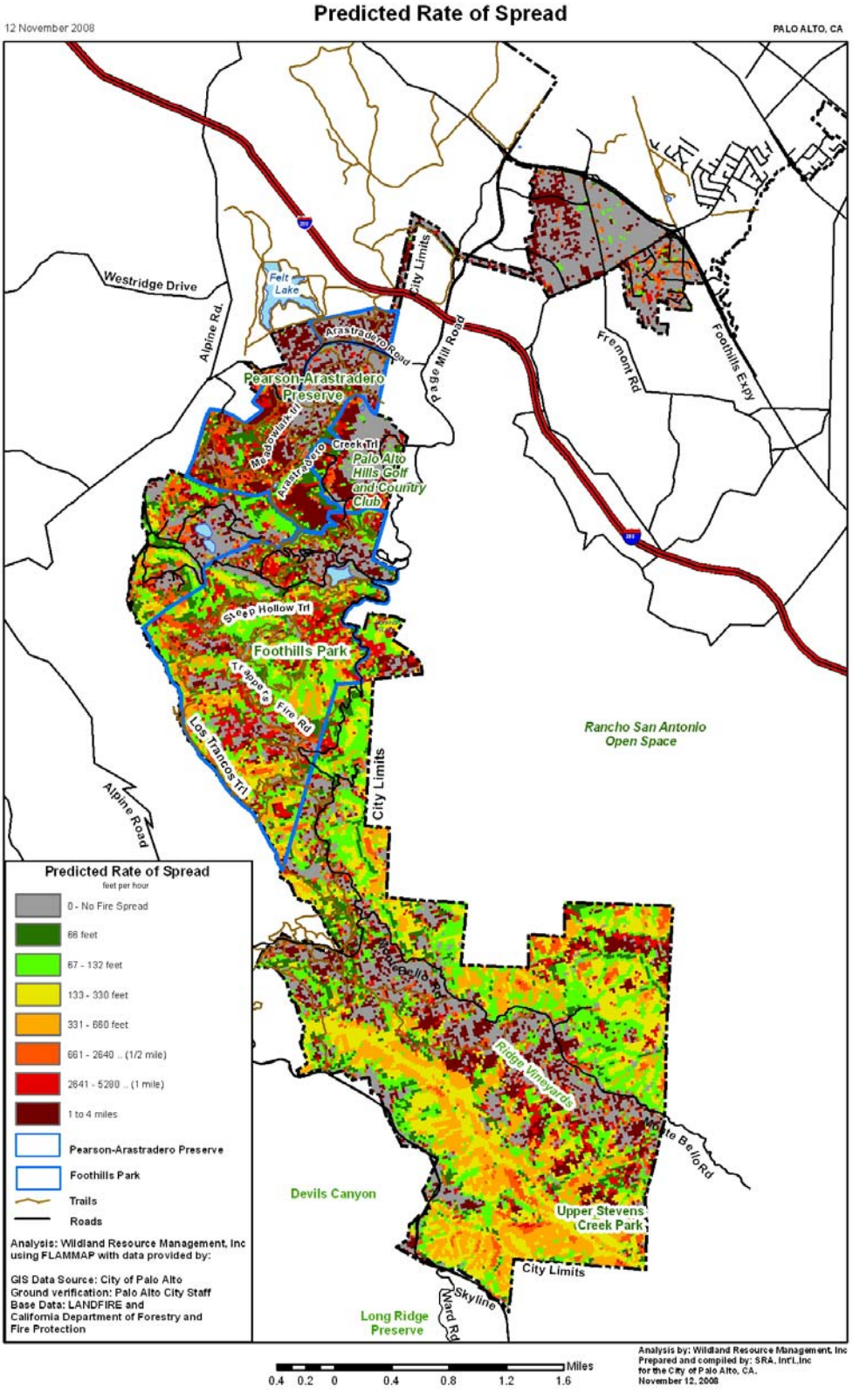

Figure 8: Predicted Rate of Spread.

3.2 Fire Suppression Capabilities

The Department's response area in the WUI Fire Area covers nearly 10 square miles, from Skyline Boulevard in the Palo Alto foothills to Foothill Blvd and from Page Mill Road to Los Trancos Road. Approximately 200 residences and large business complexes (some of them exceeding a million square feet in area) are located in Palo Alto's Wildland Urban Interface Fire Area. The City of Palo Alto Emergency Operations Plan (June 2007) notes that 11 health care facilities, 10 schools and 25 government-owned buildings are located in the wildland urban interface threat areas, along with 19 miles of roadway that are subject to high, very high or extreme wild fire threat.

The Fire Department has 122 personnel organized in four areas:

- Emergency Response (Operations)
- Environmental & Safety Management (Fire Prevention Bureau)
- Training & Personnel Management (Support)
- Office of Emergency Services

The Fire Department staffs seven full time stations located strategically throughout the City. To provide coverage in the sparsely developed hillside areas, an additional fire station in the foothills is operated during summer months when fire danger is high.

The Fire Department facilities are located as follows:

Fire Administration
250 Hamilton Avenue, City Hall

Fire Station 1
301 Alma Street

Fire Station 2
2675 Hanover

Fire Station 3
799 Embarcadero Road

Fire Station 4
3600 Middlefield Road

Fire Station 5
600 Arastradero Road

Fire Station 6
711 Serra Street, Stanford

Fire Station 7
2575 Sand Hill Road, Menlo Park

Fire Station 8
Foothills Park

Rangers from the Open Space and Parks Division perform a vital service aiding fire suppression, providing detection, notification and initial size-up of fires, along with evacuation or reconnaissance. The Rangers offer detailed local knowledge, and support the Station 8 firefighters. Currently ten staff are fully trained and equipped for first response. There are four trucks with 150-200 gallons of water.

The City of Palo Alto has secured many agreements that augment fire suppression capabilities. They participate in the California Master Mutual Aid Agreement and supporting separate agreements. During a

proclaimed emergency, inter-jurisdictional mutual aid will be coordinated at the County Operational Area (Santa Clara County OES, or EOC, if activated), or Mutual Aid Regional level whenever the available resources are:

- Subject to state or federal control.
- Subject to military control.
- Located outside the requesting jurisdiction.
- Allocated on a priority basis.

The current Insurance Service Organization rating for the City of Palo Alto is ISO Class 2.

3.3 Access

Regional access to the Foothills Area is provided by Highway 280, Foothill Expressway and Skyline Boulevard. Page Mill Road serves as a major north-south connector from Highway 280 to Skyline Boulevard. Los Trancos Road provides access along the western boundary of the Palo Alto Foothills Area from Alpine Road south to Los Trancos Woods. Page Mill Road and Los Trancos Road have several long sections that are steep, windy and narrow.

Circulation is limited within the Foothills Area. Arastradero Road links the western and eastern portions. Alpine Road and Los Trancos Road provide access to portions of the western part of the City. Moody Road and Altamont Road are other important circulation routes in Los Altos Hills.

3.4 Sensitive Resources

The Palo Alto Foothills Area includes a mix of social and environmental attributes that may be adversely affected by wildland fire or proposed fuel treatments and strategies. Areas that hold cultural or environmental significance enhance the quality of life in the City of Palo Alto and provide habitat for a variety of plant and wildlife species. These sensitive resources are valuable to the Palo Alto community and to the ecosystem; they should be protected and preserved. Actions are proposed that will reduce the risk of fire spreading to sensitive resources and otherwise minimize the damage to those resources.

Social and cultural factors that may exist in the area affect fire management planning and include specific land uses such as agriculture and rangeland, the presence of public service utilities and structures, and the presence of historical or cultural artifacts. Environmental concerns include vegetation communities, wildlife habitat, soil and erosion conditions, and water and air quality. Figures 9 and 10 provide an overview of potential sensitive resource locations throughout the two parks.

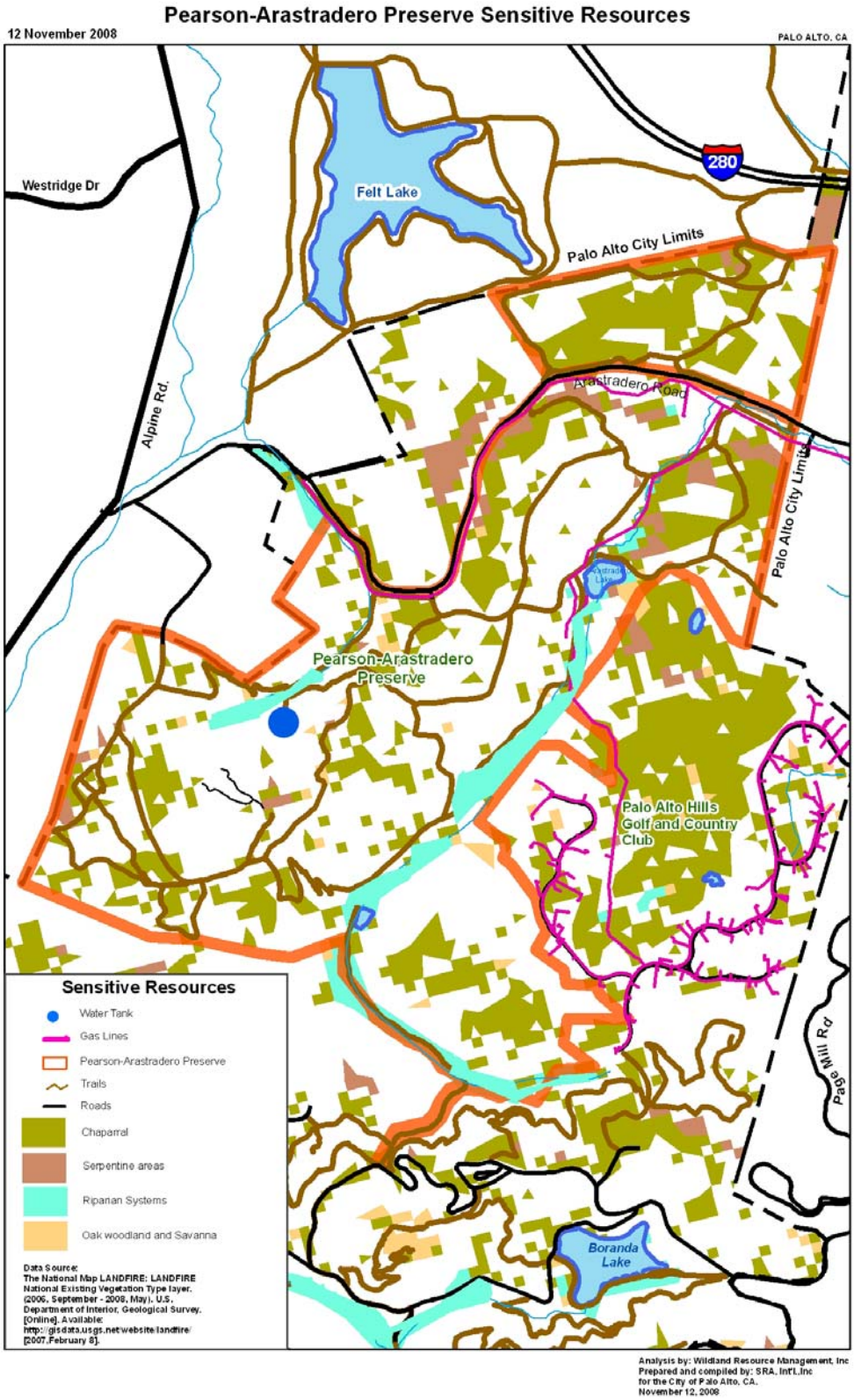

Figure 9: Locations of Cultural and Environmental Sensitive Resources in Pearson-Arastradero Preserve.

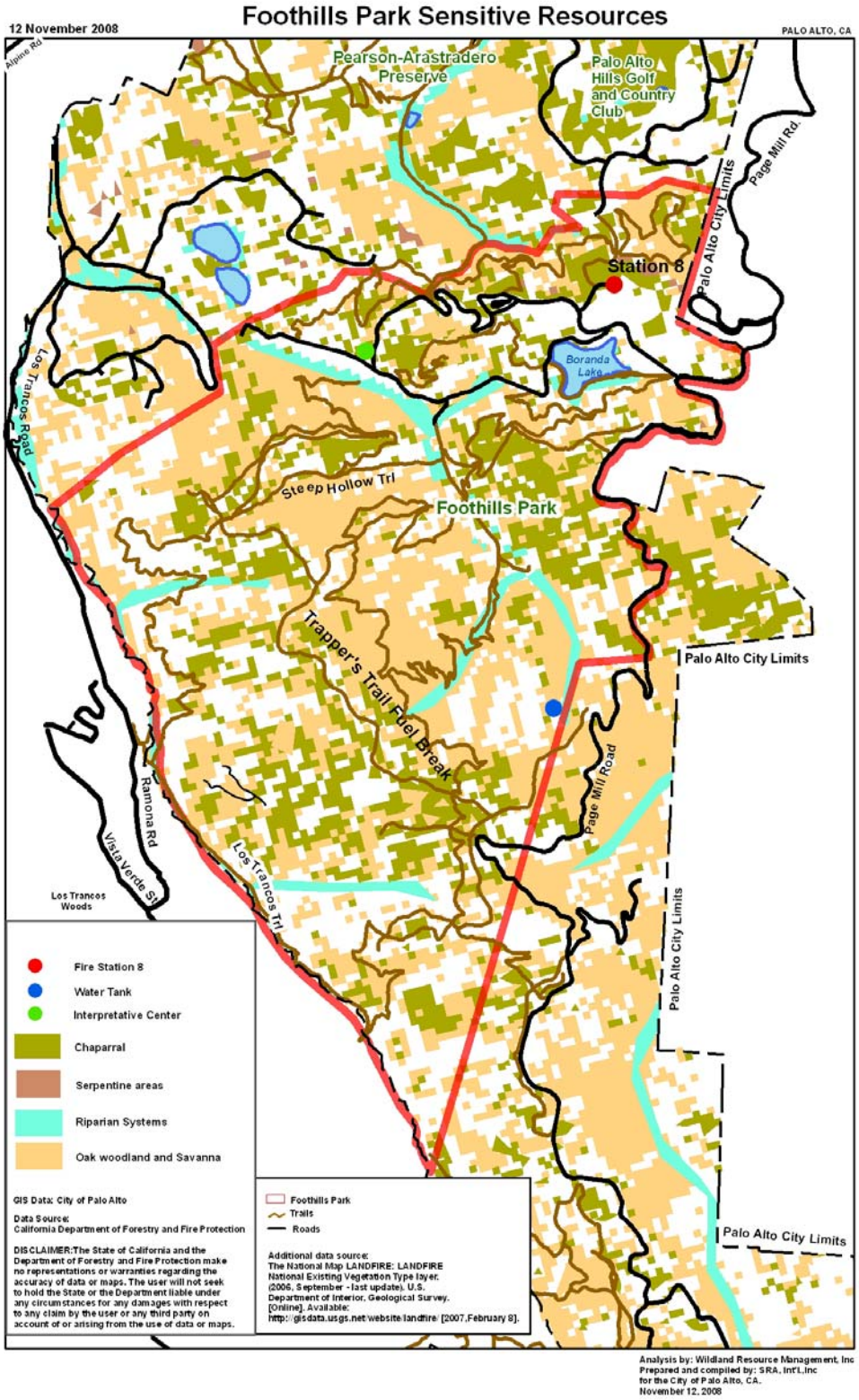

Figure 10: Locations of Cultural and Environmental Sensitive Resources in Foothills Park.

3.4.1 Social and Cultural Features

Social and cultural features are areas and activities that have a special community attribute or contribution ranging from the value of personal property to the functioning of public service and public safety operations. Foothills Park and Pearson-Arastradero Preserve are both open space areas dedicated for park, recreation and conservation purposes. They are generally undeveloped except for park amenities, utilities, public service and safety infrastructure, and roads and trails. The projects in this plan pertain directly to the lands within Foothills Park and Pearson-Arastradero Preserve, and along the evacuation routes within the City limits of Palo Alto. The lands adjacent to the parks include residential and private property as well as public and private open space, and are affected by fire management through code modification, fire department staffing, and other non-project measures that reduce the risk of fire spreading to these resources along with minimizing potential damages. The residential and private property adjacent to the parks include:

- Open space owned and managed by the Midpeninsula Regional Open Space District and Stanford University
- Private residences in the Town of Los Altos Hills, Town of Portola Valley, City of Palo Alto, Santa Clara County, and San Mateo County
- Neighborhoods/associations such as Altamont, Los Trancos Woods, Vista Verde, Blue Oaks, Portola Valley Ranch, Palo Alto Hills, Montebello, South Skyline, and others
- Privately-held recreation facilities, such as equestrian centers and the Palo Alto Hills Golf and Country Club
- The site of what was a private research facility (the American Institute of Research)

Both Foothills Park and Pearson-Arastradero Preserve contain utility lines and access roads that are used and maintained by the City of Palo Alto. The Pearson-Arastradero Preserve contains overhead electrical utility lines that enter the Preserve from Arastradero Road and extend along Arastradero Creek. South of Foothills Park, transmission lines run east-to-west across the southern edge of the park near Page Mill Road and Montebello. The Arastradero and Foothills parks contain several reservoirs, booster stations, and water and sewage lines. The external, aboveground portions of this infrastructure represent potential features that must be taken into consideration either as values at risk to wildland fire or included in fire mitigation treatment planning and execution.

The primary structures within the two parks include the Foothills Park interpretive center, Pearson-Arastradero Gateway interpretive center, Fire Station 8, a maintenance complex, and three public restrooms. No significant cultural or historical sites have been found within the park areas. However, the Foothills area is similar to other areas in the Santa Cruz Mountains that have provided hunting, fishing, and encampments for Native American tribes. A potential exists for discovery of cultural or historic sites.

3.4.2 Environmental Features

Environmentally sensitive areas are those that have specific characteristics which the community, State, or nation has determined to be worthy of protection or preservation. These can include the maintenance of a diverse plant and wildlife ecosystem or the protection of endangered or threatened species. The Palo Alto Foothills hold a specific environmental value within the City of Palo Alto as a conservation area as well as a mixed-use area supporting private and public activities.

Foothills Park and Pearson-Arastradero Preserve consist of a mix of grassland, mixed evergreen, oak woodland, riparian areas (creek, lake), and chaparral. The two parks are located in the watershed of Los Trancos Creek and Arastradero Creek. Foothills Park contains the headwaters of Arastradero Creek and is downstream of Los Trancos Creek and contains Boronda Lake. The Arastradero Creek, an unnamed tributary to Arastradero Creek, and an unnamed tributary to Los Trancos Creek run through the Arastradero Preserve. The Pearson-Arastradero Preserve also contains a small lake, called Arastradero Lake, and John Sobey Pond.

The Palo Alto Foothills contain several environmental areas that deserve specific consideration in the Fire Management Plan. These areas represent the combined contributions of unique wildland habitat capable of supporting a mix of wildlife, a diverse plant and wildlife population containing several protected and monitored species, and a mix of ecosystems ranging from riparian areas to serpentine soils.

3.4.2.1 Species and Wildlife

The variety of environmental conditions in Foothills Park and Pearson-Arastradero Preserve provide habitat for a broad range of wildlife and plants – including some designated as protected or sensitive either by the State of California or the Federal government (Figure 11).

The parks provide known habitat for two protected species and potential habitat for several others – particularly in the riparian zones and areas near Boronda Lake and Arastradero Lake. The California Red-Legged Frog and Steelhead Trout are known to inhabit Los Trancos Creek. In addition, the riparian areas, grasslands, and oak woodlands above Los Trancos as well as Boronda Lake may provide additional foraging and breeding habitat for the California Red-Legged Frog.

Several species of sensitive plants and animals have been locally identified within the parks. In addition, the parks provide potential habitat for a variety of bird and plant species of concern, ranging from plants such as the Santa Clara Red Ribbon to mammals such as the San Francisco Dusky-footed Woodrat. The potential habitats for these species include the riparian and wetland areas along Los Trancos, Boronda Lake, Arastradero Lake, and John Sobey Pond; the serpentine soil areas identified in Pearson-Arastradero Preserve; and the Oak Woodland and Chaparral zones. In addition to these sensitive species, there are also plant species of local concern, such as Phacelia and bush poppies.

The following is a table highlighting sensitive species that may be present in the parks. It is possible that additional sensitive species or habitat areas may be discovered in the future.

Figure 11: Sensitive Species Known or Potentially Occurring in Foothills Park or Pearson-Arastradero Preserve.

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
Endangered	Endangered	San Francisco garter snake (Thamnophis sirtalis tetrataenia)	POTENTIAL HABITAT - potential habitat in Boronda Lake; suitable habitat in Arastradero Lake.	Boronda Lake, Arastradero Lake
N/A	Protected	Ringtail (Bassariscus astutus)	POTENTIAL HABITAT - Forage habitat in riparian zone; possible nesting in hollow trees in riparian zones. Los Trancos Creek provides most likely habitat.	Los Trancos Creek

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
N/A	Endangered	Point Reye's meadowfoam (Limnanthes douglasii sulphurea)	POTENTIAL HABITAT - freshwater marsh occurs in Arastradero Lake; some wet areas in grassland near Arastradero Creek may provide habitat.	Arastradero Lake, Arastradero Creek and tributary grasslands
Endangered	CNPS: Rare, threatened, or endangered in CA	Contra Costa goldfields (Lasthenia conjugens)	NOT LIKELY - Could possibly occur in wet areas in grassland, although the likelihood is very low.	
Endangered	Endangered	San Mateo thorn-mint (Acanthomintha duttonii)	UNKNOWN - Info pulled from CNDDB Palo Alto topo map - not mapped.	
Species of concern	DFG: Species of special concern	Western pond turtle (Actinemys marmorata)	POTENTIAL HABITAT - Potential habitat in Boronda Lake, Los Trancos Creek, and Arastradero Creek; possible sighting in Arastradero Lake; habitat onsite includes Arastradero Creek, John Sobey Pond, Arastradero Lake, and the unnamed tributary to Los Trancos Creek.	Boronda Lake, Los Trancos Creek, Arastradero Creek, John Sobey Pond, Arastradero Lake, Tributary for Los Trancos Creek
Threatened	DFG: Species of special concern	California red-legged frog (Rana aurora draytonii)	KNOWN and POTENTIAL HABITAT - potential breeding habitat at Boronda Lake, Los Trancos Creek and tributaries, John Sobey pond, and Arastradero Lake; foraging habitat in riparian zones, grassland, and oak woodland above Los Trancos Creek and tributaries; May occur on Los Trancos Trail.	(1) Boronda Lake, Los Trancos Creek and tributaries, John Sobey Pond, Arastradero Lake (2) Riparian Zones (3) Grasslands, Oak Woodlands in vicinity of Los Trancos Creek (4) Los Trancos Trail
Threatened	DFG: Species of special concern	California tiger salamander (Ambystoma californiense)	POTENTIAL HABITAT - breeding habitat may occur in the "bowl" near the top of the Pearson-Arastradero Preserve, which is in proximity to the unnamed tributary to Los Trancos Creek	Unnamed tributary to Los Trancos Creek
Threatened	DFG: Species of special concern	North Central Coast steelhead/sculpin stream	KNOWN HABITAT - Los Trancos is a known steelhead stream.	Los Trancos Creek
Threatened	DFG: Species of special concern	Steelhead Trout (Oncorhynchus mykiss irideus)	KNOWN HABITAT - Los Trancos is a known steelhead stream.	Los Trancos Creek
N/A	CNPS: Rare, threatened, or endangered in CA	Ben Lomond buckwheat (Eriogonum nudum var. decurrens)	POTENTIAL HABITAT - Habitat present in chaparral and woodland.	Chaparral, woodland

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
N/A	CNPS: Rare, threatened, or endangered in CA	Big-scale balsamroot (Balsamorhiza macrolepis)	POTENTIAL HABITAT - Habitat present in grassland and oak woodland.	Grassland, Oak Woodland
N/A	CNPS: Rare, threatened, or endangered in CA	Delta tule pea (Lathyrus jepsonii)	POTENTIAL HABITAT - fresh water marsh occurs in Arastradero Lake, and may occur in Arastradero Creek and the tributary to Arastradero Creek.	Arastradero Lake, Arastradero Creek and tributary to Arastradero Creek
N/A	CNPS: Rare, threatened, or endangered in CA	Legenere (Legenere limosa)	POTENTIAL HABITAT - Potential habitat along drainages, Boronda Lake.	Boronda Lake
N/A	CNPS: Rare, threatened, or endangered in CA	Robust monardella or Round-headed coyote mint (Monardella villosa ssp. globosa)	PRESENT/POTENTIAL HABITAT – Locally identified habitat present in woodland and chaparral. Every trail has either woodland or chaparral, or both habitats.	Woodland and chaparral
N/A	CNPS: Plant of limited distribution	Santa Clara red ribbons (Clarkia concinna automixa)	PRESENT (Foothills)/POTENTIAL HABITAT - Habitat present in oak woodland areas along trails	Oak Woodland
N/A	CNPS: Rare, threatened, or endangered in CA	Santa Cruz manzanita (Arctostaphylos andersonii)	POSSIBLE HABITAT/NOT LIKELY - Low possibility in oak woodland and chaparral. Every trail has either woodland or chaparral, or both habitats.	Oak woodland and chaparral
N/A	CNPS: Rare, threatened, or endangered in CA	Serpentine-based plants	KNOWN - two areas of serpentine soil have been identified in Arastradero; one is in grassland and the other is in chaparral. No occurrences in Foothills although some soil/landcover data have noted potential areas.	Areas of Serpentine Soil in Arastradero (Grassland, chaparral). Some potential areas in Foothills
N/A	CNPS: Rare, threatened, or endangered in CA	Dudley's lousewort (Pedicularis dudleyi)	NOT LIKELY - Coniferous forest, maritime chaparral. These habitats are not present in Foothills Park.	
Endangered	CNPS: Rare, threatened, or endangered in CA	Showy Indian clover (Trifolium amoenum)	NOT LIKELY (Foothills)/POSSIBLE (Arastradero) - Info pulled from CNDDB Palo Alto topo map, seeps in grassland.	
Threatened	N/A	Bay checkerspot butterfly (Euphydryas editha bayensis)	NOT LIKELY - serpentine grassland areas either too small or not present	

