

WILDFIRE HAZARD ASSESSMENT AND PLAN



for
Rancho Laguna
SummerHill Homes
Moraga, CA

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Approved by:

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Moraga-Orinda Fire District

Table of Contents

SUMMARY	1
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– Section One – EXISTING CONDITIONS

A. SETTING/CONTEXT	3
1. General location of project	3
2. Description of the Project	3
3. Description of Adjacent Properties	5
B. REGULATORY CONTEXT	5
1. Fire Safety Regulations - Ordinance No. 13-01	5
2. Exterior Fire Hazard Control	5
3. Other Conditions and Restrictions	6
4. Easements	6
C. SITE-SPECIFIC ASSESSMENT OF FIRE HAZARD AND RISK	6
1. Wildland Fuels on the Project Site	6
2. General Weather Information	7
3. Local Weather Conditions	8
4. Terrain on Project Site and Surroundings	9
5. Predicted Fire Behavior of Project Site and Surroundings with no Mitigations	9
6. Fire History of the Area	12
7. Description of Fire Hazards from CAL FIRE Very High Fire Hazard Severity Zone Mapping	12
8. Anticipated Fire Threat from and to Adjoining Properties	12

– Section Two – FIRE HAZARD MITIGATION MEASURES

A. INTRODUCTION	14
B. PRINCIPLES GUIDING VEGETATION MANAGEMENT	14
C. SUMMARY OF VEGETATIVE FUEL MANAGEMENT ZONES	14
D. STANDARDS FOR NON-COMBUSTIBLE ZONE	15
E. STANDARDS FOR DEFENSIBLE SPACE/LANDSCAPING ZONE	18

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

F. OPEN SPACE VEGETATION MANAGEMENT FOR FIRE HAZARD REDUCTION ZONE	20
G. STANDARDS FOR TRAILS FUEL MANAGEMENT ZONE	20
H. STANDARDS FOR ROADSIDE VEGETATION MANAGEMENT	21
I. WETLAND MITIGATION FUEL MANAGEMENT	21
J. STATEMENT REGARDING COMPLIANCE WITH FIRE SAFETY CODES AND REGULATIONS	21

**– Section Three –
IMPLEMENTATION MECHANISMS**

A. HOMEOWNER AND HOMEOWNER ASSOCIATION RESPONSIBILITIES	22
B. DELEGATION OF FUEL MANAGEMENT AND CONSTRUCTION RESPONSIBILITIES	23
C. PHASING OF MAINTENANCE RESPONSIBILITY AND FUEL MANAGEMENT SCHEDULE OF ACTIONS	23
D. MECHANISMS FOR COMPLIANCE	24
E. FREQUENCY OF FUTURE MAINTENANCE	24

– Appendices –

APPENDIX A – FUEL TYPE AND FIRE BEHAVIOR IN DIFFERENT FUELS	25
APPENDIX B – SPECIES LIST FOR PROHIBITED LANDSCAPING PLANTS	28
APPENDIX C – SELECTION OF FIRE RESISTANT LANDSCAPING	29
APPENDIX D – KEY TERMINOLOGY	30
APPENDIX E – HYDRANT/FIRE SERVICE REQUIREMENTS	31

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna
Rheem Blvd., Moraga, California

Summary

This Wildfire Hazard Assessment and Plan (“Plan”) for the Rancho Laguna II residential subdivision (“Project”) meets the requirements established by the Moraga-Orinda Fire District Ordinance 13-01 (2010 Uniform Fire Code). The Plan addresses the following items related to wildfire hazards:

- Provision of access for fire apparatus,
- Provision of water supply for fire protection, and
- Provisions to control the spread of fire.

The Plan also is intended to meet the Town of Moraga’s Conditions of Approval for the Project to provide a Fire Protection Plan as part of the Open Space Management Plan. The Plan will ensure that:

- The Project design is consistent with the Town’s emergency evacuation plan.
- The water supply is adequate for fire suppression, in terms of flow, pressure, hydrant location and compliance with fire codes.
- Emergency response vehicles have full access to the site.
- Residences have fully compliant fire sprinklers.
- The project shall pay fire flow tax.

The Plan describes existing conditions and proposed fuel modifications that will direct maintenance of landscaping and open space areas. The Plan describes actions needed to maintain fuels (both vegetative and structural) in a fire-safe condition. The proposed fuel modifications will decrease fire intensity, facilitate fire suppression, and reduce property loss. The Plan recommends development and maintenance of a defensible space zone for 100 feet from each structure and 10 feet from roadside edge to help ensure fire safety. Open space management will prevent shrubby growth in the grassland areas.

The Plan designates areas to be cultivated regularly and requires areas of irrigated landscaping using fire resistant species. The Plan complies with the Town of Moraga’s conditions of

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

approval for the mitigation measures regarding erosion control, biotechnical slope stabilization and preservation of woodland and riparian vegetation.

To make vegetation management easier to implement, the Plan does the following:

- Delineates vegetation fuel management zones.
- Establishes appropriate treatments for each zone.
- Sets record-keeping and reporting requirements and mechanisms for enforcement.

In addition, the Plan provides information on fire-resistant and drought-tolerant landscaping so that homeowners can protect their properties against wildland fire. This Plan also addresses fire-resistant design and construction, based on the Moraga-Orinda Fire District Ordinance 13-01.

Under current environmental conditions and with mitigation measures in place, fire behavior at the Project site will be generally less than two-foot flame length within 100 feet of a structure.

– Section One –
EXISTING CONDITIONS

A. SETTING/CONTEXT

1. General location of project

The 178.9-acre project site is located in the Town of Moraga bounded by Rheem Blvd to the west, single-family residences to the southwest, St. Mary's Road and Las Trampas Creek to the south and southeast, and existing open space to the north and east.

2. Description of the Project

The project consists of 27 new single-family homes on approximately 17 acres and dedicated open space on approximately 162 acres. The site consists of a grassy prominent steep-sided ridge and two narrow valleys. The east-facing slopes are covered with expanses of grass, with woodlands; the west-facing slope is grassy with woody vegetation in narrow drainages and along Rheem Blvd. Ten of the new homes will be located at the base of the slope near Rheem Boulevard, and seventeen of the homes will be located higher on the slope on the southeast side of the main northwest-southeast ridge than runs through the site.