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
N/A	CNPS: Plant of limited distribution	Gairdner's yampah (Perideridia gairdneri)	KNOWN - in grassland, riparian areas of Arastradero.	Riparian, Grasslands
N/A	CNPS: Plant of limited distribution	Mexican mosquito fern (Azolla mexicana)	POTENTIAL HABITAT - Potential habitat in Boronda Lake; Arastradero Creek from John Sobey Pond to Arastradero Lake	Boronda Lake; Arastradero Creek from John Sobey Pond to Arastradero Lake
N/A	CNPS: Rare, threatened, or endangered in CA	White-flowered rein orchid (Piperia candida)	POSSIBLE HABITAT - Potential habitat along portions of Chamise, Coyote, Fern Loop, Los Trancos, Panorama, Toyon and Woodrat Trails.	Oak Woodland
N/A	DFG: Species of special concern	Long-eared owl (Asio otus)	POTENTIAL HABITAT - May use oak woodland and riparian corridors in Foothills Park. Includes Chamise, Costanoan, Coyote, Fern Loop, Los Trancos, Panorama, Sunrise, Trappers, and Woodrat Trails.	Oak Woodland, Riparian Zones
N/A	Species of special concern	Big brown bat (Eptesicus fuscus)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	Species of special concern	California myotis (Myotis californicus)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	BLM: Sensitive	Long-eared myotis (Myotis evotis)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	IUCN: Species of concern	Long-legged myotis (Myotis volans)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	Species of special concern	Mexican free-tailed bat (Tadarida brasiliensis)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	IUCN: Species of concern	Silver haired bat (Lasionycteris noctavigans)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	DFG: Species of special concern; BLM: Sensitive; IUCN: Species of concern; USFS: Sensitive	Townsend's western big-eared bat (Corynorhinus townsendii townsendii)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
N/A	IUCN: Species of concern; BLM: Sensitive	Yuma myotis (Myotis yumanensis)	POTENTIAL HABITAT - Potential forage habitat.	Oak Woodland, Riparian Zones
N/A	DFG: Species of special concern; BLM: Sensitive; IUCN: Species of concern; USFS: Sensitive	Pallid bat (Antrozous pallidus)	POTENTIAL HABITAT - throughout Pearson-Arastradero Preserve.	Oak Woodland, Riparian Zones
Species of concern	DFG: Species of special concern; BLM: Sensitive; IUCN: Species of concern; USFS: Sensitive	Foothill yellow-legged frog (Rana boylei)	POTENTIAL HABITAT - Potential habitat in Los Trancos Creek and tributaries. May occur on Los Trancos Trail; suitable habitat in Arastradero Creek and the unnamed tributary to Los Trancos Creek.	Los Trancos Creek, Arastradero Creek, Tributary
None	Locally unusual	BlueGrey Gnatcatcher (Polioptila caerulea)	PRESENT – Locally identified in North Coastal Scrub, coyote brush.	Arastradero Creek and Juan Bautista de Anza Trail
N/A	CNPS: Rare, threatened, or endangered in CA	Franciscan onion (Allium peninsulare var. franciscanum)	POTENTIAL HABITAT – Habitat present in oak and mixed evergreen woodland, and grasslands.	Oak Woodland, Grasslands, Evergreen Woodlands
Species of concern	DFG: Species of special concern: IUCN: Species of concern	Saltmarsh common yellowthroat (Geothlypis trichas sinuosa)	POTENTIAL HABITAT – May use Boronda Lake. Riparian habitat, John Sobey pond and Arastradero Lake.	Riparian Zones including Boronda Lake, John Sobey pond, Arastradero Lake
N/A	CNPS: Rare, threatened, or endangered in CA	San Francisco collinsia (Collinsia multicolor)	POTENTIAL HABITAT – Habitat present in oak woodland.	Oak Woodland
N/A	DFG: Species of special concern; IUCN: Species of concern	San Francisco dusky-footed woodrat (Neotoma fuscipes annectens)	PRESENT/POTENTIAL HABITAT – Known to occur along Woodrat Trail. Nesting habitat in riparian vegetation and oak woodland, forage in all habitats on site.	Woodrat Trail, restoration site near Arastradero Road, and Arastradero Creek Trail

Federal Status	California Status	Asset Name	Geographic Extent	Mapping Location
N/A	CNPS: Rare, threatened, or endangered in CA	Western leatherwood (Dirca occidentalis)	POTENTIAL HABITAT (Arastradero)/KNOWN (Foothills) – Oak woodland and riparian; Foothill woodland, mixed evergreen forest and riparian. Occurs on site along the Los Trancos and Steep Hollow Trails.	Los Trancos and Steep Hollow Trails in Oak Woodlands and Riparian areas
N/A	CNPS: Plant of limited distribution	Forget-me-not popcorn flower (Plagiobothrys myosotoides)	POTENTIAL HABITAT (Foothills)/NOT LIKELY (Arastradero) – Habitat present in chaparral.	Chaparral in Foothills
N/A	CNPS: Rare, threatened, or endangered in CA	Slender-leaved pondweed (Potamogeton filiformis)	NOT LIKELY – Possibly in Arastradero Creek/Boronda Lake and unnamed creeks in the Preserve, presumed extinct in Santa Clara County; not known from San Mateo County.	
N/A	CNPS: Rare, threatened, or endangered in CA	Congdon's tarplant (Centromadia/Hemizonia parryi ssp. Congdonii)	NOT LIKELY (Foothills)/POSSIBLE (Pearson-Arastradero) – Info pulled from CNDDB Palo Alto topo map, seeps in grassland.	
N/A	CNPS: Rare, threatened, or endangered in CA	Fragrant fritillary (Fritillaria liliacea)	NOT LIKELY (Foothills)/POSSIBLE (Pearson-Arastradero) – Info pulled from CNDDB Palo Alto topo map, seeps in grassland.	

Figure 11: Sensitive Species Known or Potentially Occurring in Foothills Park or Pearson-Arastradero Preserve.

3.4.2.2 Soils and Geology

Soil erosion occurs when soil materials are worn away and transported by wind or water. The soils that comprise Foothills Park and Pearson-Arastradero Preserve include some soil and slope combinations that represent potential erosion hazards that could be accentuated by wildland fire events that remove significant portions of vegetation or some forms of fuel treatments that disturb ground cover. Figure 12 lists the potential erosion hazards posed by soil mapping units that comprise portions of the parks. Due to the presence of several highly and moderately erodible soil types, the areas that represent significant hazards from either fire or treatment are those with slopes in excess of 15 %.

Soil Mapping Unit	Soil Name	Location	Erosion Hazard
Los Gatos-Maymen Complex (50-75% slope)	Los Gatos Gravelly Loam	Foothills Park & Pearson-Arastradero Preserve	Very High
	Maymen Rocky Fine Sandy Loam	Foothills Park	Very High
Los Gatos Clay Loam (15-30% slope)	Los Gatos Clay Loam	Foothills Park	Moderate

Soil Mapping Unit	Soil Name	Location	Erosion Hazard
Los Osos Clay Loam (15-30% slope)	Los Osos Clay Loam	Pearson-Arastradero Preserve	Moderate
Azule Clay Loam (15-30%)	Azule Loam	Pearson-Arastradero Preserve	Slight to Moderate
Cropley Clay (2-9% slope)	Cropley Clay	Foothills Park	Slight
Pacheco Clay Loam	Pacheco Clay Loam	Pearson-Arastradero Preserve	Slight
Pleasanton Loam	Pleasanton Loam	Pearson-Arastradero Preserve	Slight

Figure 12: Soil Types in Foothills Park and Pearson-Arastradero Preserve.
Derived from STATSGO2 data and research from City of Palo Alto Trail Management Plans.

4 FUEL MANAGEMENT IN CITY PARKS

Not every area identified as a potential fire hazard can be modified to produce low-intensity fires. Not only would this be too costly, but environmental impacts would also be unacceptable. Fires that burn in un-treated areas will not benefit from treatment elsewhere. The exception is that the fire may be contained in the treated area, thereby never reaching the untreated area.

4.1 Identifying Potential Treatment Areas

Selection of pre-fire fuel treatment areas is based on the probability of the event and the potential damage of that event. Factors taken into consideration are:

- **Need for enhanced access and egress**: Actions to promote life safety and efficient emergency response is of utmost importance. Roadside treatments that aid safer access and evacuation have a high likelihood and magnitude of benefit.

- **Ignition locations:** Treatments are located either where ignitions are likely to occur or could spread into (e.g. a grassy spot near a road, or near a barbeque). Even where an area would burn with great ferocity, if there is only a remote chance of ignition, it has a lower treatment priority.

- **Adjacency to improvements or other sensitive values at risk from wildfire:** The closer the fuel source is to a structure, heavily used area, or environmentally sensitive area, the higher the treatment priority. Therefore, an area in the interior of a Park/Preserve, well removed from other vulnerabilities, should not be treated with the same priority as a hazardous situation near valuable and/or vulnerable resources.

- **Propensity of the treatment to aid containment:** Treatments that facilitate access or create locations where containment is likely to be successful have greater benefit because they improve fire suppression success. Also, a fire that is easy to contain will be more likely to have fewer environmental impacts from the suppression action itself.

In the end, the most intense fire, and possibly the largest potential fire size, may not be highest on the treatment priority list. This may be because the likelihood of the event coupled with the potential damage from the fire would not yield the highest risk.

4.2 Establishing Project Objectives

Projects are justified by various objectives, spanning the need to keep fires from crossing boundaries, minimizing damage to developed areas, and minimizing damage to natural resources. Others comply with regulations, which themselves are intended to increase access, facilitate fire suppression and minimize resource damage.

The following table (Figure 13) is an outline of project goals and actions:

Project Goal	Actions
Maintain ability for safe access and egress and refuge during suppression activities	• Roadside and driveway fuel modification to reduce fire intensity to allow for firefighting vehicles access and ensure safe passage for staff and visitors to pre-determined safety zones. • Improve access to potential wildfire locations to increase effectiveness of firefighting resources (road realignments, access upgrades) • Identify areas for potential use for firefighter safety and refuge during a fire (safety zones)
Minimizing damage to developed areas	• Reduce potential for ember production, • Manage fuels along borders with structures, anywhere around structures (within 100 feet) • Retrofit structures to make them more ignition-resistant • Enhance firefighting effectiveness • Reduce fuels around other facilities at risk (e.g. communications equipment, high use recreation areas)
Reduce damage to structures and developed areas from wildfire near structures	• Manage fuels per Defensible Space Guidelines to reduce flame length to 2 feet within 30 feet of structures
Reduce potential for ignitions	• Roadside fuel treatments • Reduce fuels around barbeque sites and selected electrical transmission lines • Ensure mechanical equipment has features to minimize ignitions • Conduct fuel management in a manner that prevents ignitions
Facilitate containment and control of a fire	• Strategically compartmentalize fuels in order to facilitate containment and control • Modify fuels to reduce fire intensity and allow firefighters better access to the fire, slow spread of fire and make firefighting actions more effective, • Modify fuels to allow for backfires
Reduce the chance of damage to life and property by keeping fire from crossing boundaries – Participate in cooperative projects with adjacent landowners	• Fuel management to compartmentalize the landscape • Fuel management along the borders of the Park/Preserve • Modification of the volume or structure of the fuels to reduce chance of ember production • Modification of the volume or structure of the fuels to enhance firefighting effectiveness
Minimize damage to natural resources	• Conduct pre-treatment surveys for sensitive species • Follow best management practices during fuel management • Fuel management around fire-sensitive areas to reduce fire intensity • Use of modified fire suppression in sensitive areas
Fuel modification for ecosystem health	• Reduce invasive species • Perform selected prescribed burns to promote fire-adapted native species

Figure 13: Project Goals and Actions.

4.3 Current Fuel Management Program

Fuel Management is not new in the two parks. The two parks have a long history of managing vegetation to both promote fire safety and to enhance natural resources (Figures 14 and 15). In some cases, projects attain both goals. Previous projects in Foothills Park encompass discing along park boundaries, grazing with goats in Las Trampas Valley, maintenance of a mowed fuel break along various locations, including a broad fuel break sometimes 200-ft wide along Trappers Ridge, and more narrow fuel breaks along the Madrone Fire Road, Shotgun Fire Road, Pony Tracks Fire Road, and around Station 8. Fuel management in Pearson-Arastradero includes discing along park boundaries, mowing 14 different broad areas within the park, and maintenance of vegetation along park roads. Figures 16 and 17 highlight specific mowing and grazing areas for both parks from 2001 to 2008.

Grading (of the fire roads) has been a component of the contract between Van der Steen General Engineering and Palo Alto for annual firebreak maintenance.

Grading has been performed as part of this contract only in the last three years; low annual rainfall and erosion has not warranted grading. To minimize grading work, city employees from all departments are strictly prohibited from driving the bare soil roadways that do not have asphalt or compacted rock. Grading, as a component of the contract, is specified as only when necessary.

Discing has been performed by City staff for the last 7+ years. After trials with several methods, the City found that a two discing cycles work best. The first cycle is performed when the threat of spring rains has diminished, drainages or low areas are dry, and annual grasses are still green. The depth of discing is less than 6-inches, and causes a disruption of the growth of the annual grasses (less biomass). The second cycle of discing is after the annual grasses have cured/dried but there is still some soil moisture. Discing is full depth or up to 10-inches. Completely dry soil makes traction nearly non-existent, which is a safety hazard for the equipment operator, and produces copious amounts of dust to the surrounding area during both discing and grading operations.

Mowing is routinely conducted during the early summer by City staff for resource enhancement. Figure 16 indicates the areas within Pearson-Arastradero Preserve that are mowed at least annually. Approximately 200 acres are routinely mowed. Outside of the areas mowed for resource enhancement, large areas are mowed annually in Foothills Park as part of a fuel break. A fuel break is mowed on Trappers Trail, varying from 100-ft to 300-ft in width. Another area routinely mowed is along Pony Tracks Fire Road from the intersection of Los Trancos Trail to Page Mill Road. Most areas are less than 100-ft but the area between Pony Tracks and Los Trancos Trail can reach 300-ft in width.

Grazing with sheep and goats is a relatively new component of the fuel management program within the City of Palo Alto Parks. Approximately 5 acres were grazed in 2007 in Las Trampas Valley in Foothill Park, the picnic areas near the road.

Defensible Space is maintained near existing structures in Foothills Park and Pearson-Arastradero Preserve. This employs the use of hand labor to limb trees and shrubs, cut grass, landscape with fire-resistant plants, and irrigate selected plants.

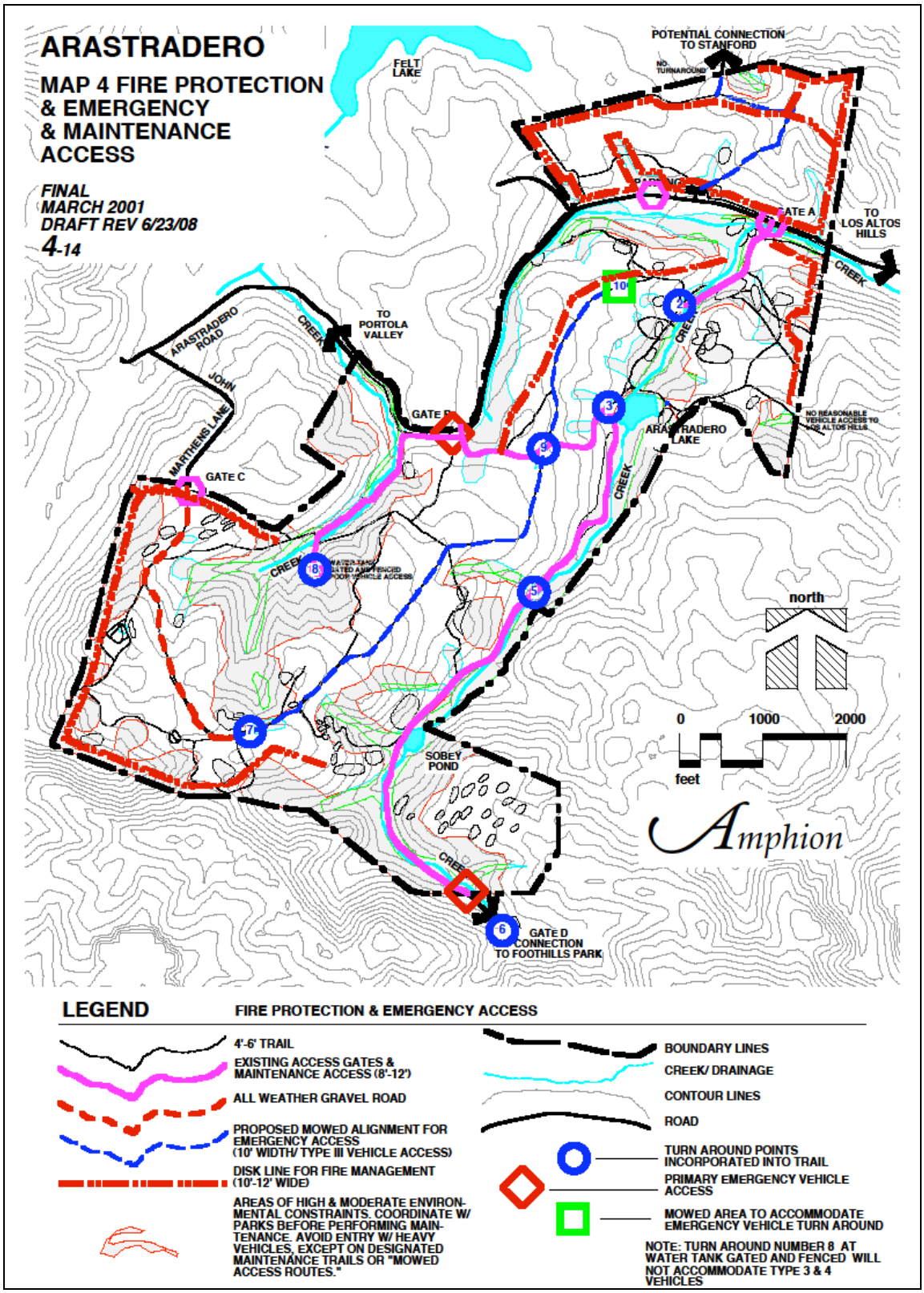

Figure 14: Pearson-Arastradero Preserve Current Fuel Management Areas.

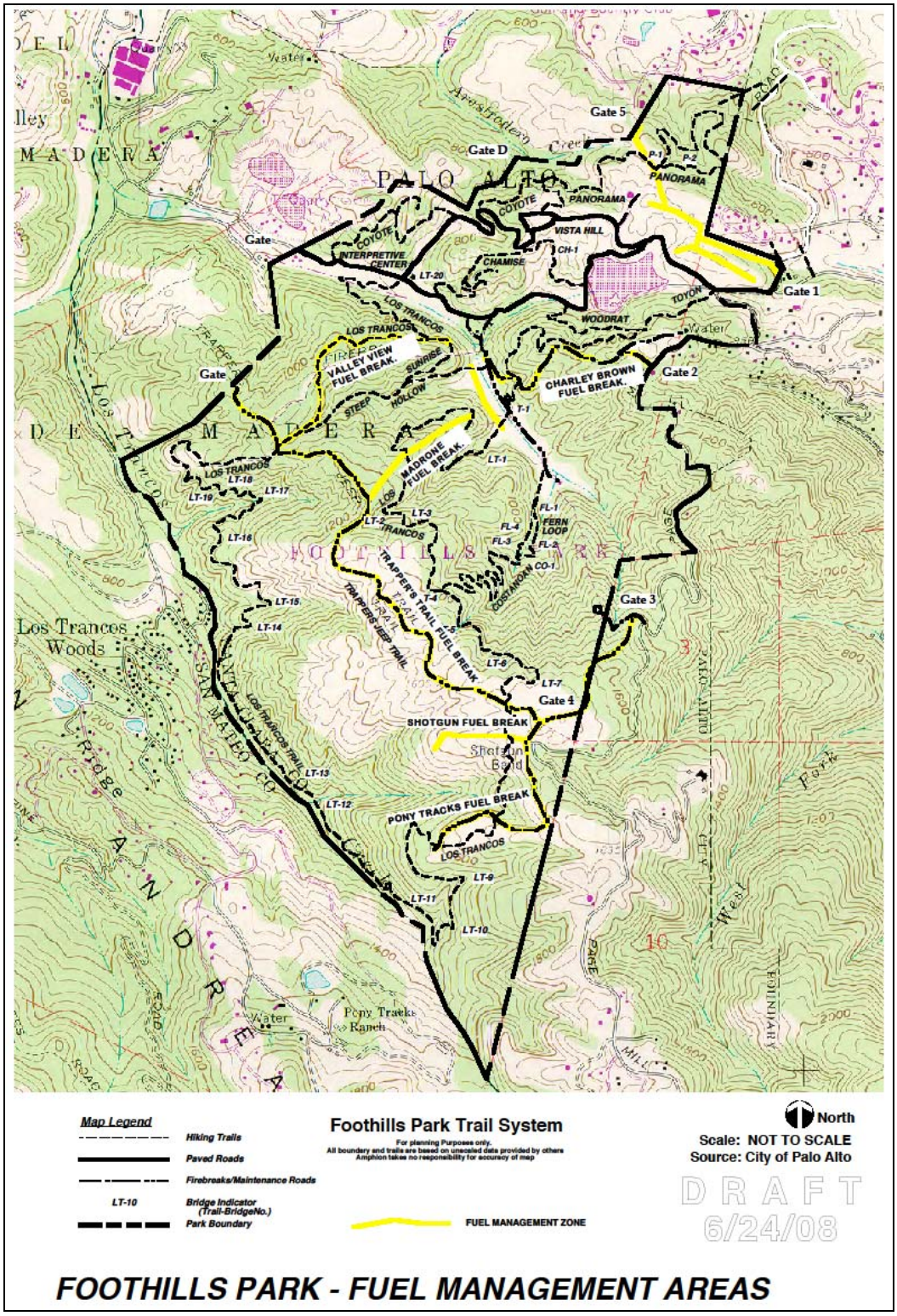

Figure 15: Foothills Park Current Fuel Management Areas.

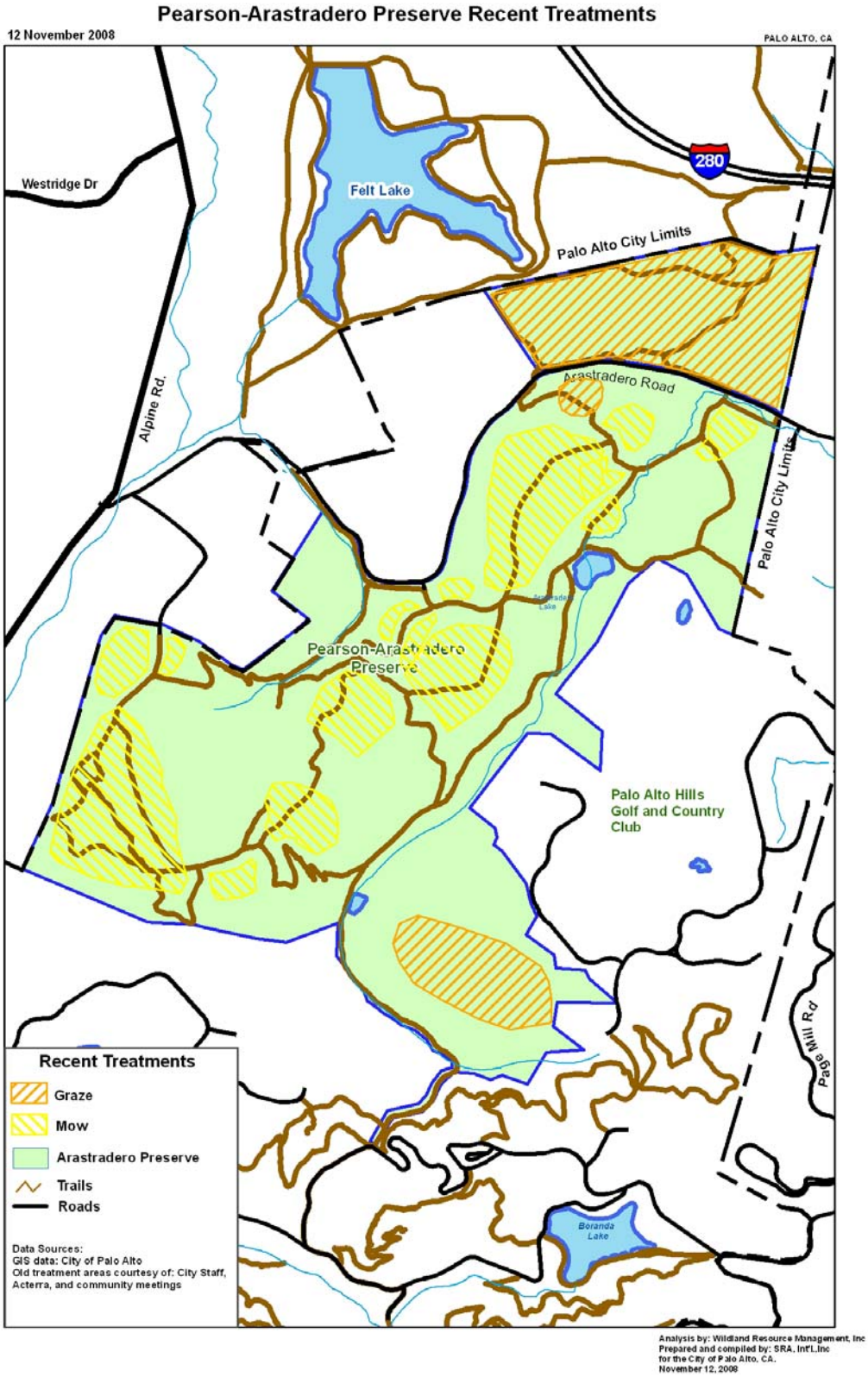

Figure 16: Recent Treatments in Pearson-Arastradero Preserve.

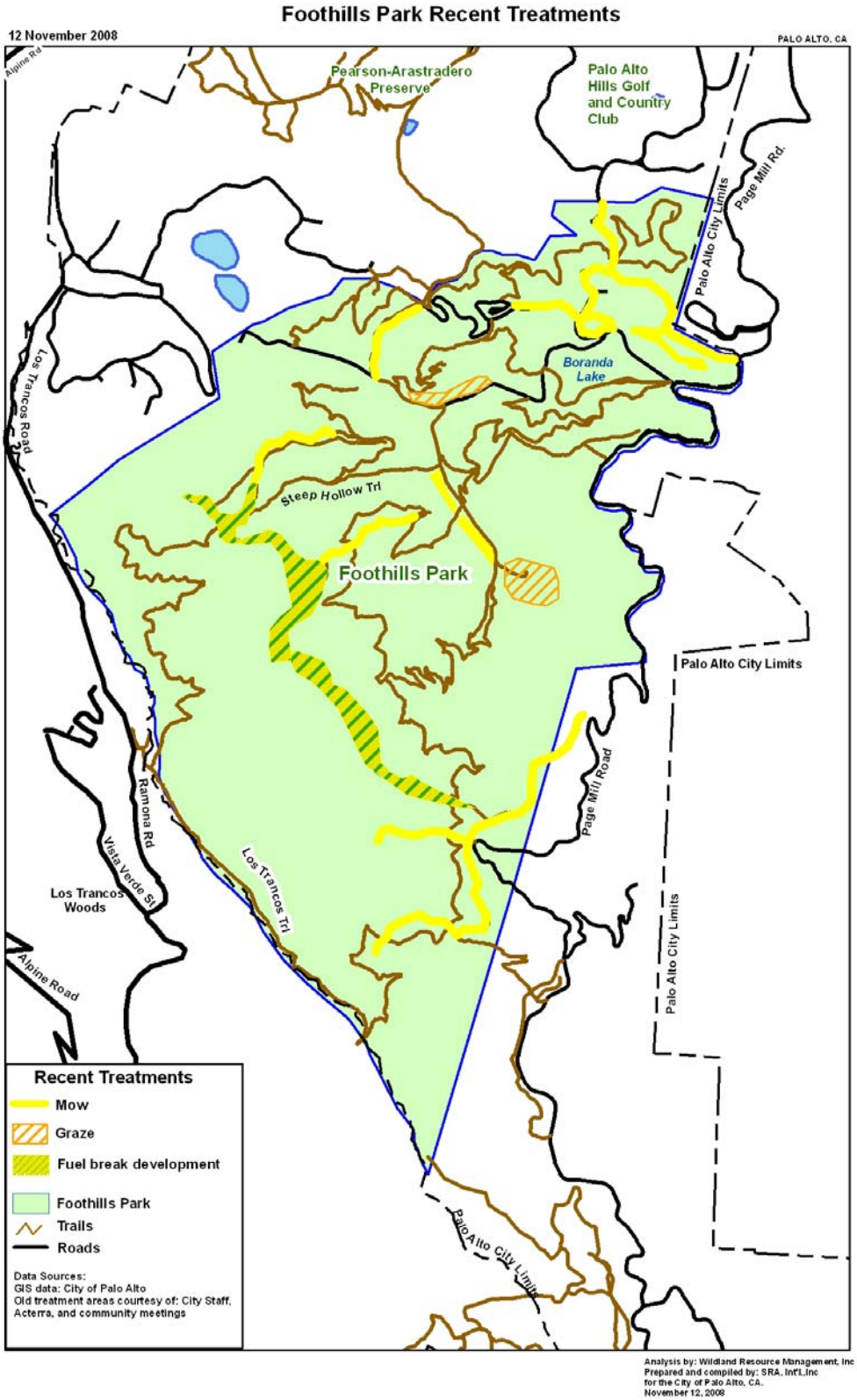

Figure 17: Recent Treatments in Foothills Park.

4.4 Project Description

4.4.1 Scope of Recommended Fuel Management Projects

The scope of the projects encompasses the two parks in the foothills of Palo Alto: Foothills Park and Pearson-Arastradero Preserve. In addition, treatments along four roads extend outside the parks themselves but are confined to City boundaries or rights-of-ways: Page Mill Road, Arastradero Road, Los Trancos Road, and Skyline Boulevard.

4.4.2 Project Description Summary

Fuel management is proposed on 330 acres of Foothills and Arastradero Parks to protect lives, enhance the safety of improvements in and around the parks and to enhance ecosystem health. Fuel management falls into the following categories: roadside treatments along potential evacuation corridors, creation and maintenance of firefighter safety zones, creation and maintenance of defensible space around structures in the parks, and treatments to aid containment of fires in and within the park.

Treatments are performed on a rotational basis with intervals of approximately every five years, with an anticipated area of approximately 100 acres treated annually after the initial treatments are performed.

Vegetation types that will be treated include:

- Grasslands
- North Coastal Scrub
- Chaparral
- Oak Woodland
- Riparian Woodland (limited areas and limited treatment only)

4.4.3 Project Objectives

Projects are justified by various objectives, spanning the need to keep fires from crossing boundaries, minimizing damage to developed areas and minimizing damage to natural resources. Others comply with regulations, which themselves are intended to increase access, or facilitate fire suppression.

A variety of projects reduce the chance of damage to life and property. There are projects that keep fire from crossing boundaries, which could be in the form of fuel management to compartmentalize the landscape, or fuel management along the borders of the parks, or modification of the volume or structure of the fuels to reduce chance of ember production or enhance firefighting effectiveness.

Other projects focus on minimizing damage to developed areas, and may be distinct from efforts to reduce fire size, particularly where fire growth is in the wildland. Methods to minimize damage to structures would encompass the following actions: stop ember production, manage fuels along borders with structures, anywhere around structures (up to 100 feet), retrofit structures to make them more ignition-resistant, and enhance firefighting effectiveness.

While fire is a natural force in the foothills of Palo Alto, fuel management also aims to minimize damage to natural resources within the City of Palo Alto. This may include fuel management around sensitive areas such as riparian corridors, or use of fire where needed for resource management. The skillful application of controlled burning would be justified where fire exclusion is harmful, for example, where species require fire for seed germination, or where native grasslands experience brush encroachment, or where an unnatural accumulation of understory fuels (both live and dead) develops. Enhancing firefighting effectiveness, so that fire response can better apply or restrain fire's impacts on sensitive natural resources may further justify projects.

Finally, some projects are further justified by local regulations. For example, the City of Palo Alto regulations require installation and maintenance of 100-ft defensible space around structures, fuel management for a minimum width of 10-ft along roads, and maintenance of 13.5-ft high vertical clearance over roadbeds.

4.4.4 Priority

Fuel management is not possible, nor advisable, on every acre of the wildlands in the two City parks. Not even all the areas of high hazard can be treated with a reasonable level of funding, so prioritization needs to occur. Finding the most effective location and scope is a challenge because of uncertainties around relative fire hazard, erosion, potential, ignition potential, cost of implementation, environmental impacts of the management itself, and social values attached to the project location.

Selection of fuel treatment areas is based on several factors, including the probability of the event, the potential damage of that event, ignition locations, adjacency to improvements or other sensitive values at risk from wildfire, and the propensity of the treatment to aid containment.

4.4.5 Project Locations

The following table (Figure 18) and maps (Figures 19 and 20) summarize the project locations. Each treatment location was selected to achieve a specific objective. Many treatments are associated with roadsides, structures and City Park/Preserve boundaries. Treatments for containment are strategically located at ridgetops, in places that have access, are not too steep for mechanical treatments, avoid riparian areas, and are not prone to soil erosion. Sections 4.4.7 through 4.4.13 provide additional information regarding project treatments by project type.

Figure 18: Listing of Project Locations.

Designation	Project	Description
Life Safety		
Foothills Park		
F.F1	Firefighter Safety Zone 1	Trappers Ridge & Los Trancos Trail
F.F2	Firefighter Safety Zone 2	Trappers Ridge & Madrone Fire Road
F.F3	Firefighter Safety Zone 3	Trappers Ridge high point
F.F4	Firefighter Safety Zone 4	Trapper Ridge south end

Designation	Project	Description
F.E1	Evacuation Route - Page Mill Road	Within PA City from Arastradero to southern Pony Tracks
F.E2	Evacuation Route - Park Road	Entrance to Maintenance Yard Las Trampas Valley
F.E3	Evacuation Route - Park Northwest	Interpretive Center to the 600-700 block of Los Trancos Road
F.E4	Evacuation Route - Park Northeast	Boronda Lake to Alexis Drive
F.E5	Secondary Evacuation Route - Wildhorse Valley	Wildhorse Valley from Towle Campground to Las Trampas Valley
Pearson-Arastradero		
A.E1	Evacuation Route – Arastradero Road	Arastradero Road
Off-site		
PA.1	Evacuation Route Page Mill Road	
PA.2	Evacuation Route Arastradero Road	
PA.3	Evacuation on Los Trancos Road between Santa Clara County boundary and Oak Forest Court	
PA.4	Evacuation Route Skyline Blvd.	
Structure and Infrastructure Protection		
Foothills Park		
F.D1	Defensible Space	Entry Gate and Restroom
F.D2	Defensible Space	Station 8
F.D3	Defensible Space	Restrooms at Orchard Glen
F.D4	Defensible Space	Interpretive Center
F.D5	Defensible Space	Maintenance Shop Complex
F.D6	Defensible Space	Boronda Pump Station at Campground
F.D7	Defensible Space	Park Tank
F.D8	Defensible Space	Boranda Water Tank
F.D9	Defensible Space	Dahl Water Tank
Pearson-Arastradero		
A.D1	Defensible Space	Gateway Building and Restrooms
A.D2	Defensible Space	Pump Station

Designation	Project	Description
A.D3	Defensible Space	Corte Madera Water Tank
Ignition Prevention		
Foothills Park		
F.I1	Ignition Prevention	Lakeside Picnic Area
F.I2	Ignition Prevention	Shady Cove Picnic Area
F.I3	Ignition Prevention	Encinal and Pine Gulch Picnic Areas
F.I4	Ignition Prevention	Orchard Glen Picnic Area
F.I5	Ignition Prevention	Oak Grove Group Picnic Area
F.I6	Ignition Prevention	Towle Camp
Containment		
Foothills Park		
F.C1	Containment	Trappers Trail
F.C2	Containment	Pony Tracks south of Trappers Ridge
F.C3	Containment	Pony Tracks north of Trappers Ridge
F.C4	Containment	Bobcat Point
F.C5	Containment	North of Entry Gate
F.C6	Containment	Valley View Fire Road
Pearson-Arastradero		
A.C1	Containment	Property boundary adjacent to Liddicoat
A.C2	Containment	Property boundary adjacent to Stanford and Portola Pastures
A.C3	Containment	Redtail Loop Area
A.C4	Containment	Property boundary adjacent to Paso del Robles
A.C5	Containment	Property boundary Laurel Glen - north
A.C6	Containment	Property boundary Laurel Glen - south
A.C7	Containment	Property boundary west of Meadow Lark Trail
A.C8	Containment	Property boundary adjacent to former private research facility
A.C9	Containment	Property boundary adjacent to John Marthens Lane

Designation	Project	Description
A.C10	Containment	Arastradero Creek (to Juan Bautista trail)
A.C11	Containment	Meadow Lark to Juan Bautista Trail
A.C12	Containment	Meadow Lark south
A.C13	Containment	Bowl Loop Trial
A.C14	Containment	Arastradero to Rx fire area
A.C15	Containment	Acorn Trail
A.Rx1	Containment	Juan Bautista Prescribed fire north
A.Rx1	Containment	Acorn Trail Prescribed fire south

Figure 18: Listing of Project Locations.

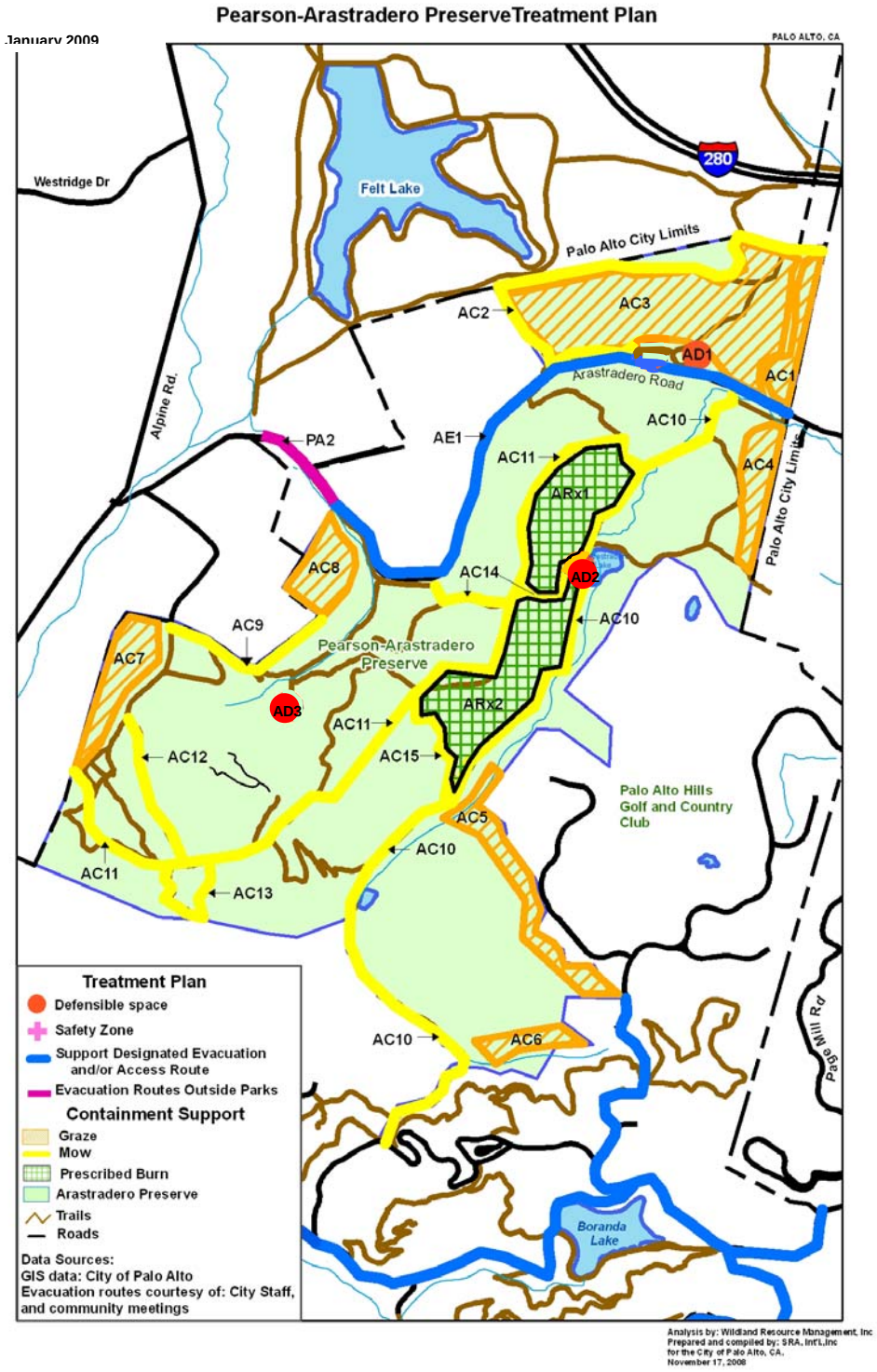

Figure 19: Proposed Treatment Locations in Pearson-Arastradero Preserve.

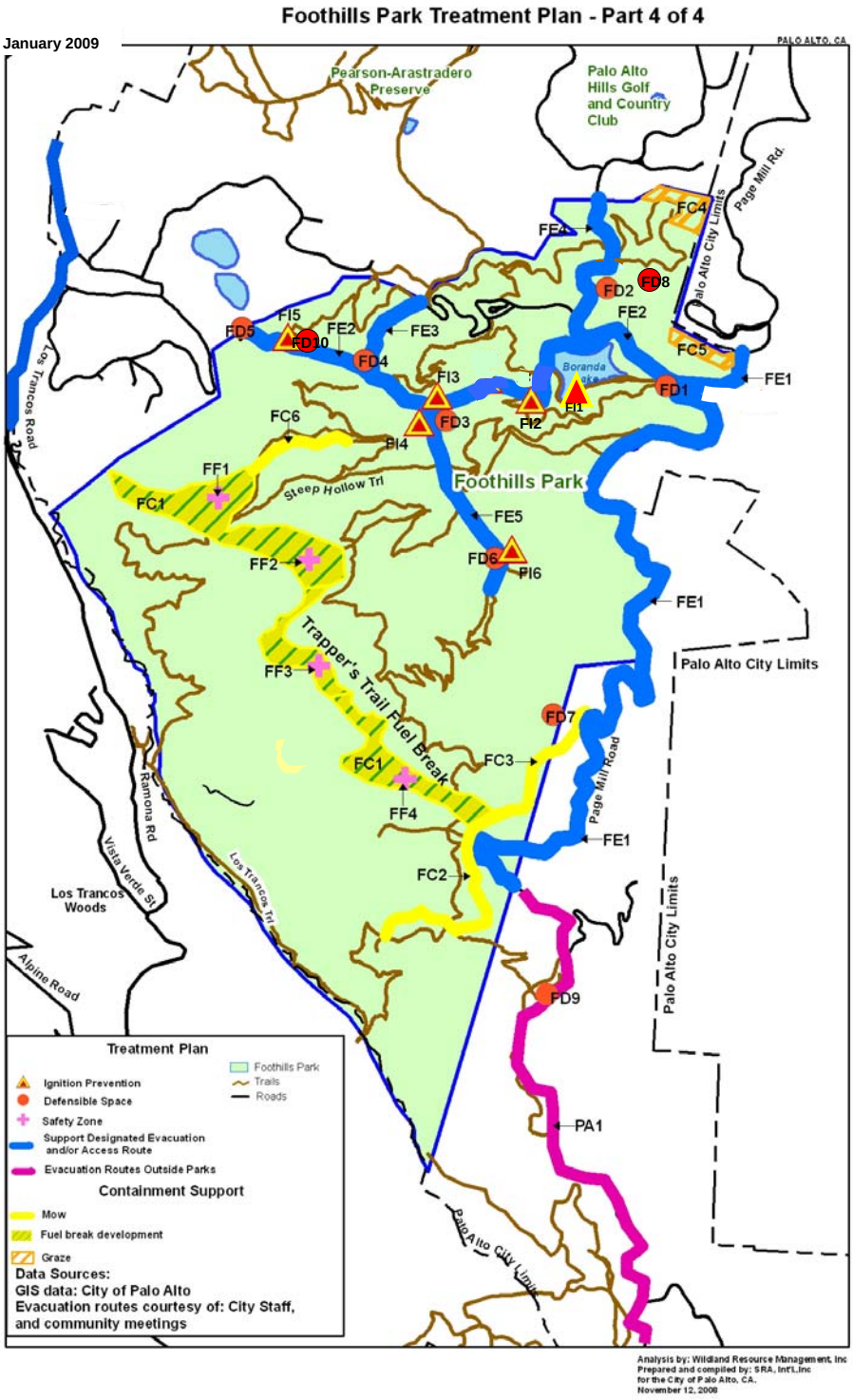

Figure 20: Proposed Treatment Locations in Foothills Park.

4.4.6 Project Dimensions and Post-Treatment Standards

The dimensions of the treatments follow in the table below (Figure 21). The treatments that will occur within the project area depend on the vegetation type and treatment method. The post-treatment standards for each treatment type and a description of the treatment methods are also included.

Project Types	Dimension	Treatment Frequency	Comments
Roadside Treatments			
Major evacuation routes	30 feet on both sides of pavement edge	Rotate 3-5+ years depending on fuel type	Annual for first 10 feet with grass fuels
Secondary evacuation routes	15 feet on both sides of pavement edge	Rotate 3-5+ years depending on fuel type	
Defensible Space	100-ft from structure	Annual	Follow-up treatments may not be required annually
Ignition Prevention	10-ft from barbeque	Annual	
Firefighter Safety Zones	100-ft radius	Annual	
Containment Fuel Breaks			
Area treatment	Within 300-ft of ridgetop of Trappers Ridge	Rotate 3-5+ years	
	Areas designated goat grazing within park	Rotate 3-5+ years	
	Two designated potential prescribed burn units per map	Rotate 3-5+ years	
Perimeter treatment			
Brush/understory	In designated areas within 300 feet of park boundary	Rotate 3-5+ years	
Grass	Discing or mowing 15-45 feet from park boundary, as practical	Annual	
Eucalyptus Removal	Individual tree removal	One time	Follow up to ensure no stump sprouts

Figure 21: Treatment Methods and Intervals.

4.4.7 Roadside and Driveway Fuel Modification for Safe Access and Egress

4.4.7.1 Specific Goal of Action

The most important goal for this set of projects is to reduce fire intensity near roads to allow firefighting vehicles to pass and ensure safe passage for staff and visitors to pre-determined safety zones, or safe locations out of the parks. In addition, the projects outside of the City parks/preserves are aimed at facilitating access and egress between different portions of Palo Alto's wildland urban interface.

4.4.7.2 Location and Description of Projects

Projects would be located along roads and driveways of varying width, depending on whether the road is a major or secondary evacuation route.

- 10 feet where flames are predicted to be less than eight feet in length (generally in grassy locations and in oak woodlands), such as along Wildhorse Valley in Foothills Park.

- 30 feet from pavement edge along major evacuation routes that are Page Mill Road, Los Trancos Road, Arastradero Road, Skyline Boulevard, and the road from the Foothills Park Entry Gate to the Maintenance Shop.

Palo Alto should work cooperatively with Los Alto Hills, the Town of Portola Valley, CalTrans, San Mateo County, Santa Clara County, and other agencies to ensure vegetation along Page Mill Road, Arastradero Road, Los Trancos Road, and Skyline Blvd. are mowed, trees are maintained, and other treatments are implemented and sustained.

Figure 22 lists the location and description of proposed safe access and egress projects. Figure 23 provides a graphical representation of major evacuation routes that are external to the two preserves.

Designation	Project	Description	Distance	Treatment Method
Foothills				
F.E1	Page Mill Road	Within PA City from Arastradero to southern Pony Tracks	13,855 ft	mowing, grazing, hand labor
F.E2	Evacuation Route - Park Road	Entrance to Maintenance Yard Las Trampas Valley	7,211 ft	mowing, grazing, hand labor
F.E3	Evacuation Route - Park North west	Interpretive Center to the 600-700 block of Los Trancos Road	1,263 ft	mowing, grazing, hand labor
F.E4	Evacuation Route - Park North east	Boronda Lake to Alexis Drive	2,618 ft	mowing, grazing, hand labor

F.E5	Secondary Evac Route	Towle Campground to Las Trampas Valley	2,818 ft	mowing, grazing, hand labor
Pearson-Arastradero				
A.E1	Evacuation Route	Arastradero Road	6,337 ft	mowing, grazing, hand labor
Off-site				
PA.1	Page Mill Road	From Foothill Park South to Skyline Blvd.	11,980 ft	mowing, grazing, hand labor
PA.2	Arastradero Road	From Page Mill to Arastradero Pk, and from Arastradero Pk to Los Trancos	940 ft	mowing, grazing, hand labor
PA.3	Evacuation Route - Los Trancos	Los Trancos Road between Santa Clara County boundary and Oak Forest Court	4,406 ft	mowing, grazing, hand labor
PA.4	Skyline Blvd.	Skyline Blvd.[3]	7,907 ft	mowing, grazing, hand labor

Figure 22: Listing of Project Locations for Evacuation and Access.

[3] *CalTrans is responsible for treatments within the designated right-of-wa,y which is variable in width (generally 2-30-ft). Regardless the City of Palo Alto is committed to conduct treatments on City lands adjacent to the road.*

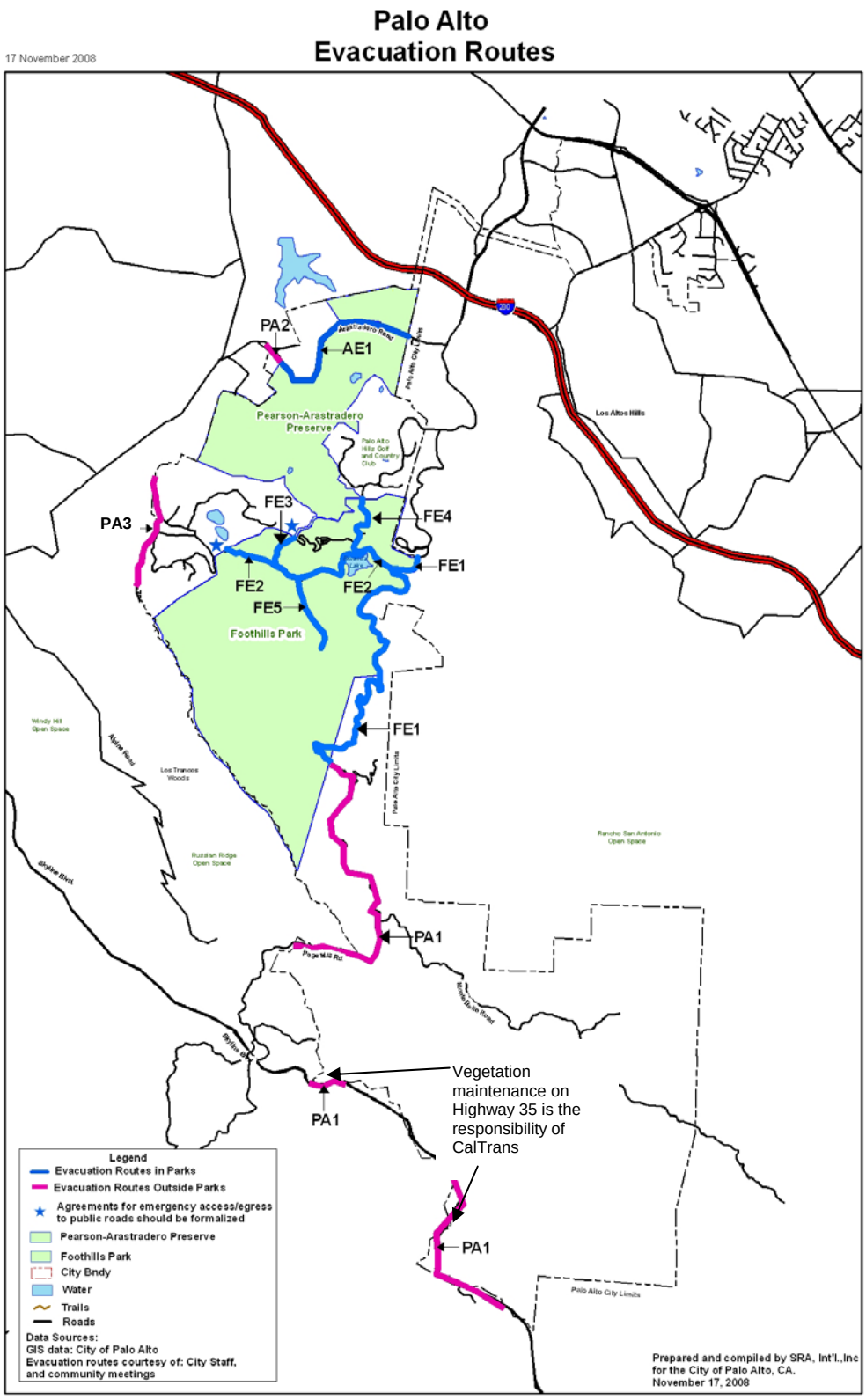

Figure 23: Evacuation Routes External to Foothills Park and Pearson-Arastradero Preserve.