Access is provided by one road (Fay Hill Road) off Rheem Blvd. Fronteras Drive serves 10 homes a short distance off Rheem Blvd. Fay Hill Road rises up the steep slope to Sonora Road, which traverses the ridgeline approximately one-half mile south to the site of seventeen homes on Sonora Road and Los Santos Court. All roads are at least 20 feet wide, and Fay Hill Rd is 26 feet wide in some places. An emergency vehicle access easement runs from the southern end of Fronteras Drive to Rheem Blvd. Emergency vehicle access inside the open space is provided by a series of old ranch roads and a 20-foot-wide public trail easement. These access routes link adjacent open spaces and development, starting at the staging area near the intersection of Fay Hill Road and Sonora Road.

The Moraga Geologic Hazard Abatement District (Moraga GHAD or GHAD) will be responsible for long-term management of the open space, guided by an Open Space Management Plan. Moraga GHAD responsibilities, as provided in the Open Space Management Plan, will begin a minimum of three years after issuance of the first building permit within the Rancho Laguna development. Prior to the Moraga GHAD acquiring monitoring, maintenance, and ownership responsibilities as provided in the Plan of Control, GHAD tasks within the Open Space Management Plan will be the responsibility of and funded by the developer.

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna



Figure 1. Project Context Aerial and Site Plan

Structures will generally be constructed with ignition-resistant design and materials. Landscaping is guided by HOA Design Review Guidelines or other similar review process. For

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

the lots along Sonora Road and Los Santos Court, back yard fencing will use non-combustible material such as wire (with wood posts), but side fencing will be built with solid wood and wood lattice for the top two-feet. For the lots along Fronteras Drive, the back and side yard fencing will be built with solid wood and wood lattice for the top two-feet.

3. Description of Adjacent Properties

Adjacent properties include both developed and undeveloped parcels. Immediately east of the Project site is the dedicated open space of Palos Colorados. The southeastern border of the Project site abuts undeveloped open space. Single family residences are located adjacent to the southwest side of the Project site (along Rheem Blvd) and approximately 350 to the northwest of the Project site (off Buckingham Drive). In addition, backyards of single family homes on Birchwood Drive comprise the top of the slope to the west of the project. Multi-family structures are located to the west of Rheem Blvd., off Via Barcelona and Woodminster Drive. .

B. REGULATORY CONTEXT

1. Fire Safety Regulations - Ordinance No. 13-01

The Project is within the service area of the Moraga-Orinda Fire District (“MOFD”). MOFD has adopted the California Fire Code, 2013 edition, including Appendix Chapters A, B, C, E, F, G, H, I, J, and the International Fire Code, 2012 Edition, with certain amendments. (See MOFD Ordinance 13-01.)

The Project design complies with the applicable provisions of the California Fire Code, 2013 edition, including Appendix Chapters A, B, C, E, F, G, H, I, J, and the International Fire Code, 2012 Edition. The Project is not within a High Fire Hazard Severity Zone and therefore is not subject to California Fire Code Chapter R237.

The MOFD Fire Marshal has reviewed and approved the access for fire apparatus and the water supply for fire protection for the Project. The Fire Marshal approved an exception to the general water supply standards to allow a fire flow of 1,500 gpm from one adjacent hydrant. The Fire Marshal also approved a turning radius of 30 feet on fire access routes for fire apparatus. The Project otherwise complies with all MOFD standards regarding fire access and water supply.

A copy of the Fire Marshal’s approval is attached as Appendix E.

2. Exterior Fire Hazard Control

The 2014 Exterior Fire Hazard Control Standards for Vegetation Management requires all landowners with parcels smaller than one acre to:

- Keep grass shorter than 3 inches during the fire season.
- Maintain trees adjacent to or overhanging structures free of dead or dying material.
- Remove any portion of a tree within 10 feet of an outlet of a chimney or stovepipe.
- Remove any lower branches of tree up to 6 feet in height above ground.

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

- Remove hazard trees¹.
- Maintain an area 15 feet from structures clear of combustible materials.

The same MOFD standard requires that the open space parcel comply with a different set of vegetation management treatments:

- Parcels will be treated to create 30-foot-wide firebreaks and crossbreaks, to divide the parcel into approximately 5-acre sections.
- Active pastureland may have 15-foot-wide firebreaks and crossbreaks (rather than 30-foot wide) if the height of the grass during summer months is kept to 3 inches or less by the end of August.

3. Other Conditions and Restrictions

Conditions of approval relating to conservation easements as well as environmental conditions and ownership of open space can affect the fire hazard by placing limitations on maintenance, or by creating an interface between developed and wildland fuels.

The Town of Moraga imposed conditions of approval on the Project. These conditions state that the Moraga GHAD will be responsible for open space management, that it may use grazing as a management technique except for certain locations. In addition, several deed restrictions pertain to wildland fire hazard reduction and open space management. Neither the conditions of approval nor the deed restrictions would prohibit implementation of this WHAP.

4. Easements

A 150 KV electrical transmission line traverses the project site east of the developed lots. Electrical power lines can be a source of ignition. The distribution lines are to be underground, and therefore not an ignition source. In response, the easement for this tower entails a requirement that the vegetation around the tower is kept free of vegetation. PG&E is required to ensure that the vegetation is managed each year around each tower before the fire season starts – usually ten feet from the tower in all directions, if certain fire producing equipment is on the tower.

C. SITE-SPECIFIC ASSESSMENT OF FIRE HAZARD AND RISK

The site-specific assessment of the project's fire hazard is based upon an analysis of the fuels, weather and topography that influence fire behavior. The potential effectiveness of fire suppression efforts as influenced by access and water supply on the project site is included in the analysis.

1. Wildland Fuels on the Project Site

The vegetative fuels on the project site are annual grasses (Fire Behavior Prediction System [FBPS] Fuel Model #1, oak woodland (FBPS Fuel Model #8) and patches of north coastal scrub

¹ Hazard trees are those that are at risk of falling and causing damage.

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

(FBPS Fuel Model #5). Grass covers the vast majority of the site and most of the areas closest to structures. Oak/bay woodlands are located below and east of structures on Sonora Road and deep in drainages on east-facing slopes elsewhere in the open space. Shrubby fuels, comprised of linear strings of willows in moisture areas in lower elevations or coyote brush in patches on steep uplands sites and along Coyote Creek and Rheem Blvd., are a significant component of the fuel complex. Figure 2 is a map of the different types of fuels on the project site.