4.4.8 Fuel Modification for Firefighter Safety Projects

4.4.8.1 Specific Goal of Action

This project goal is specific to the safety of firefighters during emergency response. In times of emergency, a safe refuge comprised of low fuels is vital.

4.4.8.2 Location and Description of Projects

These projects would install and maintain four firefighter safety zones within Foothills Park. Specifically, they are located on the Trappers Trail fuel break, at Los Trancos Trail, Madrone Fire Road, at the high point on Trappers Ridge and the south end of Trappers Ridge.

Designation	Project	Description	Acreage	Treatment Method
Foothills				
F.F1	Firefighter Safety Zone 1	Trappers Ridge & Los Trancos Trail	> 1 acre	mow, graze
F.F2	Firefighter Safety Zone 2	Trappers Ridge & Madrone Fire Road	> 1 acre	mow, graze
F.F3	Firefighter Safety Zone 3	Trappers Ridge high point	> 1 acre	mow, graze
F.F4	Firefighter Safety Zone 4	Trapper Ridge south end	> 1 acre	mow, graze

Figure 24: Listing of Project Locations for Fire Fighter Safety Fuel Modification.

4.4.9 Structure and Infrastructure Projects – Defensible Space

4.4.9.1 Specific Goal of Action

- Reduce damage to structures, developed areas and critical infrastructure from wildfire by reducing flame length to two feet within 30 feet of structures by managing fuels per Defensible Space Guidelines in Section 1.6.8. In some cases, treatment will need to extend to 100 feet in order to reduce flames to two feet within thirty feet of a structure.

- Minimize negative effects of fuel manipulation on wildlands

- Reduce damage to wildlands from wildfire

4.4.9.2 Location and Description of Projects

This vital suite of projects is located generally within 100 feet from structures that are currently in use, which includes entry gates, interpretive centers, restrooms, and maintenance or infrastructure facilities. Some of the projects are to protect the water and electrical services provided to the park. In addition, fire-resistant features should be installed when these structures are remodeled or repaired. The structures in the Parks/ Preserve can serve as a demonstration of the types of actions that should occur in private yards as part of compliance with local codes and ordinances. The following lists specify which structures need defensible space established and maintained annually:

The area around structures is currently treated, however the actions recommended will bolster survivability of structures.

Designation	Project	Description	Acreage	Treatment Method
Foothills				
F.D1	Defensible Space	Entry Gate and Restrooms	> 1 acre	hand labor
F.D2	Defensible Space	Boranda Water Tank	> 1 acre	hand labor
F.D3	Defensible Space	Restrooms at Orchard Glen	> 1/2 acre	hand labor
F.D4	Defensible Space	Interpretive Center	> 1 acre	hand labor
F.D5	Defensible Space	Maintenance Complex	> 1 acre	hand labor
F.D6	Defensible Space	Boronda Pump Station at Campground	> 1 acre	hand labor
F.D7	Defensible Space	Park Tank	> 1/2 acre	hand labor, grazing
F.D8	Defensible Space	Station 8	> 1/2 acre	hand labor, grazing
F.D9	Defensible Space	Dahl Water Tank	> 1/2 acre	hand labor, grazing
F.D10	Defensible Space	Oak Grove Restrooms	> 1/2 acre	hand labor, grazing
Pearson-Arastradero				
A.D1	Defensible Space and Restrooms	Gateway Building	> 1 acre	hand labor, mowing

A.D2	Defensible Space	Corte Madera Pump Station	> 1 acre	hand labor, mowing
A.D3	Defensible Space	Water Tank	> 1 acre	hand labor, mowing

Figure 25: Listing of Project Locations for Defensible Space.

4.4.10 Ignition Prevention Fuel Management Projects

4.4.10.1 Specific Goal of Action

Ignitions from barbeques may occur in Foothills Park. Ignition prevention relies upon fuel management, coupled with education, signage, and enforcement of park rules regarding fire safety. Under extreme fire weather conditions, the parks may be closed to the public. The fuel management will consist of the following:

- Follow standards for defensible space for a 30-ft radius from the barbeque site.
- Remove vegetation to create a non-combustible zone for a 10-ft radius from the barbeque site.

4.4.10.2 Location and Description of Projects

Designation	Project	Description	Acreage	Treatment Method
Foothills				
F.I1	Ignition Prevention	Shady Cove Picnic Area	> 1/4 ac	hand labor
F.I2	Ignition Prevention	Encinal Picnic Area	> 1/4 ac	hand labor
F.I3	Ignition Prevention	Pine Gulch Picnic Area	> 1/4 ac	hand labor
F.I4	Ignition Prevention	Orchard Glen	> 1/4 ac	hand labor
F.I5	Ignition Prevention	Oak Grove Group Picnic Area	> 1/4 ac	hand labor
F.I6	Ignition Prevention	Towle Camp	> 1/4 ac	hand labor

Figure 26: Listing of Project Locations for Ignition Prevention.

4.4.11 Fuel Modification for Containment Ease

4.4.11.1 Specific Goal of Action

The specific goal of modifying fuels in the two parks is to compartmentalize fuels in order to facilitate the containment and control of a fire. The treatment areas are positioned in strategic locations, usually on a

ridgetop, with access, avoiding areas that would preclude the use of mechanical equipment such as steep slopes or riparian areas. Fuels are modified to reduce fire intensity and thus allow firefighters better access to the fire, making firefighting actions more effective. Fuel modification also creates more opportunities to backfire, which occurs during wildfires where fire suppression crews create large firebreaks in advance of the fire front. Fuel modification can also slow the spread of a fire, further enhancing fire control efforts. Where trees abut grasslands in the new fuel breaks, it is especially important to limb trees and remove shrubby understory from trees along the edge of the forest canopy in order to break vertical continuity between grass and tree canopy. This action will remove the "ladder fuels" that promote crown fires and hinder fire containment.

4.4.11.2 Location and Description of Projects

In Pearson-Arastradero, the projects entail discing and mowing along the grassy perimeter of the preserve, and grazing in the shrubby areas that abut residences. Grazing of shrubby areas near residences need not occur every year, but rather on an approximate three-year rotation. Strips of grass along selected trails are likewise recommended for mowing to enhance containment and access. Two prescribed fires are recommended in the interior of the preserve as another means to remove fuels to reduce wildfire intensity and aid containment during a wildfire.

In Foothills Park, a series of fuel breaks are recommended in shrubby fuels. In the fuel breaks, a rotation of treatments is recommended. The fire roads would be graded annually, and grass mowed within 10-30 feet of the road. Additional mowing/brush cutting would extend to the break in topographic slope, which could be located as far away from the road as 200-ft. This type of mowing would occur in any one location approximately every 3 years; the intent is to maintain the area in a mixture of grass with less than 30 percent canopy cover of shrubs. While treatments may vary over time, the recommended rotation is between rest, mowing/brush cutting and grazing.

Designation	Project	Description	Acreage or Distance	Treatment Method
Foothills				
F.C1	Containment	Trappers Trail	72.51 acres	mowing, grazing
F.C2	Containment	Pony Tracks south of Trappers Ridge	2,975 ft	mow annually 10-ft on either size of road, use a brush hog (or grazing animals) to mow areas to the break in slope both under wooded canopy and in grasslands with cover of coyote brush greater than 30%
F.C3	Containment	Pony Tracks north of Trappers Ridge	2,461 ft	mowing, grazing
F.C4	Containment	Bobcat point	5.28 acres	graze with goats

F.C5	Containment	North of entry Gate	3.47 acres	graze with goats
F.C6	Containment	Valley View Fire Trail	1,459 ft	mowing
Pearson-Arastradero				
A.C1	Containment	Property boundary adjacent to Liddicoat	5.39 acres	grazing, mowing
A.C2	Containment	Property boundary adjacent to Stanford and Portola Pastures	5,371 ft	grazing, mowing
A.C3	Containment	Within Redtail Loop Trail, to entire eastern boundary of Preserve	48.72 acres	grazing
A.C4	Containment	Property boundary adjacent to Paso del Robles	7.71 acres	grazing
A.C5	Containment	Property boundary Laurel Glen - north	11.22 acres	grazing
A.C6	Containment	Property boundary Laurel Glen - south	4.05 acres	grazing
A.C7	Containment	Property boundary west of Meadow Lark Trail	9.71 acres	grazing, mowing
A.C8	Containment	Property boundary adjacent to 1791 Arastradero Rd.	8.08 acres	grazing (mowing is not possible)
A.C9	Containment	Property boundary adjacent to John Marthens	1,726 ft	mowing
A.C10	Containment	Arastradero Creek to Arastradero Road	10,222 ft	mowing, hand labor near riparian zone
A.C11	Containment	Meadow Lark to Juan Bautista Trail	8,893 ft	mowing
A.C12	Containment	Meadow Lark	1,569 ft	mowing
A.C13	Containment	Bowl Loop	1,388 ft	mowing
A.C14	Containment	Arastradero to extended split RX1 and RX2	1,830 ft	mowing
A.C15	Containment	Acorn Trail	1,218 ft	mowing

Figure 27: Listing of Project Locations for Containment Ease.

4.4.12 Fuel Modification for Ecosystem Health

4.4.12.1 Specific Goal of Action

Only a few projects that benefit ecosystem health as their primary justification have been identified in this phase; however, many of the other projects enhance natural resources while achieving other management goals. In all cases, the goal of the action is to restore a species distribution and volume of biomass to a condition of effective fire suppression through grazing and prescribed fire.

The City should conduct fuel modification to reduce the invasion of coyote bush into grasslands and thus reduce expected heat output. The project located along Trappers Trail consists of mowing chaparral on a rotational basis every two-to three years. This will release native grasses, produce more food for wildlife and provide diversity of age and vegetation structure. Another project is to re-introduce fire in the grasslands of Pearson-Arastradero through prescribed burning a selected interior area on a rotational basis. In both cases, the objectives are to maintain grasslands and restore the native pattern of vegetation on the landscape. A third project to enhance ecosystem health is to graze, with sheep or goats, broad areas that are currently being mowed for grass and invasive weed management.

Other fuel management projects also enhance ecosystem health. Reducing the amount and height of understory shrubs creates a vegetative structure that is more open at the forest floor, with less biomass and is vertically discontinuous; this mimics the pre-fire-suppression era. This would be done either with goat herds or with hand labor forces.

4.4.12.2 Location and Description of Projects

Designation	Project	Description	Acreage	Treatment Method
Foothills				
F.C1	Containment	Trappers Trail	72.51 acres	mowing, grazing
Pearson-Arastradero				
A.Rx1	Containment	Juan Bautista Prescribe fire north	18.25 acres	Rx fire, grazing
A.Rx2	Containment	Acorn Trail Prescribed fire south	24,45 acres	Rx fire, grazing
A.C3	Containment	Within Redtail Loop Trail, to entire eastern boundary of Preserve	48.72 acres	grazing, mowing

Figure 28: Listing of Project Locations for Ecosystem Health.

4.4.13 Cooperative Fuel Management Projects for Offsite Fire Containment and Evacuation Ease

4.4.13.1 Specific Goal of Action

The goal of this project is to prevent a wildfire from spreading into the parks. The City should work with adjacent landowners to institute and maintain the vegetation in a condition that would facilitate containment and ease evacuation operations.

Another cooperative project would be to work to reduce the frequency and impact of sudden oak death, particularly on the western edge of Palo Alto.

4.4.13.2 Location and Description of Projects

Cooperation with neighbors is important in the installation and maintenance of fire-safe conditions on lands adjacent to or near the City parks. Most importantly, the enhancement of roadside treatments along Page Mill Road requires cooperation with several other landowners and agencies, as enumerated previously. Cooperative projects also include the formalization of agreements for passage through properties during time of emergency evacuation with public and private land owners and managers. The City should develop partnerships to address regional evacuation routes from residential and public areas, as detailed in the following section. Cooperative projects also include fuel management on City-owned open space adjacent to private structures. In some cases, such as on the western edge of Foothill Park east of Carmel and Ramona Road in Los Trancos Woods, access through private parcels would enable fuel management on City lands that would benefit both parties involved.

Sudden Oak Death has been observed in many locations within the Foothills area. At this time the areas are small and consist of one or two trees. The urgency for treatment of these affected areas is related to its location. Dead trees near structures, City property boundaries and along roads should be treated first. For example, dead trees along evacuation routes would get higher priority than those in the middle of remote woodland. However, if entire stands die, or sudden oak death changes the fuel characteristics of the stand, the priority and potential treatments would change. The location and extent of stands affected by Sudden Oak Death should be monitored.

Treatment should be consistent with the City policy regarding Sudden Oak Death. Treatments generally entail removal of dead material smaller than six inches in diameter. The trunks of the trees may remain if needed for wildlife habitat, however it is often difficult to retain just the larger material. The proximity of California bay to the foliage of oaks has been linked with the spread of Sudden Oak Death. Removal or trimming of bay trees to separate the foliage is another strategy to prevent further spread.

5 IMPLEMENTATION PLAN

However valuable and imperative the plan may be, implementation is the key to achieving the goals set forth by the plan. There are several recommendations that can facilitate implementation of the fire management plan.

5.1 Implementation Strategies

The creation of an Implementation Team within the City staff will support implementation. The team would benefit from representatives that could help with project design, cost estimation and budgeting, evacuation planning, and community outreach. The team would include in its mission development of educational material for the community. Implementation Team should include staff from the City Manager's Office, the Fire Department (Chief, Operations, Fire Marshal, CERT), the Police Department (Chief, Homeland Security, Communications/Dispatch, PIO), the Planning Department, Open Space/Parks, Public Works, and Utilities.

The City should support the formation of a Midpeninsula Foothills Emergency Forum (MFEF). The MFEF would collaborate on resource management issues. The scope would include pursuit of grants, equipment and resource sharing (such as mechanical equipment and expertise) and joint design of projects especially on City boundaries, or along co-owned/managed roads. The City should work with stakeholder/ partners on common issues. For example, Los Altos Hills, Stanford, Los Trancos Woods, Los Trancos Water Department, MROSD, and private neighbors all have concerns and potentially partial solutions for access and egress constraints. Each partner may have a particular asset to contribute, whether it is available funds or ready volunteers, or expertise in the subject of need. Collaboration creates a stronger base from which fruition of the plan can more readily occur.

This interagency organization would be separate from the existing FireSafe Councils; participation would include CEO-level discussions and staff liaisons from each participating agency.

The City should participate in local FireSafe Councils, in both Santa Clara County and San Mateo County[4]. FireSafe Councils can help in obtaining federal funds because the local FireSafe Councils have an already-written Community Wildfire Protection Plan, which is a prerequisite for national funding. Interagency collaboration is also fostered by FireSafe Councils. The local San Mateo FireSafe Council also facilitates access to the use of subsidized California-youth authority hand labor crews. These crews have a long track record of successful fuel management projects at surprisingly low costs. The San Mateo FireSafe Council also has a chipping program to alleviate the burden of disposing of biomass from fuel management projects.

The City should also implement projects in City park/preserves through its regular budget process. The City has a history of fuel management that should be continued. Fuel management will continue to be funded through the normal budget process, to encompass continued mowing, occasional grazing, maintenance of defensible space around structures and resource enhancement projects.

Funding specific prescribed burns is also expected through the budget process if not funded by grants or conditions tied to this project. For example, a prescribed burn in Alameda County was required as a mitigation measure for a necessary project to expand a facility near a creekbed. Similarly, projects that

[4] Participation in the San Mateo County FireSafe Council would be as an interested party but not to take official action or receive any financial benefit.

enhance natural resources can be used as mitigation measures for worthwhile projects that may have negative impacts.

While it is not expected that the City would make a profit from natural resources, the value of its grasslands as feed could be used to offset the cost of using livestock as a resource management tool. Similarly, the City should make an effort to obtain value from wood recovered from dead tree removal, potentially though innovative wood-based art projects.

The City has a rich bank of volunteer groups; projects could be implemented with the help of volunteer groups. Relationships with stakeholders such as Acterra, Friends of Foothills, 4-H, and other should be fostered. Roles for these groups could include the performance of pre-treatment surveys, construction and placement of raptor perches, support of grazing operations (movement of portable livestock fences or water sources), or distribution of educational and evacuation directional signs. Corporate volunteerism can be directed to fuel management projects.

The adoption of new codes may be less obvious than the implementation of specific projects. Regardless, the adoption of recommended changes in the City code may have more long-lasting and far-reaching effects throughout the City. These recommendations should be pursued.

Similarly, the continuation of Station 8 staffing should be viewed as a part of the implementation of this plan.

5.2 Priorities

The priority of the projects has been emphasized earlier in this report. Life safety concerns – those focusing on egress and emergency response access – are the highest priority. The projects that address this objective should be immediately pursued. The maintenance of firefighter safety zones is similarly high in priority.

Fuel management projects that prevent the ignition of structures are of the next highest priority. This would include the maintenance of defensible space around City structures and vital infrastructure facilities. These projects are mandated by law. Fuel management to prevent the spread of fires to off-site structures from City property are within a level of reasonable care expected from a City; these projects are also considered a type of containment project.

Fuel management that promotes containment of fires within City property is next in priority. These projects support the response to infrequent, yet potentially catastrophic fires. In addition, these fuel management projects prevent the more ordinary events from becoming catastrophic.

Projects that enhance natural resources are difficult to fund. However, fuel management offers occasions to both enhance natural resources and fire safety. Every fuel management project should be viewed as an opportunity to simultaneously enhance natural resources and promote fire safety.

The following criteria (not ordered by importance) can help determine the schedule of recommended fuel treatment project:

- Benefit of project in minimizing **structure damage** or chance of damaging wildfire.
- **Probability** of damaging wildfire (based on fuel loading and vegetation structure).
- Potential for **ecological benefit** (or damage without fire).

- **Divergence of fuel loading** and vegetation structure from natural conditions (i.e. deviation from natural fire regime).

- A **window of opportunity**, based on funding timelines, availability of personnel or equipment, or other factors.

- If using prescribed fire, some areas may need to be burned in a particular **sequence** to minimize the potential for escape.

5.3 Fuel Management Project Costs

Costs are variable, depending on the project design, site features, access, requirements for insurance, traffic and fencing control, staging, move-in costs, bonding, administration, wage reporting and other city requirements, such as governing regulations, or resource restrictions (i.e. species of concern).

Considering only the direct project-related costs, the unit costs of various treatment methods can vary dramatically between the types of treatment methods, but within the treatment methods as well. Similarly, the site conditions, weather, and other external factors that affect unit costs of some treatment methods are:

- Height, density, species, and arrangement of existing vegetation;

- Desired vegetation conversion and management objectives;

- Size, accessibility, slope, soil stability, and vegetation types onsite;

- Need for multiple treatment types at a site over a short period of time (cumulative costs); and

- Planning and monitoring to develop follow-up treatment prescription.

The following table describes unit costs associated with the treatment methods.

Treatment Method	Estimated Unit Cost ($ per Acre)	Notes/Other Considerations
Hand Labor Treatments		
Weed Whipping	1,500	
Chaparral Brush Removal	2,140 [a]	
Hand-Pulling	2,000	
Vista Pruning	$1/linear ft / 50-250 [b]	Roadside treatments – no shrubs
Mosaic/Drip-Line Thinning	$2/linear ft / 3,500 [a]	Roadside treatments with shrubs
Organic Mulch	575-1,600 [b,c]	Same as chipping/mulching

Treatment Method	Estimated Unit Cost ($ per Acre)	Notes/Other Considerations
Mechanical Treatment		
Grading	500-600 [b,c]	
Mowing	500-600 [b,c]	
Chipping/Mulching	575-1,600 [b]	
Roadside Mowing with Shrubs	$1/linear ft	
Prescribed Burning		
Broadcast Burning	60-400 [b]	Fixed costs are high, should use $25,000 per burn rather than per-acre costs
Grazing		
Sheep	200 [b]	
Goats	500	
Chemical Treatment		
Stump Application	200	
Foliar Application	500	

Figure 29: Unit Costs for Fuel Reduction Treatment Methods.

[a] The Sea Ranch Association Fuels Management Implementation, 2002 confirmed 2008.
[b] Applegate, Oregon Fire Plan. http://www.wildfireprograms.com/search.html?displayId=237
[c] Fire Plan, http://www.wildfireprograms.com/search.html?displayId=237

5.3.1 Project Cost Estimates

The following is a compilation of cost estimates for the 51 recommended treatment areas in Pearson-Arastradero Preserve and Foothills Park, and along selected segments of major evacuation routes in the City of Palo Alto. The total five-year cost amounts to approximately $700,000.

Costs of Firefighter Safety Zones = $800 annually

The costs of each firefighter safety zone was estimated as $200 per zone, based on the cost to mow a grassy area of approximately one acre in size. Mowing costs of unobstructed grass are approximately $200/hr, which includes the cost of the machinery and operator, and a spotter. The production rate of area mowing is approximately one acre per hour. This cost does not include move-in costs, because it assumes the mowing for firefighter safety is part of a larger mowing contract.

Because the safety zones need to be treated annually, the cost of treating all the firefighter safety zones is $800 per year.

Costs of Initial Treatment along Evacuation Routes = $192,960 initial treatment, $86,400 total for the subsequent 4 years[56]

The treatment along roads identified as evacuation routes would include a mixture of machinery-based mowing (including mowing with an articulated brush-cutting head that cuts brush) and the use of hand labor. In circumstances where wider areas can be treated, grazing animals, principally goats, can be used to perform initial treatments along evacuation routes.

The total length of evacuation routes is slightly more than 12 miles, or 63,740 linear feet, which encompasses those areas highlighted in blue on Figures 17 and 18 and in Section 4.4.7.2.

The estimate of costs for this type of treatment assumes an operation that would use the machinery wherever possible as a cost containment measure. One can assume one-half of the length can be treated with machinery for the first 10-ft off the roadside. The remainder of the area would need to be treated by hand.

Estimates are based on treating both sides of the road for 30-ft, or a 60-ft wide strip, or almost 24 miles of linear treatment. Treatment recommendations state that areas of oak woodland need be treated for only 10-ft in width because expected fire behavior is relatively calm; however, for cost estimates, every length of the roads were estimated being treated for 30-ft width.

The most inexpensive treatment is roadside mowing of grassy areas with few shrubs or trees. This is expected to occur on approximately ¼ of the length of the roadside, for the first 10-ft off the road. Roadside mowing of grass expected to cost approximately $200/hour for the machinery, operator and spotter; production rates generally run around 300 linear feet per hour, or a little less than 18 hours to treat a mile. Production is reduced by the need to pick up the cutting head to move to a new site, and the need to avoid areas of trees. Using this production rate, mowing of approximately 108 hours, or for a cost of $**21,600**.

The next most cost-effective treatment is use machinery to cut roadside shrubs within the first 10-ft of the road. Shrubs near the roads are more common, occurring on approximately ½ of the length of the roads. A cost of $200/hr for the machinery, operator and spotter is used. Production is reduced to 200 linear feet per hour, requiring 26.4 hours to cut brush for a mile. A little more than 316 hours would be required to treat the estimated 12 miles of shrubs, for a cost of **$63,360**.

Machinery has the potential to start fires from causing sparks in dry vegetation. A dedicated fire watch for the operation during fire season is recommended, at an additional cost of **$15,000**, based on 214 hours of operation during fire season, assuming one-half of the machinery-based work is performed during fire season. The remainder of the treatments will require hand labor to remove shrubs, limb the lower branches of trees smaller than three inches in diameter. This would be required on ¼ of the first 10-ft of the roads, and the entirety of the remaining 20 feet off main evacuation routes.

Hand labor crews with a supervisor typically cost $1200/day. The production rate for this type of tree limbing and shrub removal is one-tenth of an acre each day, or $10,000 per acre. Subtracting the areas treated with mechanical equipment, approximately 93 acres will need to be treated using hand labor crews, at a cost of **$93,000**.

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[5] Personal communication with J. Squadroni, of Environtech, January 2009, regarding roadside treatment costs. These cost were confirmed, based on worked performed by Environtech, including roadside treatments on Los Trancos Road in early 2000's and in Carmel Valley more recently.

[6] Personal Communication with Mike Philbin, Central Coast Land Clearing, October, 2008. Cost estimates based on work performed in 2008 on roadside treatments in Carmel Valley and in Santa Cruz County.

Government-subsidized hand crews that utilize people in the California Youth Authority system can result in dramatic cost reductions. Costs of hand labor crews can be reduced by a factor of ten.

Maintenance would consist of mowing the first 10-ft from the pavement edge yearly, at an annual cost over the next four years of $21,000 per year.

Costs of Maintaining Defensible Space around Park/Preserve Structures and Infrastructure = $17,800

Treatments to maintain defensible space around each of the structures and infrastructure facilities in the City Park/Preserve entail the use of hand labor to limb trees, remove shrubs under trees, and to mow grass. Some of the structures, such as the Gateway interpretive Center in Pearson-Arastradero Preserve, have little tree cover so mowing would comprise the treatment. Others, such as the pumping station in Pearson-Arastradero will require a higher level of effort because of a greater volume of shrubs and trees within 100 feet of the structure. Limbing and shrub removal need to only be done on a five-year interval, however mowing is required annually.

The treatments encompass the red solid circles on Figures 17 and 18 and those described in Section 4.4.9.2.

Generally the area of treatments ranges from ¼ acre to 1 acre. Mowing of the area around the structures is estimated as $100/structure, performed annually. Using hand labor to remove shrubs under trees and to remove lower branches of trees is estimated as $1,500/acre, performed every five years. There are nine structures identified in Foothills Park, with a total estimated cost of $14,100 over the next five years; Pearson-Arastradero Preserve has four such structures, with an accompanying $3,700 cost for treatment during the next five years.

Costs of Creating/Maintaining Containment Areas $403,486

Containment Areas in Foothills Park

Treatments to enhance the actions to contain fires span two different shapes and sizes of treatments. Area treatments are recommended in Foothills Park for Trappers Trail, the Pony Tracks South of Trappers Ridge, the Bobcat Point Containment Zone and the area north of the Foothills Park Entry Gate. Shrubs and lower tree branches should be trimmed within the containment areas on a three-year interval of time. The grass in Trappers Trail and Pony Tracks South of Trappers Ridge will be mowed every three years, with the exception of a width of 30 feet on both sides of the graded trail. Shrubs in the Bobcat Point Containment Zone and the North of Entry Gate Containment Zone are recommended to be treated every five years. Grass in the other containment zones is to be mowed annually in order to bolster containment efforts during fire suppression.

Trappers Trail Containment Zone – 72.5 acs. The cost estimate of treatment is based on a rotation of treatments on a three-year cycle, and an annual treatment of mowing of a band of grass for a 30-ft width on both sides of the graded trail. One third of the area would be mowed in any year. One-third grazed, and one-third left to re-grow. This rotational treatment will allow more forage and cover for wildlife, and provide greater diversity of plants and vegetation structure. The cost of grazing one-third of the area, or roughly 25 acres, is estimated at $500/acre, or a total annual cost of $12,500. Costs of grazing are estimated to be lower than other areas because grassy nature of the area will facilitate fencing. Mowing is similarly lower in cost, at $500/acre, or an annual cost of $12,500, also because of previous treatments on the site. The total annual treatment cost for this area would be $25,000, or **$125,000** combined for the next five years.

Pony Tracks South of Trappers Ridge Containment Zone – 7 ac. The cost estimate of treatment is also based on a rotation of treatments on a three-year cycle, and an annual treatment of mowing of a band of grass for a 30-ft width on both sides of the graded trail (if the area is not grazed). Because of the small size of the

treatment area, the entire area can be mowed one year, grazed another, and left to rest a third. Using mowing and grazing costs of $500/acre, the five-year cost of treatment would be **$14,000**.

Pony Tracks North of Trappers Ridge Containment Zone – 2460 ft. The treatment cost is based on annual mowing along both sides of the graded trail. Using the production rate of 300 feet per hour and an hourly cost of $200/hr for an equipment operator and spotter, the cost of this treatment is estimated at $1640, or **$8,200** for the next five years.

Bobcat Point Containment Zone – 5.5 acs. Costs for grazing this treatment area with goats are estimated at $700/acre because the area has not been previously treated and fencing may be challenging. This would result in a cost of $3850. The treatment interval is recommended to be 5-years, so the 5-year cost of treatment would total **$3,850**.

North of Entry Gate Containment Zone - 3.5 acs. This area is similar in its treatment recommendation to the Bobcat Point Containment Zone. Grazing costs are estimated at $700/acre, with a 5-year interval between treatments. The one-time treatment cost is **$2,450**, as is the 5-year treatment cost.

Valley View Fire Trail Containment Zone – 1460 ft. The treatment cost is based on annual mowing along both sides of the graded trail. Using the production rate of 300 feet per hour and an hourly cost of $200/hr for an equipment operator and spotter, the cost of this treatment is estimated at $1,000, or **$5,000** for the next five years.

Containment Areas in Pearson-Arastradero Preserve

In Pearson-Arastradero Preserve, fifteen areas are recommended for treatments to facilitate containment during fire suppression. Of these, seven are areas where grazing is recommended, with a total acreage of almost 95 acres. The size of the areas to be grazed ranges from slightly more than four acres to almost 50 acres. Of the area to be grazed, 54 acres is comprised of grass, with few fencing challenges. However, smaller areas that amount to 41 acres to the south and west on the Preserve border are shrubby and have not been previously treated. Given the variability of the condition, the cost for grazing is estimated at $500/acre, or a total initial cost of $47,500. The grassy areas should be grazed annually, at a cost of $135,000. The shrubby areas need by treated only once every five years, at a cost of $20,500. The five-year cost thus totals **$155,500.**

Mowing the grass on both sides of graded trails is a recommended annual treatment. The linear length of this treatment is 26,846 feet, or slightly more than 5 miles. Using the production rate of 300 feet per hour and an hourly cost of $200/hr for an equipment operator and spotter, the cost of this treatment is estimated at $17,897, or **$89,486** for the next five years.

Two areas are recommended as suitable for a prescribed burn to facilitate containment and enhance natural resources. The costs for this treatment method are especially difficult to estimate because some of the operation serves as training. Often, adjacent agencies provide additional equipment and resources at no cost. A large portion of the costs associated with prescribed burning is involved in planning and obtaining the necessary permits, notification of appropriate agencies and the public and reporting of the results of the burn. Because of the uncertainty regarding the cost, an estimated cost of $25,000 per burn is set. An interval of 5 years is recommended, so a five-year cost for the two treatment areas would total **$50,000**.

Costs of Conducting Pre-Treatment Surveys = $100,000

Pre-treatment surveys and post-treatment follow-up are part of the best management practices associated with the recommended treatments. The cost for the pre-treatment surveys and post-treatment follow-up is

estimated at $20,000/yr, or **$100,000** for the total 5-year cost. This cost can be reduced if knowledgeable volunteers are involved in the survey or monitoring efforts. Estimates for the survey costs assume the City identifies treatments planned for the year and contracts with a biological consulting firm to perform targeted surveys in the treatment areas.

5.4 Funding Strategies to Support Fuel Management

Multiple funding sources provide greater stability, more funds, increased continuity, more stakeholders, the potential to expand the scope of work. Each funding mechanism has unique requirements, strengths and weaknesses. Some are best suited for one-time expenditures such as capital improvements while others are aimed at ongoing maintenance activities. The "strings" attached to each mechanism should be considered. It is advisable to match funding mechanisms with priority projects.

Funding Mechanisms at a Glance

Funding Mechanism	Characteristics				
	Need for Collaborative Process	*Funding for Capital Improvements / Initial Treatment*	*Funding for Maintenance*	*Relative ease of obtaining funding*	*Longevity/ sustainability of funds*
General Funds	Advised	☆	❍	❍	✗
Self-funding	no		☆	☆	☆
Owner self fund	no	❍	❍	☆	☆
Public Grant Funding	Advised; may be required	☆	✗	✗	✗
Private Donation/ Gifts/ Volunteerism	Advised	☆	❍ Volunteers	✗	✗
Bonds	Advised	❍	❍	✗	✗
Assessment Districts (LLAD)	Advised	✗	☆	✗	☆

☆ Relatively easy ❍ Neutral ✗ Difficult

Figure 30: Funding Mechanisms.

A key to expanding funding mechanisms is to demonstrate the value of the projects. Highlighting the value of fuel management is effectively done at a grass-roots level, through collaboration with stakeholders. This is especially important for mechanisms that require community-wide support through votes or donations of money or in-kind services.

The discussion under Section 8.1 Implementation Strategies discusses the importance of partnering with other agencies, the use of volunteers to leverage City funds, and the funding of fuel reduction work through the normal budgeting process. This is the most common locally-controlled source of funds, often covering education, code adoption, and capital improvements. While this seems to be the most reliable long-term source of funds, even self-funding projects are vulnerable to a shift in priorities (because these projects need to compete with other community public service needs) or a downturn in economic markets.

Funding projects with grants requires that the City match projects with funding sources. Creativity can yield surprising avenues for funding. For example, funds from Homeland Security may be justified to purchase equipment that washes off weed seeds from vehicles because of concerns about decontamination. In this case the same equipment can be used as a solution to disparate concerns.

Bonds may be used for capital improvement projects, especially related to evacuation. These are typically used for very expensive capital improvements such as water supply and distribution or development/ enhancement of improved access. Last, assessment districts can fund specific fuel projects that address specific geographic regions for a specific period of time. For example, assessment districts may co-fund utilities and water improvements.

Funding strategies should consider the total amount required, the schedule and duration of funds required, the focus of spending – whether it is capital or maintenance-related projects – the geographic area and the project types. Funding strategies also need to consider the effort required to obtain and administer the funds. Grants may require matching funds in the form of hard cash or in-kind services that can range from relatively simple to complex forms and justification. The National Database of State and Local Wildfire Hazard Mitigation Programs (www.wildfireprograms.usda.gov) presents how other communities have obtained funds and what they have done with those funds.

Regardless of funding mechanism, several common challenges need to be considered. When raising money for long-term projects, it is critical to build in factors for inflation and cost-escalation. Raising funds for ongoing maintenance is more difficult than raising seed money for one-time demonstrations.

5.5 Grant Opportunities

In the past ten years, an unprecedented amount of federal and state aid has been available for fire hazard reduction. Most federal aid is linked to proximity to federal lands, which may pose a disadvantage for the City of Palo Alto. One exception to this linkage is funding through the Department of Homeland Security.

The California FireSafe Council website hosts a "one-stop-shopping" application process where an applicant can obtain an e-grant concept paper. However even this website does not cover all programs.

The Federal Emergency Management Agency (FEMA) has a funding program that provides assistance to fire departments through its Assistance to Firefighters Grant (AFG) and the Fire Prevention and Safety Grant Program. AFG is limited to fire departments, while the Fire Prevention and Safety Grants are open to a wider range of organizations. FEMA has two disaster mitigation programs: the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation Program (PDM). HMGP funds are available to states after a disaster has been declared to mitigate future risk from any type of disaster. Amounts are linked to the total emergency funds. Funds from the PDM facilitate cooperation between state and local authorities with funds awarded competitively for both planning and project implementation activities at the state and local levels as a sub-grantee. This program addresses the more traditional agency focus of earthquakes and floods; the extent of funding for wildfire-related projects is yet to be determined.

The State Fire Assistance includes supplemental appropriate allocation through the National Fire Plan, in addition to a regular appropriation distributed by formula to state foresters through the USDA Forest Service. These funds can be used to plan and implement hazard mitigation projects, including fuel management, prevention and mitigation education, and community hazard reduction. The process for obtaining funds is competitive and available nationwide, with 35 percent distributed among the states to meet firefighting preparedness and safety needs.

Obtaining funds through grants often involve intricate application process or include administrative burdens associated with monitoring how funds are spent and complex reporting requirements. Using funds for ongoing projects is a concern because the sustainability of grant funding is sometimes questionable.

Grant opportunities often become available for a short period of time. Requirements and levels of funding change annually. For example, the federal Department of Homeland Security and the Federal Emergency Management Agency recently announced a new policy for funding wildfire mitigation. On September 8, FEMA Mitigation Chief David Maurstad issued a policy that describes how the post-disaster Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation grant program (PDM) can be used for wildfire mitigation activities by eligible grant applicants.

Activities eligible for funding under these grants include creation of defensible space through removing or reducing vegetation; the application of non-combustible building envelope assemblies, use of ignition-resistant materials, and proper retrofit techniques for structures; and hazardous fuels reduction vegetation management or thinning within two miles of at-risk structures. Check with your state Emergency Management Office or FEMA Regional Mitigation staff for more information about HMGP and PDM grants.

6 TREATMENT STANDARDS AND METHODS

6.1 Treatment Standards for Vegetation Types

For each vegetation type group, the resulting fuel bed characteristics after treatment are described[7]. Following the vegetation prescriptions, a set of guidelines for creation and maintenance of a fire safe area (defensible space) around residences and other improvements are recommended. In all vegetation types, preference for removal should be given to non-native invasive species.

6.1.1 Prescription for Grasslands

- Mow or graze to no longer than 4 inches in height, or disc
- Native grasses should be mowed to a height no shorter than 4 inches and may be mowed later in the year to accommodate seed ripening and seed distribution [8]
- Maintain brush cover less than 30%
    - less than 20% where slope steepness is greater than 20%
    - Requires annual treatment, usually requiring treatment of all grass near structures within 2 weeks of starting to mow.
- Alternatively, prescribed burn in late spring or early fall with a resulting cover of not less than 20%

6.1.2 Prescription for North Coastal Scrub and Chaparral

- Mow/grind to cut and mulch shrub tops within treatment area; alternatively,
- Create islands of less than 12 feet in diameter or 2 times the height of tallest shrub (whichever is smaller) can remain. Clumps should be natural in appearance including specimens of variable age classes

[7] These standards/prescriptions were initially developed by Amphion, Inc. for use by the FEMA-funded East Bay Hills Vegetation Management Consortium (VMC). These standards/prescriptions have been reviewed and adopted by the following agencies in the consortium: Cities of Berkeley, Oakland, and Piedmont; East Bay Municipal Utility District; East Bay Regional Park District; University of California; Lawrence Berkeley Laboratory; and PG&E. As part of the review process, a Citizen's Advisory Committee and a Technical Advisory Committee, which were comprised by a cross-section of members of the public, reviewed and commented on the standards. The reference is Amphion Environmental, Inc. 1995. Fire Hazard Mitigation Program and Fuel Management Plan for the East Bay Hills, prepared for the East Bay Hills Vegetation Management Consortium, Oakland, California.

[8] Acterra is available to advise on the timing of native grass seed cycles, especially in relation to invasive weed seed cycles.

- Distance between islands shall be greater than 2 times the height of tallest shrub or a minimum of 8 feet, whichever is greater
- Retain between 20-30 percent of brush areas in brush crown cover
- The removal of brush should be based on criteria which are listed in approximate order of importance to fuel management objectives:
    - Relative flammability - remove the most flammable species first.
    - Plant vigor - remove shrubs of low vigor, dying or dead shrubs.
    - Sprouting capability - remove species with sprouting capacity first.
    - Effects of plant species on soils - i.e. retain shrubs with slope-holding capacity, that increase soil nutrients (ceanothus).
    - Value for wildlife food and cover.
    - Aesthetic values.
    - The order of priority will change according to local conditions such as the relative abundance of each species. For example, where coffeeberry is not abundant, it may be placed high in priority to retain. Attempts should be made to maintain diversity of species.
- Maintain a crown cover of less than 30%
- Can convert to grass, especially in fuel breaks
- Maintain less than 20% dead material in the shrub canopy
- Protect oak, madrone, buckeye and trees shorter than 6 feet in height. Cut out shrubs below drip lines and within 6 feet from edge of tree canopy
- Anticipate 3-5 year treatment cycle

Priority For Removal Follows:	Remove Only If Necessary
chamise	coffeeberry
coyote bush	buckeye
poison oak	ceanothus
Himalaya blackberry	wild currant
northern sticky monkey flower	California blackberry
coastal sage brush	bush lupine
scrub oak	madrone
manzanita	toyon
	oaks

Figure 31: Initial Priority of Removal for Brush.

6.1.3 Prescription for Oak Woodlands

- Prune branches up to 3 inches in diameter for a height of 8 feet. Prune up to a maximum of 1/3 the height of trees that are less than 24 feet tall.
- Maintain under 5 tons/acre of duff no deeper than 3 inches.
- Leave all trees bigger than 8 inches diameter. Leave 1/3 of the trees under 8 inches to retain a range of size categories and species. Maintain a stand density of less than 50 trees per acre as long as canopy is still closed.
- Can mulch site to a maximum depth of 2 inches to prevent invasion of noxious weeds.
    - Treatment cycle is from 7-10 years.

6.1.4 Prescription for Riparian Forest

Avoid treatment. Where necessary:

- Create or maintain an 8 feet vertical clearance between live needles and understory fuel. Remove all dead material. Prune branches up to 3 inches in diameter. Prune up to a maximum of 1/3 the height for trees less than 24 feet in height.
- Maintain less than 10 ton/ac. Depth of duff no greater than 5 inches.
- Mulch to between 2 and 5 inches in depth.

- Treatment cycle is between 10-15 years.

6.1.5 Defensible Space Guidelines

Palo Alto staff will be responsible for maintaining a 100 feet wide defensible space on all sides of any structure in the two parks. All dead plants and combustible materials shall be removed within 100 feet of each structure to establish and maintain a defensible space. Removal of combustible materials includes, but is not limited to, the following actions:

- Cut grass and weeds to less than 4 inches. Cutting of native grass and wildflowers may be delayed until after seed set unless they form a means of rapidly spreading fire to any structures.

- Remove all dead plant material from within 100 feet of each structure. This includes keeping the ground, roofs, decking, and balconies free of dead leaves, needles or other plant debris. This also includes removing from trees loose papery bark, and dead branches smaller than 3 inches in diameter, to 8 feet above ground. Remove all dead branches from within live ground covers, vines, and shrubs. Refer to Figure 1 explaining pruning.

- All live vines and live branches smaller than 3 inches in diameter shall be cut up to a height of 8 feet above ground. Figure 32 provides a description of pruning best practices.

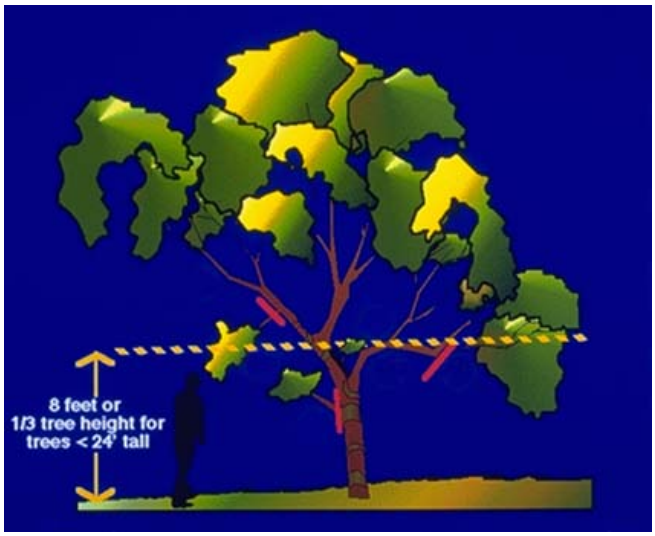

Figure 32: Pruning Example.

Prune branches to a height of 8 feet above the ground. In young trees, prune branches on the lower one-third of the height of the tree. Do not disturb or thin the tree canopy, as this promotes growth in the understory, which is more easily ignited.

- Remove plants as necessary to break vertical continuity between ground covers, shrubs, trees, and decks or overhangs on buildings. Vertical separation is the distance from the top of shrubs or ground cover to adjacent trees, designed to minimize the spread of fire to the crown of trees or structure roofs. Vertical spacing should be a minimum of 8 feet or 2 times the height of the understory plants to the leaves or needles of adjacent overstory trees, decks or overhangs, whichever provides greater separation. For overstory trees under 24 feet in height, the minimum clearance can be reduced to 1/3

of the overall height of the overstory tree provided this reduced clearance does not form a means of rapid transmission of fire.

- In areas without a tree overstory, create shrub islands per the standard for north coastal scrub. Within 100 feet of improvements, grass between shrub islands should be mowed when cured (dry).

- Remove all branches within 10 feet of any chimney or stovepipe including chimneys on adjacent properties.

- Chipped materials can remain on the site provided the chipped mulch layer is no greater than 2 inches in depth.

6.2 Description of Treatment Methods

6.2.1 Summary

Fuels can be removed on a large scale by prescribed burns, grazing animals, and mechanical treatment. In small open space areas and around structures, hand labor is effective in reducing the fuel load. Eucalyptus tree removal may be effective in specific locations of high risk. Fuels can be redistributed on a large or small scale through mechanical treatments, such as mowing, discing, or grading.

In all the following treatments except hand labor, economies of scale are dramatic; the larger the project, the greater the efficiency.

6.2.2 Timing of Treatments

The timing of the initial or follow-up treatments is important to achieve the desired fuel management performance standards and resource management objectives. Given the variable nature of fuels through changes in weather and season over time, the schedule of the treatment may often be just as important as the type of treatment selected. For example, treatments in grasslands typically take place when grass cures or dries out. Cutting grass too early will be ineffective, as the grass will usually grow back, negating the treatment. Conversely, cutting grass too late will leave the grass in a hazardous condition during periods of high fire danger. Fuel treatments also need to be conducted when the weather is not too dry or windy, as some treatment types - especially mechanical treatments - may inadvertently start fires.

Timing the treatment methods appropriately can reduce potential impacts to special-status species or sensitive wildlife species. It is likely that there will be some months of the year when particular practices need to be implemented (e.g., pre-treatment nesting surveys or avoidance of breeding habitat) to avoid adverse affects to special-status species.

Timing treatments to either control or avoid the spread of invasive plant species or insect pests is also critical. For example, treatments performed when plants have set or are setting seed will spread the seed whether it is a native plant or invasive weed. Treatments should therefore take advantage of differences in the timing of seeding of native plant species and avoid periods when invasive species are in seed. Pruning of pines and eucalyptus should be done when insect pests are not flying to minimize the associated spread and damage from these insects. Pruning should take place from November to April to minimize the susceptibility to bark beetles or red turpentine beetles. In most cases, the timing and method of treatment can be modified to accommodate local habitat needs and still reduce fire hazard to an acceptable level.

6.2.3 Hand Labor

Hand labor involves pruning, cutting or removal of weeds or shrubs either by hand or with hand-held equipment. This process is slow and expensive, but most selective and has little impact beyond the removal of the target plants. This technique generates considerable debris when pulling, pruning, and cutting vegetation. The debris is not always removed from the site due to the high cost of doing both the clearance and removal by hand. Not removing the debris, however, leaves a significant hazard, possibly greater than pre-treatment because the debris may be voluminous, dry, well aerated, and quite flammable. This method is most commonly used by residents to reduce fuel volume on private lands, or by hand crews on short-term contract with the City of Palo Alto to reduce hazard adjacent to improvements. Some expertise is required to work with trouble species such as poison oak, to prune oaks and control shrubs, and to identify new fuel hazards as they arise. Hand labor encompasses the operations of pruning and weed-whipping, tree removal, pruning, bark pulling, removal of dead wood within the tree/shrub canopy, litter removal and mulching, and establishing new plant material. Hand labor allows use of a wide variety of methods to reduce fuel load, including both chemical and mechanical treatments.

Hand Labor - Pruning Trees and shrubs must be hand-pruned to vertically separate fuels. Pruning lower branches of trees is usually done with a hand-held pole saw (with or without a motorized chain saw attached). Lower branches on shorter trees can be pruned with loppers.

Hand Labor - Weed-whipping Like mowing, weed whipping reduces fire hazard by reducing the fuel height. However, it is done by hand to avoid harming rock outcrops and desired small plants (such as oak regeneration and landscape material). This treatment is generally limited to small material such as grass or short herbs. Weed whipping may be accomplished any time of the year, and regardless of whether the material has cured.

Weed whipping is performed with a hand-held, gas powered tool that cuts grasses and very thin woody material with a fast-spinning fishing-line type of cutter. Because this method is performed manually, it can be used to selectively remove certain vegetation. Most large woody stems are not cut by the treatment, however seedlings (such as oak seedlings) can be severely damaged. Treatments can be completed with greater care than the others (however the height to which plants are cut may be difficult to control if the operator is not experienced) and minimize soil disturbance and erosion. It is also often the only type of treatment possible on steep slopes and in wooded areas. The average weed whipping rate is 750 square feet/hour.

The schedule for a skilled laborer should be tailored to the timing of their tasks. For example, selective weed whipping of annual grasses before they set seed while leaving native bunch grasses until after these plants set seed can shift the proportion of vegetative cover over time to more bunch grasses. This shift in type of grasses can shorten the length of time the landscape is prone to ignition. Similarly, thistle reproduction can be minimized by cutting while they are growing, but before they set seed. Pruning should be done from November to April; this schedule avoids spreading destructive bark beetles and/or other pathogens.

The cost varies from $10,000 per acre to approximately $1,500 per acre, depending on the time of year, extent of project, and level of detail required.

6.2.4 Mechanical Treatments

Mechanical treatments, including mowing, weed whipping, discing, and grading, rearrange rather than reduce the actual fuel load. Heavy machinery is usually used in flat areas where terrain and the presence of rocks or numerous trees do not prohibit travel. This type of machinery should not be used on slopes over 30% because of concerns for worker safety as well as erosion control and slope stability issues.

Heavy machinery: attachments to tractors (brush hogs, flail, mowers, tiger mowers)

Roadside mowing is a prime example of the use of heavy machinery with attachments. A variety of attachments serve numerous purposes. For example, a brush hog attachment cuts and breaks brush plants off and produces a mulch of the brush debris. Mowers that cut or flail grass and small woody plants are also attached to tractors. Attachments (such as mowers) with articulated arms that reach as far as 20 feet away from the tractor reduce the area over which the tracks must travel, and offer more maneuverability. These articulated arms also cut and/or break off material. Heavy machinery is a moderately fast, and a relatively inexpensive treatment. There is little control over which plants are cut, but machines can travel around isolated areas of concern.

Heavy machinery should not be used when the ground is soft in order to prevent ruts and bared soil. Soil movement can be caused by all users on foot, bicycle, equestrian and vehicles (patrol vehicles and fire apparatus). Soil movement can be ruts or minor depressions, which will lead to large ruts or voids. This technique can be used at almost any other time of year, but is faster when done in the summer or fall when brush is brittle and grass has cured. It must not be used during times of high fire danger because the machines can start fires. The under-carriage of the machine and attachments should be washed off after use in areas of weed infestations.

Grading and Discing involves stripping a swath of land bare of vegetation with a tractor and blade. It is very effective in producing fire trails 8 to 12 feet across and as a maintenance tool for access routes. Generally, grading is done mid-spring, by a contractor when there is still residual moisture in the soil, but after the threat of spring rains has diminished[9]. Costs are reasonable, (from $100 to $300 per acre) and relate to the size of the project and condition of trail surface.

However, there are several disadvantages to this treatment. By removing all competing vegetation, grading creates an excellent establishment site for weedy species, which may be serious fire hazards. Untimely grading, for example, in mid-summer, can help sow seeds of weedy exotics, such as yellow star thistle, mustard and Italian thistle. In addition, annual grading causes soil disturbance and alters drainage patterns. Runoff, blocked from cross-drainage by the banks on either side of a graded fire trail, is redirected down the trail. This situation favors coyote bush and exotic grasses, leading to a shift in the grassland species composition. Grading spoils will need to be feathered into the sides or smoothed back into grading area annually.