2. General Weather Information

Weather conditions significantly impact both the potential for fire ignition and the rate, intensity, and direction in which fires burn. The most important weather variables used to predict fire behavior are wind, temperature, and humidity.

Wind increases the flammability of fuels both by removing moisture through evaporation and by angling the flames so that they heat the fuels in the fire's path. The direction and velocity of surface winds can also control the direction and rate of the fire's spread. Winds can carry embers and firebrands downwind. These burning fuels can ignite spot fires that precede the primary front. Gusty winds cause a fire to burn erratically and make it more difficult to contain.

The winds that create the most severe fire danger, known as the "Santa Ana" or "Diablo" winds, typically blow from the northeast. However, winds from the west are also likely to cause unacceptable damage. Another worst-case scenario is a fire driven by a northwest wind that follows a northeast wind. Because the northeast wind is normally associated with low humidities and high temperatures, it dries the fuels. At the end of this "Santa Ana" or "Diablo" wind condition, the fog often moves quickly shoreward, preceded by a brisk, high-speed northwest wind. Under these conditions, the fuels would still be dry from the previous weather conditions.

WILDFIRE HAZARD ASSESSMENT & PLAN

Rancho Laguna

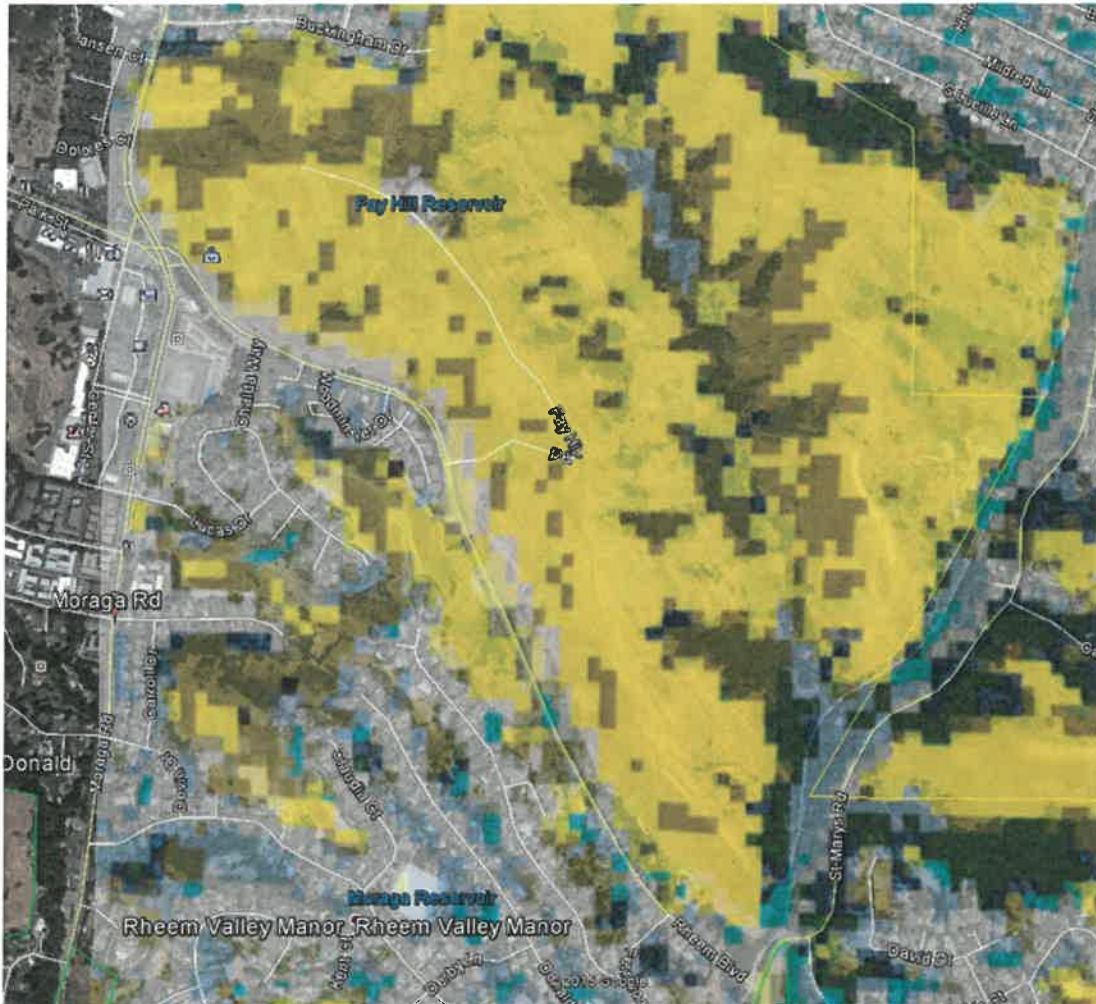


Figure 2. Wildland fuel types on the project site. Yellow = grass, olive = grass/shrub, green = oak woodland, gray = non-burnable (trails, pavement, development).

3. Local Weather Conditions

The project site's location in proximity to the coast influences its weather conditions. It has the warm, dry summers and cool, moist winters characteristic of the fog belt area. The area averages about 18 inches of precipitation a year, primarily in the fall and winter. Most of the measurable rainfall generally occurs during the winter months (mid-October to mid-April). Thus, the fire season (the time of highest fire danger) comprises the dry months of May to October.

Although summertime temperatures are usually quite warm (75 to 85° F), it is common for the fog to roll in during the early evenings and creep over the ridge tops to the site. Thus, proximity to the bay often creates a pattern of hot days and cool nights. Fog also sometimes keeps summertime temperatures cool in the project site.

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

The wind normally blows from the west but the most severe fire conditions occur in association with strong north or northeast winds. Under these conditions (common in the fall), humidities drop to 10% and temperatures rise to over 100° F.

In addition, occasional episodes consisting of several still, stagnant days formed by stationary highs occur during summer months. During these periods—characterized by continuous high temperatures and low relative humidities—fuels dry to a National Fire Danger Rating System rating of over 81 for the Burning Index, indicating extreme resistance to fire control. This overall weather pattern creates extremely low humidities and enhances the possibilities of ignition and extreme fire behavior.