Discing involves cultivating or turning over the upper 10" of soil, and produces an uneven surface with a discontinuous fuel distribution and is appropriate only if mowing or grazing is not applicable that year or in a specific location. Rate of production is quite high; normally the operator can disc land parcels of two acres or less within one day. Discing is normally performed annually once grass has cured (so the grass will not grow back that season). A tractor with discer attachment can typically cultivate a swatch 15 feet wide in a single pass. While this is an effective barrier to surface fire spread, it is also an ideal disturbed area with prime growing conditions for weeds and distribution of their seeds. Surface erosion can be significant in areas prone to this process.

[9] Residual soil moisture makes the soil pliable or workable, and allows the soil to compact. When grading is performed when the soil is completely dry, the soil is very difficult to work. Pearson-Arastradero has high clay content soils and causes premature soil movement unless the contractor supplements soil moisture with a water truck, which is an additional expense.

6.2.5 Grazing with Sheep and Goats

This method includes the intentional use of sheep and goats to consume vegetation thus reducing the amount or density of fuel. These types of livestock are not recommended to create a fuel break, but can be used to maintain this type of pre-suppression feature. Similarly, livestock can prevent grasslands from shrub encroachment, and an oak woodland free of significant understory. The option is effective where the plants are palatable to the animals selected. Control of the livestock and prevention of the impacts of overgrazing is critical to successful use of this technique. As a fuel management technique, livestock need not graze every year.

Grazing can reduce or encourage weedy pest plants depending on the timing and intensity of grazing. A range management plan and a grazing monitoring program needs to be established to identify the impacts and ensure that the animals are removed once fuel management goals are met. Perennial grasses may require modifications from management of annual grasses using grazing animals. Because presence of healthy perennial grass stands has many benefits, these modifications are generally recommended. The benefits of perennial grasses are that they cure later in the season, which limits the opportunity for ignition. Mowing typically can be scheduled over a longer time period. Rotation of grazing animals is preferred over greater grazing pressure. Typically, perennial grasses react best when grazing is applied after seed maturation - from late spring through the fall. Goats may import seeds from another weedy site. The herd can be quarantined at goat herd's ranch for three days where they will be fed alfalfa to clear out their systems. The herder can also use short-haired goats that will carry fewer seeds in their fur.

The herding instinct of sheep and goats allows professional herders to range in very mobile bands without the installation and maintenance of permanent fences. Portable electric fences are commonly used to help control the herd and the outcome of their grazing. Goats will browse materials up to 6 feet above the ground creating a desirable vertical separation between the canopy and ground cover. However, measures must be taken to prevent girdling of trees by goats browsing on bark. Herd movement has the advantage of breaking off dead material in a stand as well as punching a humus layer into the soil (if the ground is somewhat moist) and thereby removing available fuel. Grazing treatments need to be repeated, however, following up or alternating with a different, complementary technique can extend its effectiveness.

If work is needed to be done during May-July, scheduling can present a challenge because many clients in the greater area desire the service at that time. To minimize the negative effects of grazing on a specific plant, goats should graze after seed set of that particular plant. During initial fuel reduction treatments, goats may be most cost-effective in the late fall or early spring when demand for their services, and possibly price are reduced. Multi-year contracts, and contracts for larger areas typically lower the costs per acre. Providing a place where the herd can stay during the winter also lowers costs for treatment. Providing a water source for livestock is another way to reduce costs. Water sources can be as rudimentary as a plastic wading pool or a portable trough.

A herd of 200-300 goats can generally treat one acre per day. Costs can vary from $300 to $1000 per acre with an average of $700 per acre, depending on fencing requirements as well as type and density of vegetation present. The cost includes transportation, the shepherd's salary, supplements and healthcare for the goats, fencing and insurance.

6.2.6 Broadcast Prescribed Burns

Prescribed burning reintroduces fire into the ecosystem as a "natural treatment" and can promote native flora and aid containment of fires by reducing fuel volumes.

Prescribed burns are usually performed by the local fire protection district. CalFire may be willing to participate in a limited prescribed burning program as part of their hazard reduction efforts within the Vegetation Management Program, even though the project area would be outside the State Responsibility Area. If burns were conducted by CalFire, the State would not only assume liability, but also share costs. Regardless, it is likely that CalFire and other nearby fire protection districts and departments would offer mutual cooperation and/or assistance.

Several precautions, such as installing firebreaks and notifying various agencies, must be taken before performing a prescribed burn. Treatment boundaries are often road and trail crossings, which reduces the number of fire breaks that need to be created by fire personnel, thereby reducing labor costs and time needed to prepare for the burn as well as minimizing the amount of surface soil disturbance and potential for soil erosion.

Prescribed burning requires the development and approval of a prescription or burn plan, which is typically developed by the local fire protection district in consideration of fuel reduction requirements, local weather conditions, and available resources for fire management. The soot and smoke generated, as well as the chance of escape, make prescribed burns a public safety concern. Planning and coordination with interested parties must be an integral part of the program.

Broadcast burning may occur throughout the year; however, it is usually conducted during late spring when the ground is still wet or during fall or winter after plants have completed their yearly growth cycle and their moisture content has declined. Spring burns are preferred by some fire staff to ensure a greater measure of public safety, however, there may be impacts to animal and plant reproduction activities. Fall burns are more closely aligned with the natural fire cycle found in California. If a prescribed burn were to be conducted in the fall, the period before leaves or new herbaceous material covers the slopes will be short (possibly a month or two).

Prescribed burning can enhance the local grasslands and promote the abundance of wildflowers. Any small oaks or shrubs to be retained will need to be protected during the burn to prevent their mortality. While the abundance of wildflowers the subsequent years is an appealing sight, the burned area will be temporarily blackened.

6.2.7 Eucalyptus Tree Removal

By removing eucalyptus trees their canopy no longer contributes to a fire in the form of a crown fire or ember production. Additionally the production of surface fuels is reduced since biomass production (branches, leaves, duff etc.) is decreased. This technique has positive impact on reducing spotting potential, heat output, spread rate and, potentially, ignitability depending upon what replaces the overstory.

Tree removal varies from cutting of individual trees, to removal of entire overstory canopy. This process can be slow and expensive, but can be selective with limited impact beyond the removal of the target plants (depending upon scale of removal). Sometimes harvesting techniques can be quite rapid. If the whole tree is not harvested, the technique generates considerable debris (from tree branches) that should be removed using machinery to haul. The boles of trees hauled away and other debris should be either hauled away or may be burned later as a part of a prescribed burn (pile or broadcast). A portion of debris may be left as a sort of erosion control measure and to cover bare spots.

And bats may use eucalyptus trees as perches and nesting sites. Replacement perches and nesting platforms for raptors can be constructed, located, and installed prior to removal of the trees to minimize displacement of raptors. If the tree harbors a maternal bat roost, removal should be coordinated with the appropriate wildlife

agencies, including the California Department of Fish and Game and possibly the US Fish and Wildlife Service. Volunteers can locate and construct the raptor perches and nesting platforms, with guidance from suitable experts (e.g. Audubon Society or the Point Reyes Bird Observatory).

Tree removal creates patches of disturbance by the removal operation. Subsequent treatment of the area is dependent upon the species that encroach into these patches. Removal of exotics or weed species on an annual basis should be anticipated until an acceptable stable vegetation type is re-established.

Sprout removal is often required as a follow up treatment, involving the application of herbicides and/or other techniques such as grinding the stump or placing plastic over the stump.

6.2.8 Herbicide Application to Control Invasive Plants

Using herbicides to control invasive plant species that exacerbate wildfire risk is used as part of an Integrated Pest Management[10] program and in combination with other treatment measures (e.g., mowing, burning and hand removal). Application following another treatment method in which plants are trimmed or shortened can increase the effectiveness of the chemical treatment. Herbicides can also be used to kill herbaceous plants in exposed areas, such as roadside grass and weeds, and are typically applied while the grasses and weeds are still actively growing. Foliar treatments are generally not applied within seven days of significant rain because the herbicide may be washed off before it is effective, and not on windy days because of concerns for spray drift.

The use of Garlon 4 Ultra herbicide can be used to treat areas of eucalyptus resprouting, removing the need to completely uproot or grind down the eucalyptus stump. Foliar application of Roundup to eucalyptus re-sprouts is another typical, successful chemical treatment, and can be used to eliminate small-diameter fuels in areas of high ignition risk. The use of a thistle-specific herbicide, Transline, is effective in controlling the spread of yellow star thistle, artichoke thistle, and bull thistle.

Herbicides do not remove any vegetation from an area's fuel load; the dead plant matter continues to exist at the site and could continue to be a fire hazard if not collected and disposed. Health, safety and environmental concerns have limited the widespread use of chemicals over the past 20 years, and repeated use of chemicals is not preferred due to the prevalence of unwanted species building resistance to herbicides. Additionally, concerns regarding water quality and other potential environmental impacts that may occur with prolonged use of and exposure to herbicides and other chemical applications further limit their frequent or widespread use as a treatment.

Application of herbicides is typically performed by hand, and can include sponging, spraying, or dusting chemicals onto unwanted plants. Hand application provides flexibility in application and is ideally suited for small treatment areas. Roadside application of herbicides may employ a boom affixed to or towed behind a vehicle.

Herbicide application requires specific storage, training and licensing to ensure proper and safe use, handling, and storage. Only personnel with the appropriate license are allowed to use chemicals to treat vegetation. Herbicide application is also only applied per a prescription prepared by a Pesticide Advisor licensed in that county. Personal protection equipment is essential to limit personnel exposure to chemicals.

[10] Integrated Pest Management is a strategy that uses an array of biological, mechanical, cultural, and hand labor, to control pests, with the use of herbicides as a least-preferred method of control.

6.3 Best Management Practices

The protection and preservation of culturally and environmentally sensitive areas is one of the primary drivers for development of an updated Fire Management Plan. The development of a comprehensive plan not only protects these features from the affects of fire, but ensures that vegetation treatment, fuel management, or fire mitigation efforts are planned and executed in a manner that prevents potential additional adverse impact. The following steps are considered best management practices for the continued protection of environmental areas. These steps are ideally suited to on-going fire management planning and the execution of specific fire management actions described within this plan.

- Detailed site inventory prior to treatment to determine the location of sensitive sites. Exploration into the use of knowledgeable volunteers to conduct a more detailed, site-wide survey is warranted.

- Site planning and design to determine specific vegetation treatment actions based on fire management benefits, environmental impact, and required mitigation activities.

- Protection during vegetation treatment using best management practices tailored to impacted sensitive resources.

- Protection of disturbed environmentally sensitive areas following either specific fire management actions.

The above vegetation treatment actions have been commonly used throughout the State of California. Through their implementation, a series of best practices has emerged to limit their adverse impact on the environment and to assist in the selection and planning of their application.

6.3.1 Hand Labor

Due to the direct relationship of personnel to the environment in which they operate, hand labor can represent an approach that provides the least adverse impact to environmentally sensitive areas. However, specific fire management goals and the characteristics of the sensitive area or resource must be assessed to develop an actual work plan and associated activities. The following management practices and considerations should be implemented during site planning and project execution.

- Provide or confirm adequate training, experience, and oversight to ensure that personnel are familiar with hand labor operations and planning, site conditions, potential and identified sensitive resources, and the identification of specific environmental features or conditions that must be avoided.

- Avoid treatment actions during conditions that may affect water or run-off including during storms or severe weather or immediately following severe weather.

- Avoid excessive foot or vehicle traffic on slopes, unimproved or non-designated trails, or outside of preexisting roads or access points.

- Inspect areas for nesting birds to determine if activity should be postponed or adjusted by the establishment of a buffer area.

- Clean all tools and equipment following actions and prior to movement into new environmental areas to prevent the spread of invasive or non-native plants.

6.3.2 Mechanical Treatments

Due to the potential for large equipment use, rapid action, and large-scale area operations, mechanical treatments can have significant adverse impacts on sensitive areas. As a result, pre-planning and site supervision are extremely important for any planned mechanical treatment actions. The following management practices and considerations should be implemented during site planning and project execution.

- Provide or confirm adequate training, experience, and oversight to ensure that personnel are familiar with mechanical treatment operations and planning, site conditions, potential and identified sensitive resources, and the identification of specific environmental features or conditions that must be avoided.

- Avoid treatment actions during conditions that may affect water or run-off including during storms, periods of precipitation, or immediately following severe weather. In addition, avoid scheduling any treatment actions during seasons with significant predicted precipitation. Cease operations or postpone planned operations including movement of vehicles or equipment during precipitation conditions that may combine with vehicle activity to cause damage to roads, trails, or adjacent land areas.

- Plan treatment actions and equipment selection to minimize damage or alterations to existing soils. Determine locations of potentially erosive soils prior to treatment. Restrict operations that may adversely affect sensitive soil systems such as serpentine soil areas, erosion prone soils, or riparian zones. Restriction may include using road-based operations only, and avoiding riparian set-backs established by regulatory agencies.

- Maintain a buffer of 25-50 feet between operations and water bodies or designated riparian areas. Avoid crossing drainage channels, run-off areas, or dry streambeds. Install and manage run-off barriers for rainwater in all treatment and operating areas. Restrict mechanical removal of trees to areas further than 50 feet from drainage channels.

- Restrict vehicle traffic to preexisting roads or pre-planned access points based on equipment size and operations. Limit transport and support equipment to existing roads. Limit heavy equipment use to slopes less than 30%. Install erosion control measures on all vehicle roads and traffic areas.

- Maintain strict monitoring and control of fueling and maintenance operations. All maintenance actions that may produce spills should be executed in areas with secondary containment protection, away from any water bodies or drainage areas. Clean up of all spills should be done on-site, with materials ready for use. Inspection of equipment for new leaks and mechanical problems should be performed daily, prior to operations.

- Inspect areas for nesting birds to determine if activity should be postponed or adjusted by the establishment of a buffer area.

- Clean equipment following actions and prior to movement into new environmental areas to prevent the spread of invasive or non-native plants.

- Plan operations around expected seeding conditions of targeted species (either prior to or sufficiently afterwards) to ensure efficiency of treatment action.

- Cease actions during periods of high fire danger or during red flag conditions. Ensure that all mechanical equipment have approved spark arrestors and comply with California Public Resources Code (PRC) sections 4431, 4435, 4442, and 4437 to limit potential for ignition of incidental fires.

- Maintain on-site fire suppression resources to include shovel, water pump, fire extinguisher, and two-way radio or communications for fire reporting.

6.3.3 Grazing with Sheep and Goats

- One of the primary adverse impacts of grazing is over-grazing and the resulting exposure of bare ground. Over-grazing can increase the potential for soil erosion, water run-off and drainage, elimination of native plant species, and spread of non-native plants and weeds. Prepare a grazing management plan by a certified range specialist that specifies goals, stocking levels, grazing periods, installation of range improvements (such as water sources) to evenly distribute utilization of feed, and monitoring and performance criteria.

- Develop a site-specific annual grazing plan that includes project-level plans for stocking, timing, and resource management goals.

- Prior to introduction, all animals should be quarantined and fed weed-free forage to limit spread of invasive or unwanted plant species as well as prevent spread of livestock diseases.

- Limit grazing to non-riparian areas.

6.3.4 Broadcast Prescribed Burns

Prescribed burns can have significant impacts on sensitive areas both from environmental and cultural standpoint. The planning and execution of a prescribed burn must be carefully developed. A prescribed burn can adversely affect the duff layer, generate large and unpredicted amounts of smoke, and transition from a controlled event to one that is uncontrolled and dangerous.

- Provide or confirm adequate training, experience, and oversight to ensure that personnel are familiar with broadcast prescribed burn operations and planning, site conditions, potential and identified sensitive resources, and the identification of specific environmental features or conditions that must be avoided.

- Develop a smoke management plan describing desired outcomes and specific actions for onsite personnel including a test burn, continual evaluation of smoke dispersal, monitoring of wind patterns, and monitoring of potential visibility impacts to primary roads and highways.

- Develop public safety plans to be executed throughout the prescribed burn cycle including press and information releases, signs and notifications, patrols on roads and access points, and development of a fire contingency plan.

- Maintain a buffer between the prescribed burn area and water bodies or drainage into riparian zones. Buffers should be a minimum of 25 feet for 5% slopes, 75 feet for 5-10% slopes, and 250 feet for 10% or greater slopes. No prescribed fires should be ignited near streams or in riparian zones.

- Plan the prescribed burn to minimize post-fire erosion into water bodies and drainages through natural barriers, proper construction of fire lines along contours, and proper erosion control barrier deployment. Minimize prescribed burning in areas with highly erodible soils.

- Cultural and social sites and structures shall be excluded from burn area through planning, hand-lines, or other fire protection operations. On-site personnel will be briefed on locations and features of cultural or social sites to include incident command or response personnel. Avoid prescribed burns in areas with utility infrastructure, existing property or structures, or archeological sites.

- Manage fuel moisture through pre-fire assessment and potential fuel modification. Prior to prescribed burn, remove ladder fuels into the tree canopy to increase safety and reduce torching.

- Conduct prescribed burns only on designated burn days as authorized by BAAQMD.

- Inspect areas for nesting birds to determine if activity should be postponed or adjusted.

6.3.5 Herbicide Application

The application of herbicides for vegetation treatment should focus on the goal of applying the least amount of chemical required to achieve a desired outcome, consistent with the City of Palo Alto's Integrated Pest Management policy. Best management practices for herbicide application are centered on limiting adverse or unintended impacts of herbicides due to run-off, wind-spread, or post-treatment exposure.

- Provide or confirm adequate training, experience, and oversight to ensure that personnel are familiar with herbicide operations and planning, site conditions, potential and identified sensitive resources, and the identification of specific environmental features or conditions that must be avoided. Herbicide application is only applied per a prescription prepared by a Pesticide Control Advisor licensed in that county, and applied by a licensed Pesticide Control Applicator.

- Develop public safety plans to be executed throughout the treatment cycle including press and information releases, signs and notifications, and fencing or area restrictions.

- Develop a spill contingency plan and maintain strict monitoring and control of operations. Clean up of all spills should be done on-site, with materials ready for use.

- Chemical treatments within habitat of California Red-legged Frog should be conducted according to U.S. District Court injunction and order covering 66 pesticides (Oct 2006) and subsequent EPA effects determinations.

- Clean equipment following actions and prior to movement into new environmental areas.

- Avoid treating areas adjacent to water bodies, riparian areas, and primary drainage access. Follow all herbicide labels and directions in determining applications near water resources or riparian habitats. Limit aerial application to greater than 100 feet from water resources. Limit ground and hand application to greater than 50 feet.

- Avoid treating areas used for livestock operations or intended as grazing areas.

PART B – POLICY REVIEW AND SUPPLEMENTAL RECOMMENDATIONS

1 EVACUATION AND REFUGE

1.1 Identification and Notification

The complexity of jurisdictional boundaries and responsibilities necessitates that the City of Palo Alto participate in 1) a standing forum that includes all stakeholders and 2) creating of coordinated, regional plans.

Emergency Public Information (EPI) is generally disseminated via broadcast radio (the Emergency Alert System and KZSU 90.1 FM), telephone and e-mail, two-way radio contact with neighborhood leaders and Disaster Service Workers Volunteers (via ARES/RACES ham radio and other systems), and via public address systems such as speakers on first responder vehicles.

New mass-communication systems for telephone and e-mail have recently been deployed in local jurisdictions:

- Palo Alto: Community Alerting Notification System (CANS)
- Los Altos Hills: a similar systems to CANS
- Stanford: also CANS
- San Mateo County: a county-wide system, www.smcalert.info <http://www.smcalert.info/>
- Santa Clara County: a county-wide system is pending

These systems are currently not coordinated, An incident that starts in Palo Alto and spreads to Woodside could cause 1) a failure to notify all involved or affected and 2) inconsistent or conflicting information. The National Incident Management System (NIMS) provides that events where multiple jurisdictions are involved may establish a Joint Information Center (JIC) to coordinate the efforts of all Public Information Officers (PIOs). In addition, Open Space and Park Division radios lack adequate channels (especially tactical channels) for the growing need. This will be more crucial as affected agencies switch to digital communication systems. We recommend that a pre-plan for a Foothills JIC be created which would include notification procedures for all potentially-involved dispatch centers, and that the Open Space and Park Division radios be updated.

A regional evacuation plan for the Foothills should also be created: "Foothills Regional Emergency Response and Evacuation Plan (FREREP)". This plan would provide for standardized signage and evacuation route nomenclature and protocols. The Palo Alto Police Department has developed a draft plan that could be an initial model.

Furthermore, locked gates on evacuation routes must be properly labeled and signed and first responders (including, in some cases, authorized local residents) must have keys or other access methods. For example, the Los Trancos Road gate to the back of Foothills Park is not labeled. In another example: A Los Trancos Neighborhood Preparedness Coordinator could be issued a key and given an assignment to open that gate in the event of an emergency.

Existing evacuation plans should be reviewed, updated as needed, and integrated into the FREREP. For example, the Los Trancos/Vista Verde Neighborhood evacuation plans are posted at the following location:

http://www.vistaverdeca.org/emergency_response_info.html

The (private) Pony Tracks Ranch provides emergency vehicle egress (into Palo Alto via the "stub" of Alpine Rd. on to Page Mill) as well as a safe refuge area:

http://www.vistaverdeca.org/about9.html

1.2 Regional Cooperation

After the tragic Oakland Hills Fire of 1991, several local jurisdictions came together to form the East Bay Foothills Forum. The same underlying conditions and principles support the formation of a similar group in the Palo Alto area, which could perhaps be called "The Midpeninsula Foothills Emergency Forum (MFEF)".

1.3 Temporary Refuge

Places of temporary refuge are located in areas of low hazard, in places that are regularly maintained (at least annually) in a low-fuel volume condition. Los Trampas Valley is the best example of a suitable location, however this site may also be used as by incident management teams during longer duration fires.

To enhance the effectiveness of these temporary refuges, the park staff should perform an evacuation drill. The firefighters safety zones on Trappers Ridge are NOT temporary refuge areas for anyone but firefighters with proper training and equipment.

There are opportunities for off-site refuge; private properties in the area could provide temporary refuge, but agreements between the City and property owners would need to be formalized.

2 CODES AND REGULATIONS

The 2007 California Building Standards Code became effective statewide on January 1, 2008. Included in the new code are the 2007 versions of the California Building Code (based on the 2006 International Building Code), and California Fire Code (based on the 2006 International Fire Code). With Ordinance 4975 and 4976, the City of Palo Alto adopted these codes and local amendments to the State model codes with supportive Findings of Fact, which were filed with the State Building Standards Commission. These codes became effective in Palo Alto on January 1, 2008. The codes are comprehensive and have included the key elements recommended by the model codes.

2.1 Existing Codes and Ordinances

Codes related to wildland urban interface fires can be found in both the building code and fire code.

2.1.1 Fire Code

Title 15 of the Palo Alto Municipal Code adopted the California Fire Code, 2007 Edition, including Appendices B and C, and Chapters 3, 4, 5 and 25 and Chapter 1 Appendix of the International Fire Code. Sections 15.04.520 – 15.04.587 address wildland urban interface fires.

Key components of the fire code include:

- Definition of the Wildland Urban Interface Fire Area: "*…all areas west of Highway 280 and all other areas recommended as "Very High fire Hazard Severity Zone" by the director of CDF."* (Section 15.04.520*).*

- Requirement for Preparation of Fire Protection Plan: Addition of section 4703.1 through 4703.4 requires a site specific wildfire risk assessment be prepared by an applicant when required by the fire code official. (Section 15.04.530)

- Requirements for Defensible Space: Addition of section 4707.1 – 4707.2 define the requirements for an effective defensible space within 30 feet of buildings, with an additional defensible space 100 feet when required by fire code official due to site conditions. This section also defines corrective actions and the ability of the executive body to correct conditions and make the associated expense of such correction a lien upon the property. (Chapter 15.04.530). In addition, Section 15.04.130 adds Section 304.1.2.1 that provides authorization for the fire chief to cause removal of weed or combustible materials.

- Access Requirements: Addition of sections 4714 through 4714.3 establishes access requirements for all driveways and fire apparatus roads. (Section 15.04.550)

    - Driveways require clearances of 12 feet wide and 13.5 feet high. The code requires turnarounds for driveways greater than 150 feet in length and turnouts and turnarounds for those greater than 200 feet in length and 20 feet wide. It requires that vehicle speed limits be posted on entrances to bridges, on driveways and private roads.

    - Fire apparatus roads require clearances of 20 feet width and 13.5 feet height. Dead end roads greater than 150 feet in length are required to have turnarounds.

- In addition, Section 15.04.170 amends Section 504.4 to require that access control devices (including bars, grates, gates, electric or magnetic locks or similar devises that could inhibit rapid fire department emergency access) be approved by the fire code official and be provided with an approved means for deactivation or unlocking by the fire department.

- Water Supply: Addition of sections 4715 through 47159 defines water supply requirements including water sources, hydrants, adequate water supply, obstructions, identification, testing and maintenance, clearance of fuel and standby power. (Section 15.04.560)

- Automatic Fire Sprinklers: Addition of Sections 4716 through 467716.3 adds the requirement for new buildings to be provided with an approved automatic fire sprinkler. Existing buildings are required to provide an approved automatic fire sprinkler when modifications are made that increase the building area. (Section 15.04.570)

- Requirements for Suppression and Control: Addition of Sections 4717 through 4717.3.5 add general requirements applicable to new and existing properties to provide necessary fire protection measures. These include vegetation control, maintenance of defensible space with measures that increase the requirements of Section 4707 (Section 15.04.530). These measures address (Section 15.04.580):

    - Trees: Maintain horizontal clearance of 10 feet from any structure. Pruning to remove limbs located less than 6 feet. Regularly remove deadwood and litter from trees.

    - Roadway Clearance: Clear brush or vegetative growth within 10 feet on each side of portions of fire apparatus access roads and driveways.

    - Electrical Transmission and Distribution Lines: Clearance requirements provided for the various line voltages between electrical lines and vegetation.

    - Access Restrictions: Provides the authorization for the fire code official to close WUI areas to entry (exceptions made for residents, and authorized police or fire personnel.)