4. Terrain on Project Site and Surroundings

The main topographic feature on the project is the ridge that runs from the EBMUD water tank at 950± foot elevation to the southern end of Sonora Road at 700± foot elevation. The side slopes on both aspects are quite steep, exceeding 50 percent slope in most locations. The two main valleys run north to south, which could funnel wind during high fire danger episodes when hot, dry winds blow from the north. This could spread fire from an ignition north of the project to structures on Sonora Road.

In most frequent weather patterns with winds from the west, ignitions along Rheem Blvd. could advance quickly up hill to block Sonora Road, aided by steep terrain and westerly winds.

5. Predicted Fire Behavior of Project Site and Surroundings with No Mitigations

Grasslands pose the greatest ignition potential as they are readily ignited during the fire season. Grasslands also burn with longer flame lengths, reaching 12 to 20 feet on steep slopes and burn with spread rates that challenge containment efforts. However, grassy fuel types are among the easiest fuel types to control since they are easily extinguished and burn quickly with a low total heat output.

Patches of shrubby fuels are not currently near any area of the planned development. Shrubby fuels burn with greater intensity than grasslands and are harder to extinguish. However, this fuel type is harder to ignite. In fact, willows tend to maintain higher foliar moisture throughout the fire season and rarely burn even when a fire advances into it. Regardless, if dead material is allowed to accumulate, it will burn with great intensity after a prolonged dry, hot spell. The biggest threat posed by these shrubby fuels is to provide an avenue for fire to reach oak canopies when the shrubby fuels are located directly beneath or contiguous to the woodlands, as is the case near Coyote Creek.

Of the fuel types present on the site, the fire behavior of oak/bay woodlands (in their current condition) is the most benign. Flame lengths are predicted to be less than two feet, and spread rates slower than a leisurely walk.

The oak woodland currently has little crowning potential because the height to live canopy is high (six to eight feet), and the understory fuel is sparse. Understory fuels are comprised mainly

WILDFIRE HAZARD ASSESSMENT & PLAN
 Rancho Laguna

of oak leaf litter with grass or scrub on the margins. North coastal scrub grows on the upper margins of the oak woodlands and comprises the greatest ladder fuel and potential for torching. If a fire were to burn downhill with a westerly wind from the scrub and run into the oak woodland, torching and ember production can be expected. Should a fire travel to the oak crown, it is not likely to be sustained due to the lack of understory fuels. The main reason why crown fires are not likely to spread in this type of oak woodland is that the surface fire is not expected to be intense. Rather, flame lengths (predicted to be less than two feet) are not enough to ignite the live crown six to eight feet above.

Flame lengths are often used as an indicator of the ability to suppress a wildfire and potential for damage to structures. Below is a table of fire behavior with varying slope steepness.

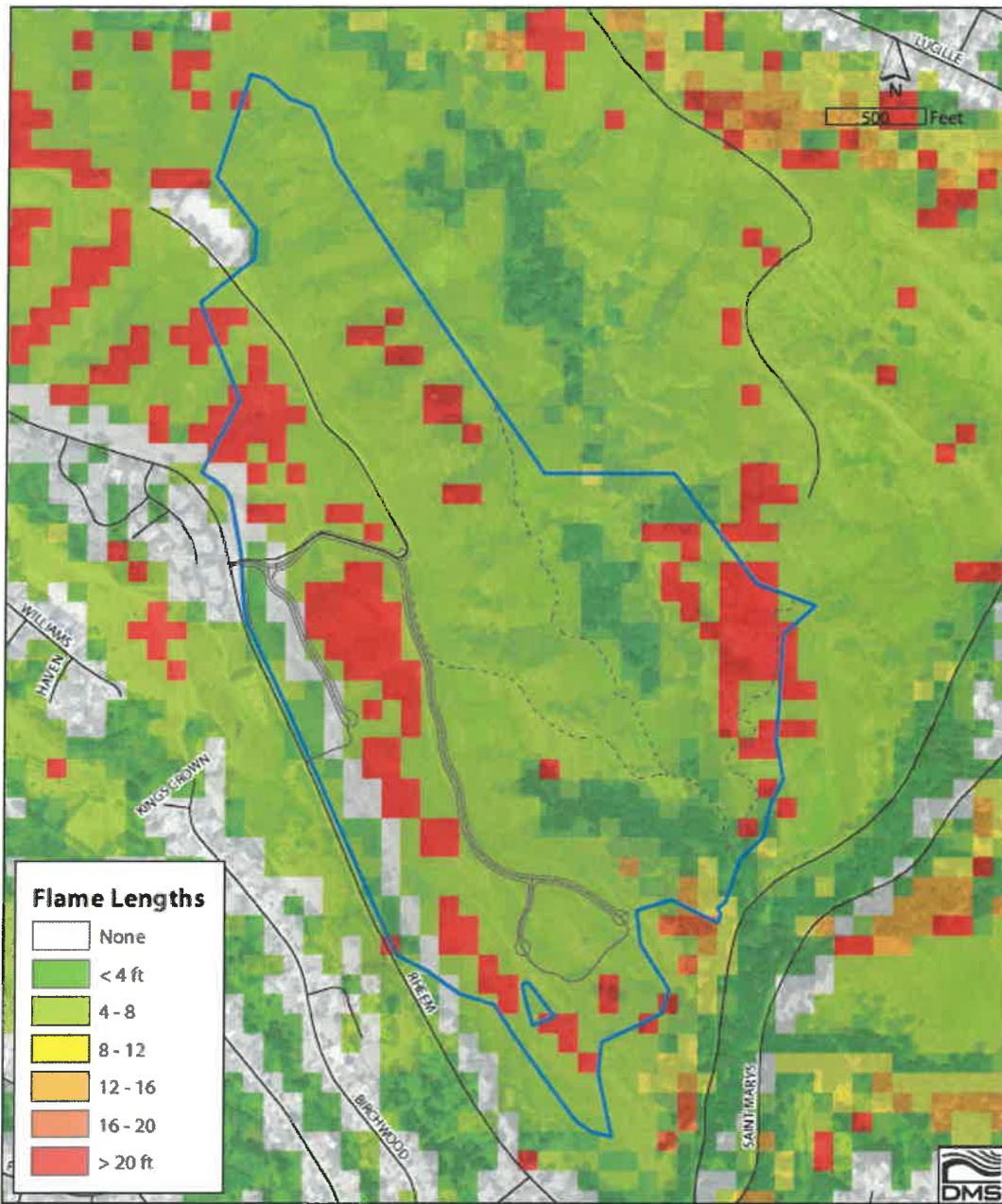
Grassland – FBPS #1	<i>Slope Steepness</i>				
	10%	20%	30%	40%	50%
Rate of spread	87	95	107	123	145
fireline intensity, Btu/ft./sec	150	162	183	212	249
flame length, ft.	5	5	5	5	5