- Ignition Source Control: Additions of Sections 4717.4 through 4717.4.10 provide regulations to prevent the occurrence of wildfires. These sections address clearance from ignitions sources; smoking; equipment generating heat, sparks or open flames; fireworks; outdoor fires, outdoor fireplaces, permanent barbecues and grills; reckless behavior. (Section 15.04.584)

- Control of Storage: Addition of Section 4717.7 provides additional requirements for storage of hazardous materials; liquefied petroleum gas installations; explosives and combustible materials. (Section 15.04.585).

- Dumping: Additions of Section 4717.6 provides regulations related to dumping of waste material and ashes or coal. (Section 15.04.586)

- Protection of Pumps and Water Storage Facilities: Addition of Section 4717.7 added regulations to increase the reliability of water storage and pumping facilities and protect such systems from intrusion by fire. (Section 15.04.587)

- Land Use Limitations: Addition of Section 4717.8 places limits on land use to reduce the potential threat to life safety by requiring permits for temporary fairs, carnivals, public exhibitions and similar uses.

- Emergency Communications: Section 15.04.190 requires, by the addition of Section 5.11.1, that new buildings or buildings expanding by more than 20%, or that change occupancy classification must provide an approved system or equipment that will allow for adequate emergency radio coverage.

2.1.2 Building Code

Title 16 of the Palo Alto Municipal Code adopted the California Building Code, 2007 Edition. In general these sections support the adopted Title 15 Fire Code. Key components of the building code that address wildland urban interface fire include:

- Wildland Urban Interface (WUI) Fire Area: The same definition as in Title 15 applies and amends Section 702A of the California Building Code. (Section 16.04.140)

- Sprinkler System: Section 903.2 is amended to provide an automatic sprinkler system throughout all buildings designated in the WUI Fire Areas (except any non-habitable structures accessory to a single family residence that have a gross floor area of 500 square feet or less). It also includes the requirement for modifications to existing structures that expand the gross floor area as listed in the Fire Code. (Section 16.04.150)

- Roofing Requirements: Section 1505.14 amends the roofing requirements in the WUI Fire Area. A Class A fire retardant roof covering is required where more than 50% of the total roof area is replaced within any one year period, for new structures and in the alteration, repair or replacement of the roof of existing structures. Roofing requirements shall also comply with Section 704A.1. (Section 16.04.170)

Chapter 7A of the California Building Code provides additional requirements for materials and construction methods for exterior wildfire exposure. It expands the roofing and attic ventilation requirements that came into effect for new buildings applying for a building permit after December 1, 2005. This portion of the code addresses:

- Roofing assemblies, coverings, roof valleys and roof gutters.

- Attic ventilation, eave or cornice vents and eave protection.

- Exterior wall coverings, openings, vents, exterior glazing and window walls and exterior door assemblies.

- Decking, floors and underfloor protection.

- Ancillary buildings and structures.

2.2 Recommendations

There are several areas that could be expanded to further improve safety in the Palo Alto WUI Fire Area. These could be done as code revisions to further enhance the code or as guidelines that are used in enforcement of existing codes. Other best practice measures may be incorporated into City contracts and used in public education:

- Expand Section 15.04.520, the *Area Defined as Wildland Urban Interface (WUI) Fire Area*, to include the lands between Foothill Expressway / Junipero Serra Boulevard and Highway 280.

- Expand Section 15.04.530 *General Requirements for WUI Fire Areas* (4703.1 *Fire Protection Plan Preparation*) to require that Fire Protection Planning begin early in the planning/ permitting process so the location of access roads, driveways and structures can be influenced to increase fire safety and emergency response. Require the plan to also address implementation and funding of defensible space vegetation management (especially important for commonly held private open space).

- Expand Section 15.04.540 *Defensible Space* (4707.1 General Item 5.) to include all ground, decking and balconies in addition to the specified "*maintain roof of a structure free of leaves, needles or other dead vegetative growth.*"

- Expand Section 15.04.550 *Access Requirements (4714.2 Driveways and 4714.3 Fire Apparatus Roads)* to add standards related to gradient and horizontal and vertical curvature, bridge load limits, parking restrictions during high fire danger weather and requirements for emergency vehicle access.

- Expand Section 15.04.580 *General Requirements for WUI Fire Areas* (section 4717.2 *Vegetation Control)* to provide additional guidance for Maintenance of Defensible Space (see following guidelines).

- Expand Section 15.04.584 *Ignition Source Control* (section 4717.4.7 *Outdoor Fires*) to identify that abatement by burning is unlawful unless by permit and unless all other applicable permits are obtained from appropriate governing jurisdictions. Burn permits are only issued to working agricultural properties.

- Fencing: Add a section requiring fences be constructed of either noncombustible material or of timbers with a minimum of one-inch nominal thickness. For example a typical fencing might consist of open wire mesh with four-inch posts and stringers that have a minimum one-inch nominal thickness. Fences should be designed with removal panels or gates so during a wildfire they do not convey fire to adjacent structures.

- Signage: Add a section requiring street, road and building address signs to have a minimum letter height of 4 inches, be 1/2 inches thick, reflectorized, painted a color contrasting with the background color of the sign, mounted on non-combustible poles and visible within 100 feet traveling from both directions.

- Mechanical Equipment Ignition Prevention: Requirements should be included in all City contracts for construction or maintenance work in the WUI Fire Area that address ignition prevention such as equipment (spark arrestor, overheating protection etc.), refueling, clearance of work area, cessation of work during periods of high fire danger weather and requirements for fire suppression equipment. This is becoming more critical for new diesel-powered vehicles because clean air/emission require exhaust particulate burning systems can more easily start fires if the vehicles are taken off-road.

- Smoking: More stringent rules regarding smoking in Pearson-Arastradero Park are recommended. Restrictions should be similar to those in place at Foothills Park.

2.3 Exterior Hazard Abatement

The following information is provided as a set of guidelines that can be developed into educational material to facilitate compliance with existing codes. The code currently addresses treatments for exterior hazard abatement in a general way; this section provides more specificity regarding the spacing of vegetative fuels.

2.3.1 For parcels of land one acre or less maintain parcel in complete abatement.

- For a distance of 30 feet a structure on slope steepness less than 30 percent grade, or 70 feet on slopes greater than 30 percent grade, from all property boundaries cut dry grass and non-woody vegetation to less than 3 inches yearly, no later than June 1.
    - This may require re-mowing if late season rains promote grass growth after the first cutting.
    - With prior approval of the Fire Department cutting of native grass and wildflowers may be delayed until after seed set provided they do not form a means of rapidly transmitting fire to any structures.
- Leaves and humus may not exceed two inches in depth anywhere in a landscaped area; however, bare earth should not be exposed in over 50% of the site and no one bare patch should be larger than 15 square feet.
- All dead vegetation (i.e. dry grass, leaves and humus) must be removed under trees and within shrubs, vines and semi-woody plants every year by June 1.
- Dead branches must be removed from mature trees and all vines, to 8 feet above ground.

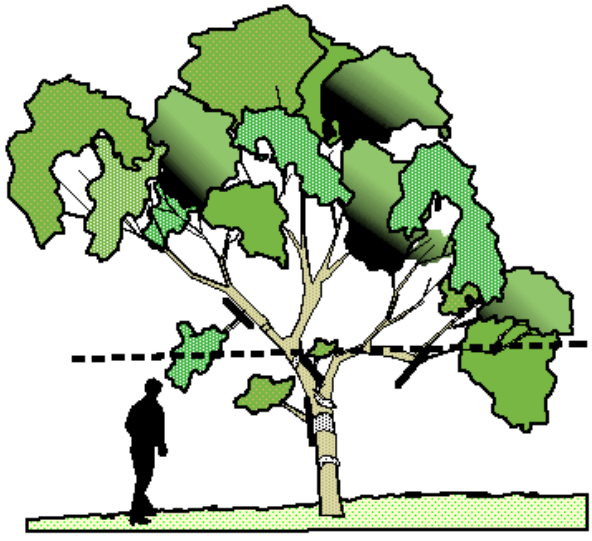

Figure 33: Pruning Example.

Prune branches to a height of 8 feet above the ground. In young trees, prune branches on the lower one-third of the height of the tree. Do not disturb or thin the tree canopy. This promotes growth in the understory, which is more easily ignited.

- Limbs of trees and large-form shrubs that are smaller than three inches in diameter shall be pruned to provide clearance of three times the height of the understory plant material or 8 feet, whichever is higher. Trees shorter than 24 feet in height shall be pruned of the lower one-third branches (Figure 33).

- The vertical distance between the ground and the lowest tree branches should be 3 times the height of any shrubs planted beneath the trees or 6 feet whichever is higher. Plants under trees should generally be shorter than 18 inches in height. Taller shrubs, including vines, semi-woody species and all chaparral species, may be near (six horizontal feet from tree crown) but not under trees.

- Remove all dead trees deemed a fire hazard by the Fire Department.

- Individual plants or shrub masses will be separated so that groupings/shrub masses will be no wider than two times the grouping height, or 120 square feet in area. Distinct groupings of shrubs (which includes vines, semi-woody species, all types of brush, and all chaparral species) will be designed to dampen the spread of fire. Alternatively, shrubs can be cut and maintained to a height of two feet.

Figure 34: Shrub Spacing.

Design groups of plants small enough to provide horizontal separation between groups. This allows proper maintenance and helps slow the spread of fire. Each shrub or group of plants should measure no wider than two times its height, or less than 120 sq.ft. (or 6 ft x 20 ft). The space between groups should be greater than three times the height of the shrubs, or at least a 12 ft. distance

- A vertical clearance of 5 feet shall be maintained between roof surface and portions of trees or other vegetation overhanging any building or structure.

- Wood piles must be enclosed in a non-combustible storage unit.

2.3.2 For parcels larger than one acre in size

- Maintain the area (space) within 100 feet of any structure on the parcel per the specific requirements for lots less than one acre in size.

- Maintain the area (space) within 100 – 250 feet from any structure on the parcel per the following specific requirements:

    - Shrub masses will be separated so that groupings will be no wider than two times the grouping height, or 120 square feet in area. Distinct groupings of shrubs (which include vines, semi-woody species, all types of brush, and all chaparral species) will be designed to dampen the spread of fire. Alternatively, shrubs can be cut and maintained to a height of two feet.

    - All dead vegetation (i.e. dry grass, leaves and humus) must be removed under trees and within shrubs, vines and semi-woody plants every year by June 1.

    - Dead branches must be removed from mature trees and all vines, to 8 feet above ground.

  - Trees, and large tree-form shrubs, shall be pruned to provide clearance of three times the height of the understory plant material or 8 feet, whichever is higher. Limbs that are smaller than three inches in diameter are to be pruned up to eight feet off the ground, and in trees shorter than 18 feet, the lower one-third of the height of the tree. See Figure 33.

  - The vertical distance between the ground and the lowest tree branches should be 3 times the height of any shrubs planted beneath the trees or 6 feet whichever is higher. Plants under trees should generally be shorter than 18 inches in height. Taller shrubs, including vines, semi-woody species and all chaparral species, may be near (six horizontal feet from tree crown) but not under trees.

- If a structure is within 100 feet of property boundary on adjacent lot, provide 30-foot firebreaks following as closely as possible to the property line and along one side of all fence lines. Fire breaks are a continuous strip of ground that is mowed to three-inch height, or disced, or dozed.

- Remove all dead trees deemed a fire hazard by the Fire Department.

- Trees on the top of ridges shall be maintained to limit torching, through pruning to provide clearance of three times the height of the understory plant material or 8 feet, whichever is higher. Limbs that are smaller than three inches in diameter are to be pruned up to eight feet off the ground, and in trees shorter than 18 feet, the lower one-third of the height of the tree as in Figure 33.

- Within 15-feet of all public or private roadways or driveways, all grass must be mowed, disced or sprayed to 3 inches height.

- In grasslands, 30-foot firebreaks and crossbreaks that divide the parcel into approximately 5-acre sections. Firebreaks and crossbreaks are a continuous strip of ground that is mowed to three-inch height, or disced, or dozed, following as closely as possible to the property line and along one side of all fence lines, ditches, and on top of all ridges. When terrain is too steep or rugged for a tractor, a hand-mowed firebreak may be required.

- Active Pastureland: **15-foot wide firebreaks** and crossbreaks are required if a sufficient number of animals are present to steadily reduce height of grass during the summer months to 3 inches or less by the end of August. If not active, 30-foot width is required.

- Active Cropland: 15-foot wide firebreaks and crossbreaks required if crop is to be harvested by mid-June. If later, 30-foot width is required.

3 FIRE PROTECTION – STATION 8

The following is a description, appraisal and recommendation regarding staffing of, equipment for and other response resources related to Station 8 in Foothills Park.

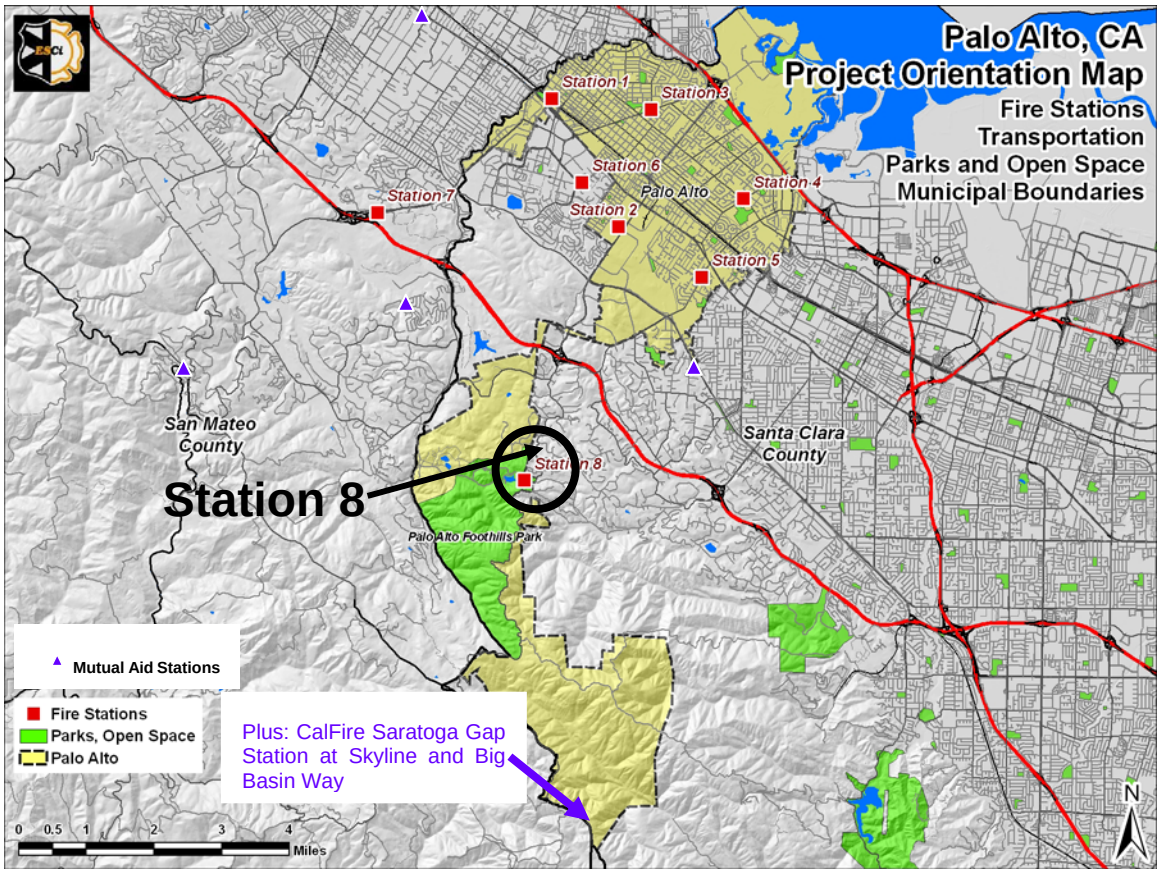

Figure 35: Fire Protection Resources.

3.1 Description

Fire Station number 8 of the Palo Alto Fire Department is located at 3300 Page Mill Road in Palo Alto, CA. It is a *seasonal* fire station that is only staffed during the daylight hours. This amounts to 12 hours per day. The period of time it is staffed is usually from July 1st to November 1st of each year. This is essentially the fire season for the area being protected and involves about 120 days of coverage. Whenever there is a declared high fire danger day or the burn index indicates an ignition threat the station may be staffed beyond the 12-hour period and outside of the fire season when appropriate.

The staffing of the station currently includes 1 Captain, 1 Apparatus Operator/Engineer and 1 Firefighter. These positions are filled through overtime allocations rather than being post positions. Initially a fire response unit located at Foothill Park was staffed with only 2 persons. It was upgraded to 3 persons following the Arastradero Fire of 1985 in the lower foothills to be consistent with contemporary fire staffing practices and when Station #8 was constructed.

The apparatus that responds from this station is a Type III Engine Company. This is an apparatus that is primarily designed to respond to wildland fires instead of structure fires. This is similar to the types of companies used by major wildland agencies.

The station provides an initial attack capability to an area that involves about 25 square miles of urban-wildland interface area. There are approximately 150 dwellings in the area, but that is not the primary risk. The fire history of this specific area is relatively free of major events in the past decades. The last reported major fire in the vicinity of the upper foothills was in 1912. Significant fires in the lower foothills (primarily light fuels) occurred in 1985, 1992, 2000 and 2007.

However, that one factor creates an impact upon existing fuel loads. The lack of major fires in the past has resulted in fuel densities that may be ready to support a wide area fire. It has been estimated that the medium and high density fuels are about three times their normal density.

The secondary response units into this area are deployed from the "El Monte" fire station of Santa Clara County Fire located to the north and the Palo Alto Stations #2 and #5. The County Fire Station is equipped with Type I and Type IV engines. Currently there is no direct link to this station in the dispatching of equipment. Depending upon who reports an emergency in the area the call could go directly to the City of Palo Alto or it could be routed through the Santa Clara County Communication Center and Palo Alto would then be notified.

The standard response into this area varies upon the level of dispatch. On medium or high dispatch days the Palo Alto Fire Department responds Engine 8 to reports of wildland fires and supports it with another Type III (3 personnel) that is cross staffed by the truck company from Station #6 on the Stanford Campus, one Type I from Station #2 (3 personnel), 2 Type IV cross-staffed patrol units from Stations #2 and #6 (6 personnel), one Paramedic ambulance from Station #2 (2 personnel) and one Battalion Chief from Station #6.

Furthermore, the dispatch system provides a brush unit from the Santa Clara County El Monte Fire Station in Los Altos Hills at Foothill Community College (4 personnel from 1000-1900 hours) and can respond an additional 4 Type I's (12 personnel) and 3 Type IV Brush units (9 personnel). Lastly, the system has the depth to provide additional resources from other mutual aid entities in the same area (e.g. Cal Fire Ranger Unit resources located in Cupertino and San Martin). These include additional Type III units (3 or more), air assets, hand crew resources, bulldozers and command staff to complete an overhead requirement in the event of a major fire. Other Type 1, Type III and Type IV resources may be made available through the Santa Clara County Mutual Aid System.

The City of Palo Alto does currently not have an adopted Standards of Cover document, but operates with an informal response goal of 5 to 6 minutes for attendance of at least 90% of its calls for service. The department also provides paramedic (advanced life support – ALS) response to the basic built out portion of the city within 8 minutes for at least 90% of those types of calls (these response goal benchmarks are exclusive of the foothills area). Station 8 has not normally been considered an ALS resource. In the past 2 years a priority has been established to staff Engine 8 with an ALS resource whenever possible.

The staffing for the station is provided in the overtime budget. Last year the amount set aside to provide coverage was $200,000.

3.2 Appraisal

The primary purpose of placing a wildland unit into this area is to prevent any ignitions from spreading beyond a reasonable fire perimeter before an adequate full fire alarm assignment and an effective response

force can be placed on the scene. The first 10 minutes of a wildland fire are critical to restricting the size of the ultimate fire. Depending upon the fuel type and density, the slope and aspect and the effects of wind upon a flame front, the period of time that it takes to get initial control of an incipient fire is very important. This is especially true in light fuels, when a fuel is running uphill and/or when fire conditions that consist of high temperatures, low humidity and wind conditions exist. The fire behavior assessment of the Foothills Area indicates a high potential for fast-moving fires.

The secondary purpose of having the unit in place is to establish a point of control for the development of an incident command system in place to address the escalation of the fire, if it is not controlled in the first 10 minutes.

The first purpose addresses the need for "distribution". In the language of response coverage the distribution of resources is the placement of companies, based upon risk factors to be readily available to handle the first few minutes of fire or emergency control.

The second purpose addresses the need for "concentration". This terminology is used to describe the deployment of an adequate amount of resources to deal with the ultimate size of the fire. These two concepts are inter-related in that fires that are controlled early do not need as many resources to be eventually deployed. Therefore, early intervention is a form of cost avoidance.

This is the basic operating assumption of all seasonal fire resources. Major wildland agencies such as Cal-Fire, the U.S. Forest Service and other wildland agencies use the concept of seasonal and part time staffing configurations to minimize fire size to as small an area as possible.

3.3 Recommendation

The staffing of this station by utilization of overtime fire personnel is a reasonable method of addressing the risk and hazards in the area. It is a cost effective way of reducing the impact of potential wildland fires in the study area. The elimination of this company places the responsibility for initial attack upon fire companies that are more remote and therefore are more likely to have lengthy response times into the area.

The staffing pattern of 3 fire fighters is the minimum for the safe and effective operation of an initial attack unit for a wildland fire. This station and its current staffing configuration should be retained in the future. In addition, staffing a police officer and maintaining a ranger staff presence in the Foothills Area during high fire risk days should be considered. This type of personnel offers extra fire detection capability and is available to assist with evacuation should an incident require that particular action.

4 TRAIL PLAN UPDATE

4.1 Pearson-Arastradero Preserve Trails Management Plan (March 2001)

The Trails Master Plan for Pearson-Arastradero Preserve recognizes that the preserve is located in the Hazardous Fire Area (Section 3.3). The plan identifies management objectives, strategies and recommended actions to meet Fire Department objectives. It recognizes the need to coordinate with the Fire Department to develop and implement a fire suppression plan that will maximize the safety of the users and the adjacent properties, without adversely impacting the natural environment. It includes fire prevention methods for firelines on the perimeter, as well as fuel reduction zones to compartmentalize the preserve for fire suppression in the event of a fire.

4.1.1 Recommended Revisions

Since the Trails Master Plan was adopted in 2001, there have been new facilities developed at the Gateway Interpretive Center and a new access to Foothills Park. Fuel management recommendations take into account these new facilities, as well as recommend the following additions and modifications to the 2001 Trails Plan:

- Addition of fuel management along the evacuation route (Arastradero Road) and management of defensible space around the Gateway Interpretive Center, parking lot and staging area to include projects A.E1 and A.D1, A.D2, A.D3 and A.D4.

- Addition of fuel reduction zones within the interior of the preserve along existing trails for containment including projects A.C9, A.C10, A.C11 and A.C12.

- The Master Plan identifies an option for the Fire Department to use controlled burns as a part of their wildland fire prevention plan. Two potential areas are recommended: Juan Bautista Prescribed Fire North (A.Rx1) and Acorn Trail Prescribed Fire South (A.Rx2).

- Modify firebreak width and performance standards.

- Addition of roadside treatment standards to Clearing and Brushing for those trails that also serve as emergency vehicle access for clearances of 13.5 feet vertical clearance and 10 feet horizontal clearance.

- Addition to Regulatory, Warning and Educational Signs regarding fire hazard signs, education information on fuel management and prescribe fire.

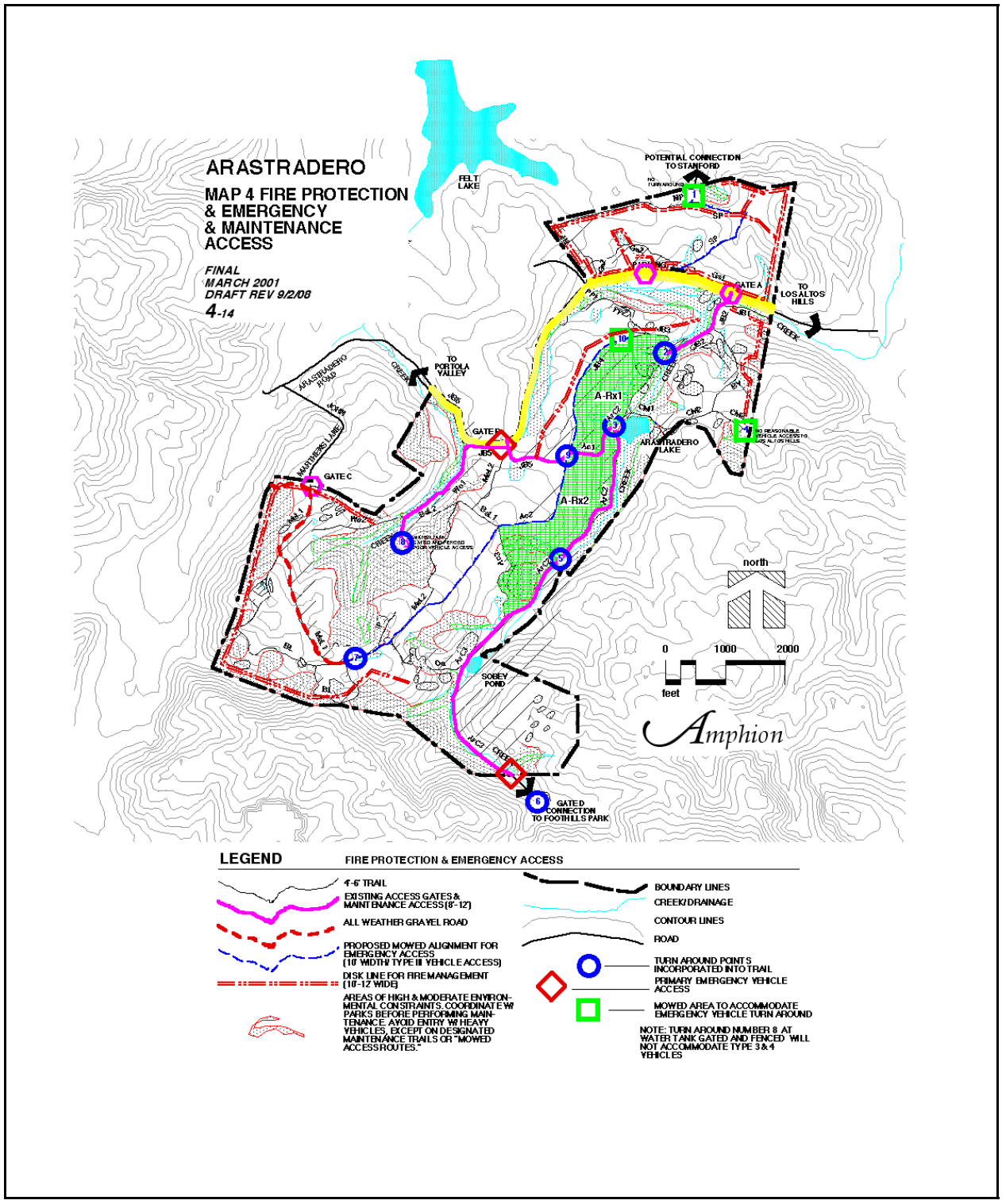

Figure 36: Emergency/Maintenance Access Points.