North Coastal Scrub – FBPS #5	<i>Slope Steepness</i>				
	10%	20%	30%	40%	50%
Rate of spread	31	33	36	40	45
fireline intensity, Btu/ft./sec	393	416	454	507	576
flame length, ft.	7	7	8	8	8

Coast Live Oak Woodland – FBPS #8	<i>Slope Steepness</i>				
	10%	20%	30%	40%	50%
Rate of spread	2	2	3	3	3
fireline intensity, Btu/ft./sec	9	9	10	11	13
flame length, ft.	1	1	1	1	1

<i>Standard Environmental Factors:</i>	<i>Low</i>
<i>Midflame windspeed = 4 mi/hr.</i>	
<i>Fuel moisture</i>	
<i>0–1/4 in. diameter</i>	3
<i>1/4 – 1 in. diameter</i>	4
<i>1 – 3 in. diameter</i>	5
<i>Live herbaceous material</i>	70
<i>Live foliage of woody plants</i>	70

WILDFIRE HAZARD ASSESSMENT & PLAN
 Rancho Laguna



Flame Lengths
 Rancho Laguna

digitalmappingolutions.com, 2015-03-17; imagery source: NAIP, 2012.

Figure 3. Spatial distribution of the various flame lengths in the project vicinity.

6. Fire History of the Area

No fires larger than 10 acres have occurred on the project site since records have been kept. However, fires in the area indicate the potential for large fires to occur. For example, four structures were destroyed by three separate wildfires in the community of Canyon between 2000 and 2005. Another large wildfire occurred approximately 20 years ago near the Crestview neighborhood. In 2004, a 6-acre fire burned near the San Leandro Reservoir.

7. Description of Fire Hazards from CAL FIRE Very High Fire Hazard Severity Zone Mapping

The project site is mapped as a moderate fire hazard severity zone, based on current fuels, population density, and topography. Nearby areas of homes on steep slopes with abundant fuels are mapped as High Fire Hazard Severity, but no Very High Fire Hazard Severity areas are within the eastern part of Moraga.

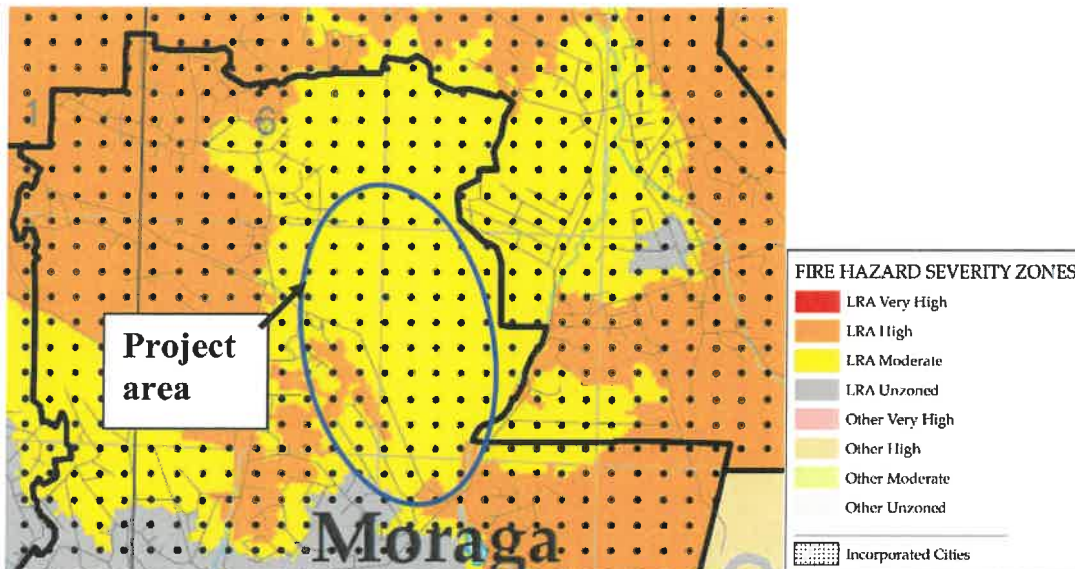


Figure 4. Fire hazard severity designation by CALFIRE, found on http://frap.cdf.ca.gov/webdata/maps/contra_costa/fhszl06_1_map.7.jpg

8. Anticipated Fire Threat from and to Adjoining Properties

The fire hazards on the project site are influenced both by the structures located nearby and the proposed new development.

Threats from Adjacent Properties

There is a significant threat of fire from the neighboring yards and structures due to ignition-prone construction (shake shingle roofing, and siding), as well as from un-maintained ornamental vegetation or small pockets of wildland vegetation.

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

The adjacent residential neighborhoods could be locations of ignitions because of the concentrated use, and possible unsafe behaviors, including barbecues, mechanical equipment use, or fireplace use without screens. The mature neighborhoods have mixed construction type, with some ignitable structures that could propagate fire to the site. The neighborhood to the north is upwind during a northeast Diablo wind condition; embers produced from this neighborhood would expect to be distributed on the Rancho Laguna site. The mature neighborhood to the south is located below Rancho Laguna; fire in this neighborhood would tend to spread to the project site.

Both the structures and un-maintained vegetation pose an ignition threat to the Project site from possible spread through flaming fronts, but more particularly from the embers they will likely produce, thereby starting fires in the surrounding area.

There is also an ignition threat from the high-voltage powerline. Most commonly ignitions are caused when electrical lines come in contact with vegetation causing an arc. However, the vegetation is well below the powerlines so ignition potential is limited. In addition, all new distribution lines will be underground.

Threats to Adjacent Properties

Untreated fuels on the eastern boundary of Palos Colorados could distribute embers to the mature residential neighborhoods. Additionally, the fast rate of fire spread in the grasslands could challenge fire containment efforts on all boundaries where steep slopes limit access and grass abuts neighbors. However, mitigation measures in Section Two, the generally ignition-resistance construction style, and the placement of structures low on the slope next to Rheem Blvd, limits the threat of this Project to adjacent properties.

**- Section Two -
FIRE HAZARD MITIGATION MEASURES**

A. INTRODUCTION

The most direct way of affecting the potentially increased fire risk and hazard posed by development is to alter or manage the wildland vegetation, improve access, and improve water supply and distribution. The proposed access and water supply for the Project are discussed in Section One of the Wildfire Hazard Assessment and Plan. This section will address the management of fuels.

B. PRINCIPLES GUIDING VEGETATION MANAGEMENT

Generally the goal of fire hazard management is to create and maintain fuel conditions in which fire can easily be controlled. A specific goal of this fuel management plan is to create conditions where a wildfire will not be propagated in the crowns of oaks near Sonora Road and to ensure a wildfire will not block Fay Hill Road or Sonora Road. One of the most effective ways to minimize damage to structures in a wildfire is to reduce fire intensity. Vegetation management is the pre-suppression means to calm fire behavior in order to reduce structural damage.

Calming a fire is done via altering the volume, size-class distribution, arrangement, moisture, or chemical content of the fuels on the site. Typically, vegetative fuel modification is done immediately around structures, by roadways, and in areas of potential extreme fire behavior. The effect of fuel modification is to reduce the ignitability, rate of spread, and fire intensity (or heat output). This would result in fewer, smaller, and less damaging fires.

C. SUMMARY OF VEGETATIVE FUEL MANAGEMENT ZONES

There are five treatment zones in this fuel management plan:

- The Non-combustible Zone (Zone 0)
- The Defensible Space/Landscaping (Zone I) including the Roadside Vegetation Management Zone
- The Open Space Management Zone (Zone II)
- The Wetland Mitigation Zone (Zone III)
- The Trailside Fuel Management Zone (Zone IV)

The Non-combustible and Defensible Space/Landscaping Zones encompass the space nearest the structures and is designed to reduce ignitions near structures, support structural survival during a wildfire, and reduce the chance that an ignition will move off site. The Roadside Vegetation Management Zone consists of vegetation near the roads and is designed to assist evacuation and emergency vehicle access and to limit roadside ignitions. The standards and actions to comply with both the Defensible Space/Landscaping Zone and the Roadside Vegetation Management Zone are the same, with one exception. In the Roadside Vegetation Management Zone there

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

must also be a 15-foot vertical clearance created by tree-trimming the entire length of the roadway.

The Open Space Management Zone encompasses open spaces near residential lots and is designed to limit fire intensity and spread by means of periodic pruning of trees, and reduction of understory plants.

The Wetland Mitigation Zone is limited to the area within 100 feet of structures outside private lots in the Wetland Mitigation Zone. Actions are limited to periodic removal of dead material to bolster fire safety to the structures that directly abut the Wetland Mitigation Zone.

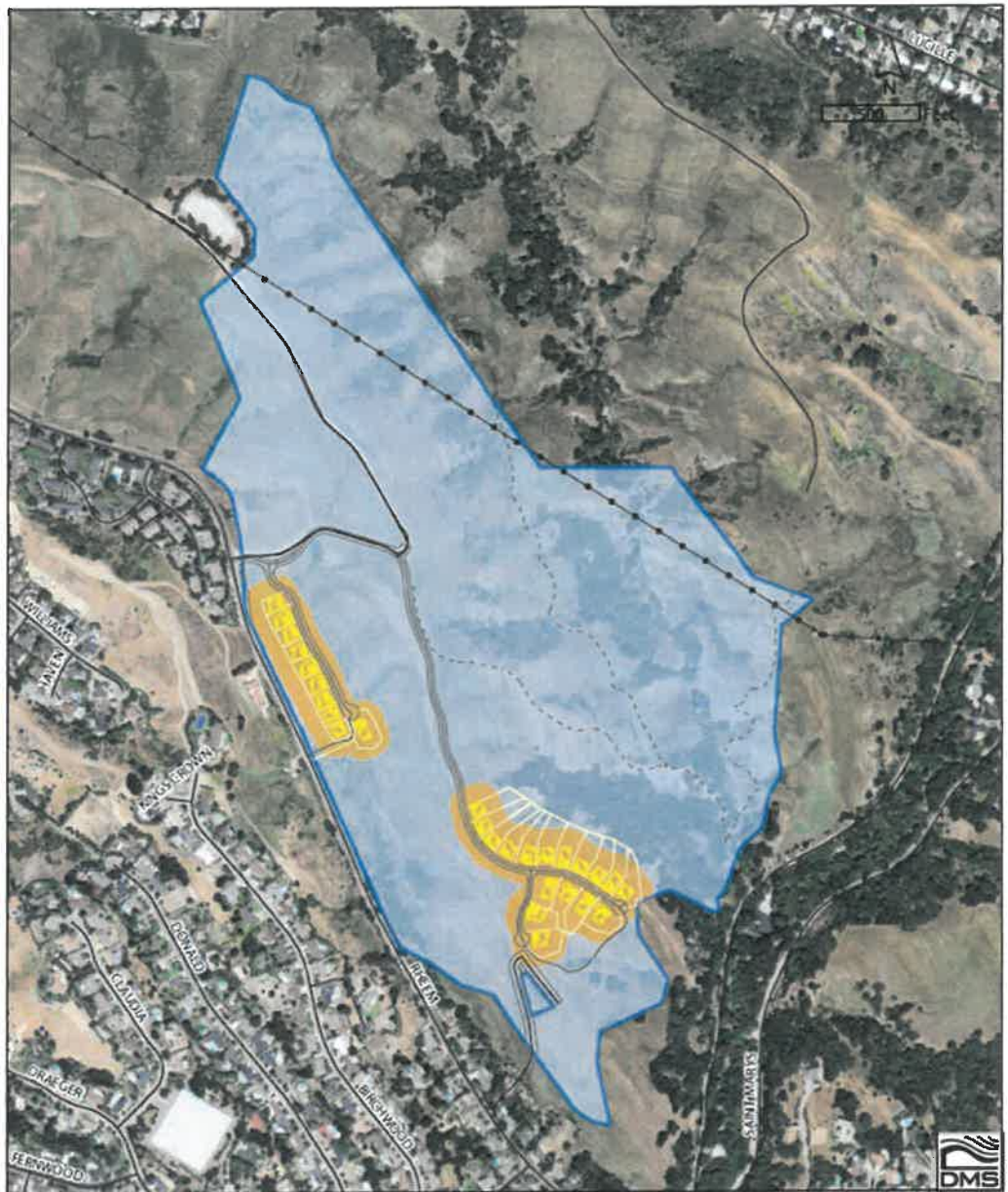
The Trailside Fuel Management Zone supports the containment of fires well away from structures.