Map depicts the emergency/maintenance access points of entry, trail travel routes to be maintained for use by the Fire Department and Utilities Department when servicing the Preserve. This map also shows disc lines and indicates those sensitive resource areas in the Preserve that should not be accessed by heavy vehicles. The map has been modified to incorporate the new facilities and associated modifications to fire control treatment areas.

4.1.2 Existing Fire Mitigation and Fuel Management in the Arastradero Trails Management Plan

Hazardous Fire Area: The Preserve is identified in the Hazardous Fire Area. (Section 3.3)

Utilities: Access for maintenance and repair of existing utilities facilities is by all-weather surface roads that can accommodate heavy vehicles for repairs. Primary entrance is Gate B. Clearance of fuels for 10' radius around poles having operable devises. Tree trimming is generally done every 2 to 3 years with ground clearing done annually. (Section 3.4)

Management Objectives, Strategies and Recommended Actions. Objective is to coordinate with Fire Department to develop and implement a fire suppression plan that will maximize the safety of the users and the adjacent properties, without adversely affecting the natural environment (Section 4.5 and Map 4):

- Access: Provide adequate access for Type 3 and 4 vehicles.
- Fire Prevention Techniques: Use least environmentally intrusive prevention methods
- Firebreak and Control Strategies: Prevent fires from spreading on adjacent properties as well as coming into the preserve. Firebreaks/disc lines should be implemented only where they serve their intended function in fire prevention and suppression.
- Temporary Closures: Provide an option for park staff to close the Preserve when conditions such as high fire danger could pose a threat to the public.

Access (Section 4.5 pg 4-9 and Section 7-2 pp 7-7-7-9).

- Provide a 40 to 45 foot "drive" between Arastradero Road and Access Gates A and B to provide a safe place for Fire Department staff to safely park their Type 3 and 4 vehicles when opening the Preserve entry gates.
    - Ensure that all six access points can accommodate fire vehicles at all times. These access points include:
        - The parking lot
        - The access gate on Arastradero Road adjacent to the west of the parking lot
        - Gate A (access limited to the existing turn-around on the west side of the first concrete bridge spanning Arastradero Creek)
        - Gate B, which serves as the primary Utilities Department access
        - Gate C, which is located off John Marthens Lane
        - Gate D - Vista Hill Gate in Foothills Park (one-way uphill, except in emergency situations)
    - Close, restore and annually mow designated emergency access routes within the Preserve as needed to create a circulation route for Type 3 and 4 vehicles in the case of emergency.

- Provide emergency turn-around capability where access roads dead-end (hammer-head configuration needed for vehicle turn-around).

    - To minimize potential impacts to the natural resources, these designated vehicle 'turn-arounds' will be the only acceptable turning points for motor vehicles within the Preserve. The final siting of new 'turn-arounds' (#2, 5 and 9) should be flagged prior to construction and the Open Space and Parks Division Manager should be advised of pending construction. Each turn-around should be clearly delineated and mapped to prevent removal of or impact to sensitive biological resources. Refer to Table 9 – Vehicle Turn-around Design Summary.

    - Recognizing that these turn-arounds are to be used for routine maintenance, construction and patrol. In special circumstances where larger fire trucks and over sized utility vehicles must access the Preserve, these vehicles may not be able to use the turn-arounds and will have to travel through the Preserve in a one way direction. In this case, it is recommended that the vehicles enter and leave through Gates B and D. In the case of a wildfire, public safety will override resource protection. In this case, the Fire Department may be required to override these vehicle guidelines to be able to suppress a fire.

Refer to *Map 36 Fire Protection & Emergency & Maintenance Access* for:

- Emergency/maintenance access points of entry.

- Trail travel routes to be maintained for use by the Fire Department and Utilities Department when servicing the Preserve.

- Disc lines.

- Sensitive resource areas in the Preserve that should not be accessed by heavy vehicles.

- Use a uniform maintenance gate at all major entry points with a universal locking device to facilitate routine and emergency access into the Preserve by multiple department staff.

<u>Fire prevention methods (Section 4.5 pg 4-9 and Section 7.5 Vegetation Management pg 7-39)</u>

- Fire prevention methods to be used at the Preserve include:

    - Establishing fire lines on the perimeters of open space lands, leaving the interior areas in their natural condition. These cover many of the recommended containment projects including: A.C1, A.C2, A.C3, A.C4, A.C5, A.C6, A.C7 and A.C8.

    - Posting signs indicating the severity of the fire danger (low, moderate, high, very high, and extreme) during the fire season.

    - Posting signs “No Fireworks” June 20 to July 10.

    - Use herbicides as approved by the Open Space and Parks Division Manager, where appropriate in implementing the wildland fire prevention plan.

Refer to *Map 4 Fire Protection & Emergency Access of the Trail Master Plan* for disc lines and areas that are to be mowed annually to maintain emergency vehicle access through the Preserve. This map also indicates those sensitive resource areas in the Preserve that should not be accessed by heavy vehicles.

Firebreak and Control (Section 4.5 pg 4-10 and Section 7.5 Vegetation Management pg 7-39)

- Firebreaks should be disced 24 feet wide or 1 ½ times the fuel height adjacent to the road, structures and where they can compartmentalize an area to reduce the risk of a fire igniting and/or spreading.
- Firebreaks should be eliminated where they are not providing any benefit to fire prevention or suppression.
- Ideally discing should be performed twice a year, first in late spring and then when the disc lines have "cured."
- If new activities/developments occur inside or adjacent to the Preserve perimeters, then the location of the disc lines should be reevaluated and expanded as appropriate.

In addition, though not currently used, maintain an option for the Fire Department to perform controlled burns in the future as part of their overall fire prevention plan.

Temporary Closures (Section 4.5 pg 4-10) of the Trail Master Plan

The City Fire Department in consultation with Open Space staff may close the Preserve when there is a threat to public safety. When such emergencies occur, the Fire Department is to notify the Police Department and the Open Space and Parks Division staff of emergency closures so they can notify the public. Emergency closures may occur when:

- Weather conditions create a critical fire danger;
- Arsonists are known to be present in the area;
- Staff resources have been pulled away for other emergencies; and/or
- Other threats to public safety are present or suspected.

High Maintenance Trails - Clearing and Brushing (Section 6.2 Trails Maintenance System & Section 7.5 Vegetation Management)

The trail clearing limits for down logs and tree limbing should be 10 feet high and 3 feet wide on each side of the trail. (Refer to Section 7, Figure 16 of the Trail Master Plan for trail clearing and brushing limits). Trail brushing limits for shrubby and herbaceous plant species extending into the trail should be 10 feet high and 3 feet wide on each side of the trail. These plants should be cleared to ground level. Clearing widths should be directed to providing clear passage and providing an average sight line of 100-feet. Low growing and slow growing shrubs and ground cover less than two feet in height should be left undisturbed.

Specific Trail Recommendations for Trails (Section 6.4)

- Acorn Trail - Segment 1 (Ac1): Maintain existing vehicle turn-around at booster pump station. Refer to Map 4 of the Trail Master Plan- Fire Protection & Emergency & Maintenance Access - Turn-around Point 3.

- Arastradero Creek Trail - Segment 2 (ArC2): Providing a new vehicle turn-around in a hammerhead configuration near intersection of former Acorn Trail (now Route F) to accommodate Type 3 and 4 emergency fire vehicles. The turn-around area should be defined using the following: grading a level area and landscaping. Such vegetation should consist of native species, similar to nearby, existing vegetation and should be placed in a natural configuration to prevent the vegetation from creating an unsafe condition or adverse visual impact. The final siting of the turn-around should be completed under the advisement of the Open Space and Parks Division Manager. Refer to Map 4 of the Trail Master Plan - Fire Protection & Emergency & Maintenance Access – Turn-around Point 5.

- Arastradero Creek Trail - Segment 3 (ArC3): Locate an emergency/maintenance vehicle turn-around in a hammerhead configuration at the existing gate on the east side of the trail. Move the gate back to accommodate Type 3 and 4 emergency fire vehicles. Improvements to the turn-around area should be confined to the existing, flat graded pad. Minimize annual pruning to area necessary to provide for vehicle access. Refer to Map 4 of the Trail Master Plan- Fire Protection & Emergency & Maintenance Access - Turn-around Point 6.

- Corte Madera Trail - Segment 2(CM2): Mow the area at junction with Bay View Trail to provide room for Type 3 and 4 emergency vehicles to perform a hammerhead vehicle turn-around following procedures outlined in Section 7.2. Maintain a minimum cover of 2 inches to minimize potential erosion impacts. Refer to Figure 36 Fire Protection & Emergency & Maintenance Access - Turn-around Point 4.

- Gateway Trail - Segment 1 (Ga1): Providing a 40 to 45 foot "driveway" between Arastradero Road and Access Gate A to allow a safe pull out for maintenance and emergency vehicles accessing the Preserve[11]. Design of maintenance drive must take into account the existing 10-foot wide crossing over a concrete culvert. The culvert is located approximately 28 feet from the edge of pavement.

- Juan Bautista de Anza National Historic Trail - Segment 2 (JB2): Develop turn-around in a hammerhead configuration to accommodate Type 3 and 4 emergency fire vehicles. Locate on west side of bridge in the area that is nearly flat and already contains hardened surfaces and non-native grassland. Avoid nearby riparian habitat and serpentine soils. Refer to Map 36 Fire Protection & Emergency & Maintenance Access - Turn-around Point 2.

- Juan Bautista de Anza National Historic Trail - Segment 4 (JB4): Mow an area near the junction of the Portola Pastures Trail to provide room for Type 3 and 4 emergency fire vehicles to turn-around following procedures outlined in Section 7.2. Maintain a minimum cover of 2 inches to minimize potential erosion impacts. Refer to Figure 36 Fire Protection & Emergency & Maintenance Access - Turn-around Point 10.

- Juan Bautista de Anza National Historic Trail - Segment 5 (JB5): Developing an emergency Type 3 and 4 vehicle hammerhead turn-around at the junction with Segment 4 of the Juan Bautista de Anza Trail. Improvements to the area should be confined, to the greatest extend possible, to the existing graded area at the trail junction. Refer to Map 4 - Fire Protection & Emergency & Maintenance Access – Turn-around Point 9.

[11] Like many of the recommendations, this has already been accomplished.

- Juan Bautista de Anza National Historic Trail - Segment 5 (JB5): Providing a 40 to 45 foot "driveway" between Arastradero Road and Access Gate B to allow a safe pull out for maintenance and emergency vehicles accessing the Preserve.

- Stanford Pastures Trail (SP): One year after the trail tread has been established mow an area near the boundary of the Preserve to provide room for Type 3 and 4 emergency fire vehicles to turn-around following procedures outlined in section 7.2. Maintain a minimum cover of 2 inches to minimize potential erosion impacts. Refer to Map 33 Fire Protection & Emergency & Maintenance Access - Turn-around Point 1.

- Meadowlark Trail (MeL1): Develop a hammerhead vehicle turn-around for Type 3 and 4 emergency vehicles to turn-around near the old barn site. Improvements to the turn-around should be confined to the existing graded pad that formerly served as the driveway for the old barn. Refer to Map 33 Fire Protection & Emergency & Maintenance Access – Turn-around Point 7.

- Woodland Trail Segment 1(Wo1): Maintain existing, paved vehicular turn-around that encircles the water tank for utility vehicles. Note that this turn-around is not suitable for Type 3 and 4 fire vehicles due to the tight turning radius around the tank. Refer to Map 4 - Fire Protection & Emergency & Maintenance Access – Turn-around Point 8.

4.1.3 Vegetation Management

4.1.3.1 Brushing and Clearing Defined

Brushing and clearing constitutes the removal of vegetative materials as required to provide adequate vertical and horizontal clearance for safe passage along a trail.

4.1.3.2 Techniques for Maintaining a Clear Passageway

Vegetation on the south sides of the trail should be pruned to allow passage, but should be preserved, as much as possible, to protect the aesthetic quality of the trail. Typically, vegetation is cleared to a height of 10 feet and 2 to 3 feet to either side of the trail edge to accommodate equestrian use. A minimum sight distance of 100 feet should be maintained, where feasible to facilitate safe shared use of the trail system.

Good pruning practices should be followed, including cutting branches almost flush with the limb, and cutting stumps at ground level or below. Large limbs should be pruned almost flush with the trunk. Dead and dying limbs and snags, which may fall on the trail, should be removed. Typically, ground cover plants and low shrubs should not be removed except on the actual trail tread.

Where specific trail segments (Refer to Section 6) recommend controlling invasive, non-native plants, the *Arastradero Preserve Management Plan* management strategies should be used. This means that vegetation management adjacent to the trails should be performed in a way that maximizes the safety of the users and minimizes adverse environmental impacts. Appropriate management techniques include in order of preference, control with "beneficial insects", where they have been determined through study not to have detrimental environmental impacts, removal by hand pulling, or pruning with weed whips or (as a last choice) with chemicals. When weed whips are employed, a 2-inch minimum cover should be retained to minimize exposure of bare earth and resulting impacts from splash erosion and gullying. Herbicides should only be used as approved by the Open Space and Parks Division Manager. In addition, the chemicals must be applied in accordance with California State law and must adhere to the conditions set forth in the City's "Integrated

Pest Management Plan" to ensure the safety of staff, visitors and wildlife and to reduce or eliminate the possibility of chemicals entering the creek.

Where a trail is located on a side slope, the vegetation on the uphill side will be more intrusive and should be cut back more severely than on the downhill side.

Low growing vegetation should be allowed to return to cut slopes to increase soil stability. Replant areas with vegetation indigenous to those areas or compatible with plantings already in place.

Overhanging limbs should be cut back flush with the tree trunk, brush should be grubbed out and disposed of out of sight of the trail and scattered not stacked. Excess rock should be disposed of in the same manner as brush and limbs. All loose roots protruding over one inch above the trail tread should be cut out to at least 4 inches beyond the margins of the tread and to a depth of 4 inches below tread level and removed. Holes resulting from root removal should be filled and compacted with mineral soil and or rock, not exceeding 2 inches in diameter.

Advance warning of all vegetation management activities in the Preserve shall be given to the Open Space and Parks Division Manager at least one week in advance of the work.

Turn-around	**Existing Conditions**	**Recommended Actions**
#1 Trail: SP	Mowed grassland dominated by non-native plants	Mow area near boundary of the Preserve for Type 3 & 4 emergency fire vehicles to turn-around. Maintain 2" min. grass cover.
#2 Trail:JB2	Area is nearly flat & already contains hardened surfaces and non-native grassland	Perform minor grading to develop hammerhead turn-around for Type 3 & 4 emergency fire vehicles on west side of bridge in the area that is nearly flat. Avoid nearby riparian habitat and serpentine soils.
#3 Trail: Jct. ArC & Ac	Existing hardened surface adjacent to lake & utility booster station.	Maintain the existing vehicle turn-around at booster pump station. No grading or vegetation removal required.
#4 Trail: CM2	Mowed grassland dominated by non-native plants	Mow area at junction of Bay View Trail for Type 3 & 4 emergency fire vehicles to turn-around. Maintain 2" min. grass cover.
#5 Trail:ArC2	Grassland dominated by non-native plants on opposite side of utility road from creek & does not affect creek zone	Perform minor grading to develop hammerhead turnaround in area that is nearly flat near junction of Route F (now scheduled for closure) for Type 3 & 4 emergency fire vehicles. Define area with native vegetation in a natural configuration. Avoid nearby riparian habitat.
#6 Trail: ArC3	Existing dirt driveway. No grading or vegetation removal required	Locate at existing gate on the east side of the trail. Move gate back to accommodate Type 3 & 4 emergency fire vehicles. Confine turn-around area to existing graded pad. Minimize annual pruning to area necessary for vehicle access.
#7	Existing drive to old barn site. No grading or	Confine turn-around to existing graded pad that formerly served

Trail: MeL1	vegetation removal req.	as the driveway for the old barn.
#8 Trail: Wo1	Existing road around the water tank. Tight radius will not accommodate Type 3 & 4 vehicles	Maintain existing, paved vehicular turn-around that encircles water tank for utility vehicles.
#9 Trail: Jct. JB 4 & 5	Flat grassland area at junction of two trails. Minor grading may be necessary	Perform minor grading to develop hammerhead turnaround at the junction Juan Bautista de Anza Trail Segs. 4 & 5. Confined work (to the greatest extend possible) to existing graded area at the trail junction.
#10 Trail: JB 4	Mowed grassland	Mow an area near junction with Portola Pastures Trail to provide room for Type 3 & 4 emergency fire vehicles to turn-around. Maintain 2" min. grass cover.

Figure 37: Vehicle Turn-around Design Summary.

Final siting of all turn–around to be approved by Open Space and Parks Division Manager prior to initiating any grading.

4.2 Foothills Park Trails Maintenance Plan (January 29, 2002)

The Trails Master Plan for Foothills Park recognizes that the preserve is located in the Hazardous Fire Area (HFA) and Mutual Threat Zone (MTZ). The plan identifies the existing fuel break system but focuses on maintenance of the existing trails.

4.2.1 Recommended Revisions

The following are recommended additions and modifications to the 2002 Trails Maintenance Plan:

- Addition of fuel management along the additional evacuation routes to northwest (Interpretive Center to The 600-700 block of Los Trancos Road), northeast (Boronda Lake to Alexis Drive), and from Towle Campground along Wildhorse Valley to Las Trampas Valley.

- Addition of four Firefighter Safety Zones along Trappers Ridge Trail at Los Trancos Trail, Madrone Fire Road and two highpoints (high point and south end); projects # F.F1, through F.F4.

- Addition of annual maintenance of defensible space around the Interpretive Center, parking lot and staging area, campgrounds, pumping stations to include projects F.D1 through F.D8.

- Addition of annual maintenance ignition reduction projects at picnic sites and campgrounds to include projects F.I1 through F.I7.

- Addition of fuel reduction zones along existing trails for containment including projects F.C1 (Trappers Trail), F.C2 (Pony Tracks south of Trappers Ridge), F.C3 (Pony Tracks north of Trappers Ridge), F.C4 (Bobcat Point) and F.C5 (north of entry gate).

- Modify tables for managing trails within specific vegetation types to accommodate fuel modification performance standards for the containment projects.

- Addition to Regulatory, Warning and Educational Signs regarding fire hazard signs, education information on fuel management and prescribed fire.

4.2.2 Existing Fire Mitigation and Fuel Management in the Foothills Park Trails Maintenance Plan

Staff Responsibilities (Executive Summary, page 104)

The foothills parks are staffed by rangers that are based out of the Foothills Park office. Park rangers are responsible for patrolling, monitoring and maintaining Foothills Park. They oversee the fieldwork of the California Conservation Corps (CCC) work program, as well as other volunteer work programs at the Park. Rangers also lead guided nature walks and give nature slide shows. In addition, while the primary responsibility for fire and medical emergencies lies with the City Fire Department, rangers will typically be the first response team for fire and medical emergencies within the park.

Park Maintenance/Utility/Emergency (e.g. fire) (Section 2.4 pg 2-5)

There are three other entry points off Page Mill Road that maintenance and emergency vehicles use to provide access from Page Mill Road. These are labeled as Gates 2, 3 and 4. Gate 2 provides access to the Charlie Brown firebreak and Toyon Trail. Gate 3 provides access to the Park Reservoir, a 1.5 million gallon city water reservoir. Gate 4 provides access to the Trapper's Fire Trail and to the southern portion of the Los Trancos Trail. In addition, utility vehicles and park maintenance/patrol vehicles wanting to access the Arastradero Creek Trail (Segment 3) within Arastradero Preserve enter Foothills Park and access this trail from Gate D. Gate D is located on the one-way road that leads from the Interpretive Center to Vista Hill in Foothills Park. There is also an access easement from Los Trancos Road in Portola Valley connecting to the service yard at the north end of the park. This easement is only accessible by park staff.

Hazardous Fire Area (Section 2.4 pg 2-6): The Park is identified in the Hazardous Fire Area because of the tremendous vegetation fuel load and the potential for extended response times in the event of a fire due to limited access/egress into the park. The area has also been designated as a Mutual Threat Zone (MTZ) by agreement with the California Department of Forestry and Fire Protection. This means that a fire within the City's jurisdiction is a threat to the State's jurisdiction and vice versa.

Firebreaks (Section 2.4 page 2-6 – 2-8): To meet the City's objective of "*reducing government costs and citizen losses from wildland fire by increasing initial attack success and or protecting assets at risk through focused prefire management objectives*" a fuel break system has been designed and implemented for Foothills Park. The main firebreak (by distance and location) is the Trapper's Firebreak Trail. It is two miles long, essentially running along the spine of the park. There are also several smaller breaks that are maintained as access roads for fire response. These branching firebreaks, which are located throughout the park, and the Trappers Firebreak Trail, are graded and compacted to a width of 10 feet or greater to accommodate the City Fire Department's Type 3 and 4 vehicles. These firebreak trails have the potential to be reduced in width, or substituted with shaded fuel breaks if environmentally desirable. (A shaded fuel break allows annual grasses to return to the land, but not medium or heavy fuels.)

Evacuation (Section 2.4 Page 2–8): In addition to the firebreak trail network, "safety islands" have been identified in the park and an evacuation plan has been developed for the park. The primary evacuation route (as identified in the Palo Alto Comprehensive Plan) is Page Mill Road. The main road through the park connects to an access easement that provides an alternate evacuation route between Page Mill Road and Los Trancos Road.

Natural Resources Management Objectives Adjacent to the Trail (Section 3.4 pg 304). Retaining native vegetation except in areas where City personnel determine that plants are creating a fire or safety hazard, or where vegetation is located within the tread of routinely maintained roads, trails and designated firebreaks

Noxious Plants and Pathogens (Page 4-17 – 4-24): Control and prevention of non-native invasive plant species is recognized as quite important. Infestations of non-native invasive plant species have been found to alter ecosystem functions such as nutrient cycles, hydrology, and wildfire frequency. Non-native invasive plant species pose a complex problem, but the management of the spread is a key factor in preventing long-lasting and negative effects on the native ecosystem. The plan recognizes that trail maintenance activities need to address the fact that most of these species gain a foothold by invading soil that has been disturbed, such as through re-grading or vegetation clearing that results in the removal of ground cover plants adjacent to the trail tread. The plan includes a table of the non-native invasive plants of greatest ecological concern. (Table 4-6 page 4-18 – 4-24.)

Sudden Oak Death (SOD) (page 4-24 – 4-25): Sudden Oak Death is caused by the pathogen *Phytophthora ramorum* that kills oaks and several other California woodland species found in Foothills Park. The pathogen appears to kill trees and shrubs swiftly and has greatly affected the visual integrity and diversity of the California Oak woodland as it is defined today. First discovered in California on Tan Oaks in 1995, it has now been confirmed in ten California counties, including Santa Clara County. **Note**: Information available on this SOD has expanded since the maintenance plan was developed in 2002.

Trails Maintenance Program Development (Section 5.2 pg 5-2): Trail inspections are integral to all trail maintenance operations. Inspections should occur on a regularly scheduled basis, the frequency of which will depend on the amount of trail use, the location, age, and the types of structures and the types of soil/terrain. At a minimum, all trail and trail structures/features should be inspected at least once a year at the close of the winter "wet season". All trail inspections should be documented in writing in a field log. Conditions that have the potential to be the most hazardous to the public, which should be watched for during field inspections, include:

- Heavy fuel loads which could create a high or critical danger fire hazard in the park.

Other Staff Duties Related to Park Protection & Trail Activities (Section 5.3 pg 5-9): While the primary responsibility for fire and medical emergencies lies with the City Fire Department, Park Rangers will typically be the first response team for fire and medical emergencies within the Park. Foothills Park Rangers have received various limited levels of fire fighting training and are dispatched as a resource to fires and other emergency calls. They are a valuable resource as they provide enhanced local knowledge of the area, and can be used to augment Engine Eight or to perform other tasks, such as evacuation or reconnaissance. The Palo Alto Fire Department has rated the Rangers control of public areas and Park maintenance practices, which augment the City's fuel management system as outstanding (Palo Alto Draft Fire Management Plan, April 1997).

Trail Maintenance Guidelines (Section 6 pages 6-1 – 6-81): Section 6.3 provides an overview in table format of the existing trail characteristics (Table 6-1 page 6-4 through 6-8). The tables currently do not include information regarding whether the trail segments are a part of the firebreak system.

Section 6.5 (pages 6-10 through 6-21) includes management strategies for maintaining hiking trails. A series of tables provides a summary of managing trails within grasslands/ oak savanna (Table 6-2), chaparral (Table 6-3), mixed woodlands (Table 6-4) and bay woodlands (Table 6-5). These tables include treatments of the vegetation ground plan, middle plane and overhead canopy. They do not specifically address management practices to be used if the trail is a part of a fire containment area. Section 6-8 includes Vegetation

Management Recommendations text that expands upon the summary tables with additional descriptions and standards (pages 6-56 – 6-63).

Trail Communication Tools (Section 6.11 pg 6-77 through 6-81): Trail signs include temporary/ permanent closures for hazards associated with critical fire danger (page 6-80). Interpretive trail guides and programs offer the opportunity to educate visitors about the biological diversity of Foothills Park and the importance of staying on trails to avoid damaging this unique resource (page 6-81).

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