D. STANDARDS FOR NON-COMBUSTIBLE ZONE (ZONE 0)

The zone within 5 feet around the perimeter of a structure is called the Non-Combustible Zone.










- This area will be planted with material that will not ignite. Non-combustible landscape constructions such as trellises or fences, and completely herbaceous (not woody) plants which do not have dead material in it are allowed. Wood trellises and fences are allowed, subject to the minimum dimensions identified in Section E.8, below. Lawn, spider plant, sea pink, as well as stone paths or gravel walkways are suitable for this zone. Species that produce and keep dead material such as ice plant or ivy may not be planted here. This zone will be kept free of all dead plants and combustible materials.
- Keep the ground, decking and balconies free of dead leaves, needles or other plant debris
- Dead material that drapes over ground cover will need to be removed yearly, before June 20. This includes leaves, bark, and branches.

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna



Fuel Management Zone
Rancho Laguna

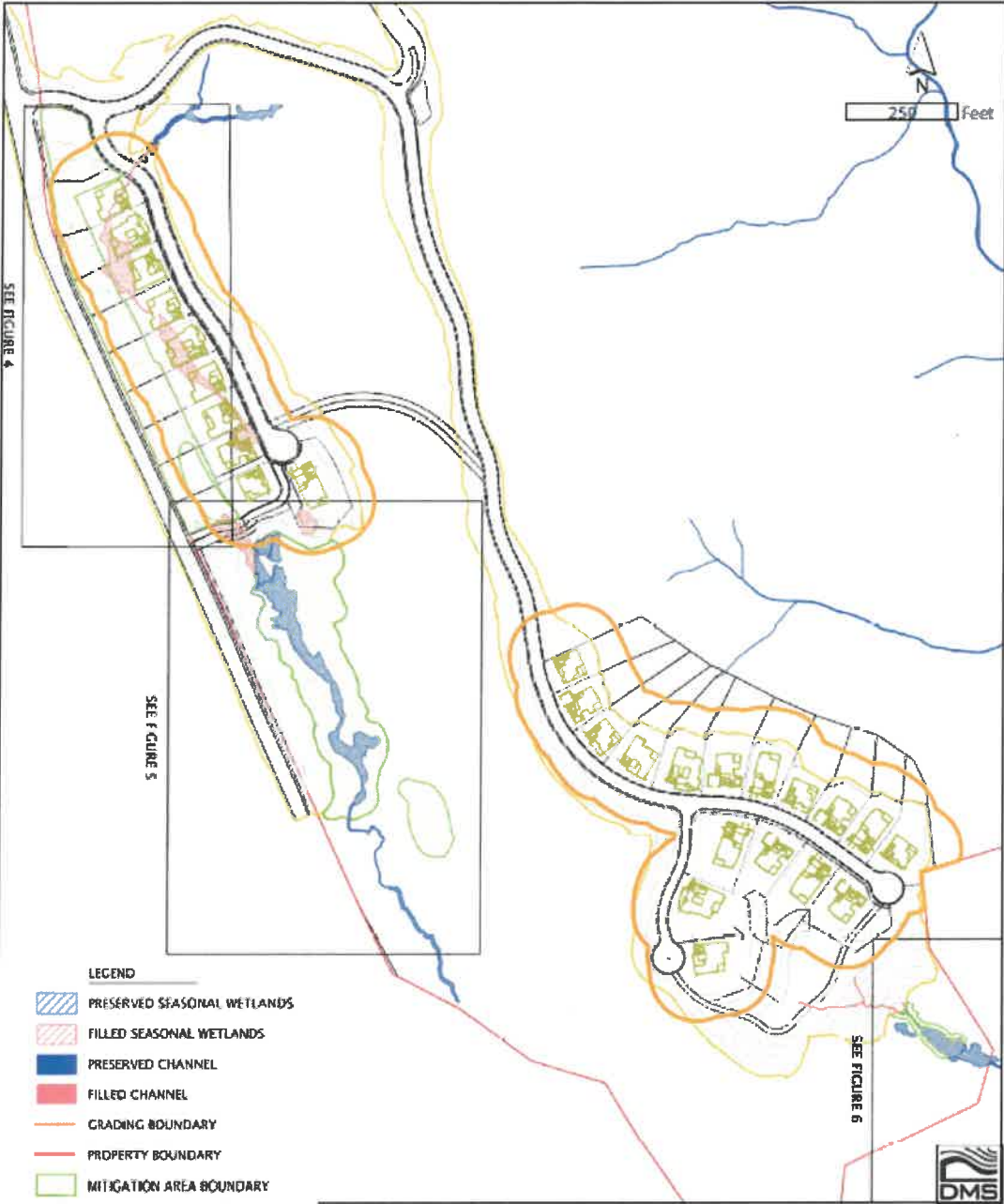
Map Features

- | | | |
|---|--|--|
|  Building Footprint |  Trail centerline |  Power line |
|  Lot line |  Road edge |  Fuel Management Zone |
|  Planned road centerline |  Existing road |  GHAD |

digitalmappingsolutions.com, 2015-03-18; Imagery source: NAIP, 2012.

Figure 5. Location of Defensible Space Fuel Management Zone

WILDFIRE HAZARD ASSESSMENT & PLAN
 Rancho Laguna



Fuel Management Zone & Wetland Mitigation Area Boundary
 Rancho Laguna

digitalmappingolutions.com, 2015-03-18; Base map from Jenner & Zentner, June 2014.

- Map Features**
- Building Footprint
 - ▭ Fuel Management Zone

Figure 6. Detail of Defensible Space Fuel Management Zone

E. STANDARDS FOR DEFENSIBLE SPACE/LANDSCAPING ZONE (ZONE I)

The following maintenance standards are intended to direct maintenance activities by the Homeowner between 5 and 100 feet of any structure. If a structure is less than 100 from a property line, the maintenance standards shall apply to the portions of the adjacent properties that are within 100 feet of the structure. These vegetation management standards comply with the California State PRC 4291, the California Fire Code MOFD Exterior Hazard Control Standards dated 1-2014, and Ordinance 13-01.

1. Remove all dead plants and dry vegetation to establish and maintain a defensible space. The following actions will provide the same level of fire safety as removing all combustible material.
 - a. Cut grass and weeds yearly to less than 4 inches in height when 30% of the grasses have turned brown. Beginning May 15, inspect the grass on a weekly basis to determine the state of grass curing. Cut the grass within the week when 30% of the grass cover is cured, and no later than June 20. Re-mow if late-season rains promote grass growth after the first cutting. Optionally, delay cutting of native grass and wildflowers until after seed set if they do not constitute a means of rapidly transmitting fire to any structure.
 - b. Keep the ground, roofs, gutters, decking, and balconies free of dead leaves or other plant debris.
 - c. Clear leaves, bark, and humus under trees and shrubs (including vines and semi-woody species) every year. At no time should a buildup of leaves and humus exceed 1 inch in depth anywhere in a landscaped area. However, do not expose bare earth in over 50% of the site.
 - d. Remove dead material that drapes over ground cover (including leaves, bark, and branches) annually, before June 20.
 - e. From mature trees, remove all vines, loose papery bark, dead branches, and live branches smaller than 3 inches in diameter to a height of 8 feet above the ground.
 - f. Remove all dead branches from within live ground covers, vines, shrubs (including semi-woody species), and immature and landscape trees.
2. Prune trees and large tree-form shrubs (e.g. oaks, bay) that are being retained to provide clearance of three times the height of the understory plant material, or 8 feet, whichever is higher. Prune limbs that are smaller than 3 inches in diameter up to 8 feet above the ground; in young trees, prune these branches within the lower one-third of the height of the tree. (Thus, if a tree is 10 feet tall, prune the lower 3 to 4 feet and keep the understory plant material to less than 1 foot in height. Then as it grows to 24 feet in height, it can achieve the 8 foot distance from the ground, and the understory plant material can reach 2.5 feet in height.) Do not disturb or thin the tree canopy, because these actions promote growth of more flammable vegetation (see Figure 7). Remove all branches within 10 feet of any chimney, flue, or stovepipe. Maintain 5 feet of vertical clearance between roof surfaces and overhanging portions of trees.
3. Do not locate plants that are replacing ones that die, or oaks planted as a mitigation measure, under trees. To avoid creating "ladder fuel situations" (in which a fire can climb from one vegetation layer to the next higher one), do not plant any tall shrubs, vines, semi-woody species, or any chaparral species under trees. Low-growing shrubs and ground covers are suitable landscaping under trees.

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

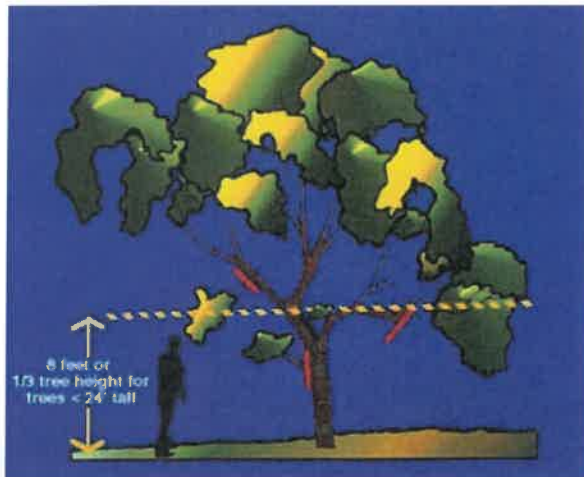


Figure 7 - Prune branches to a height of 8 feet above the ground. In young trees, prune branches on the lower one-third of the height of the tree. Do not disturb or thin the tree canopy. This promotes growth in the understory, which is more easily ignited.

4. Make sure that all landscaping and replacement plants are fire-resistant in nature. Prohibit planting of plants that are highly ignitable and burn with intensity. See <http://www.diablofiresafe.org/tolerance.html> for appropriate plants, Appendix C for features that make plants fire resistant and Appendix B for prohibited plants.
5. Manage individual plants or shrub masses to maintain horizontal spacing that will prevent fire from spreading between shrubs.
6. Remove and safely dispose of all cut vegetation and hazardous refuse.
7. Allow chipped materials to remain on the site, provided the mulch layer is no greater than 3 inches in depth.
8. Fences will be constructed of either noncombustible material or of timbers of at least one-inch nominal thickness. Typical fencing might include "view fencing", consisting of open wire-mesh with at least four-inch posts and stringers that have a minimum two-inch nominal thickness.
9. Garden structures, such as gazebos, spas, or other outbuildings, will comply with the same requirements as the main structure in terms of minimum standards for ignition-resistive materials, timber size, and non-combustible zones
10. Only gas barbeques are allowed. Barbeques must be surrounded by at least 100 square feet of noncombustible materials on the ground surface and be located 10 feet away from all overhanging trees, and 6 feet from a ceiling. Barbeques must not be left unattended when in use. Barbeques should be located no farther than 15 feet from a water source (including a garden hose) or be equipped with a fire extinguisher.

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

11. Built-in fireplaces should be either no farther than 15 feet from a water source or be equipped with a fire extinguisher. All associated chimneys will be fitted with a spark arrestor. Spark arrestors will be approved or listed per UBC or NFPA standards.

F. OPEN SPACE VEGETATION MANAGEMENT FOR FIRE HAZARD REDUCTION (ZONE II)

The land anywhere beyond 100 feet from any structure to the boundary of Rancho Laguna will be designated Open Space Management Zone (Zone II). The following standards apply to all lands in Zone II:

As stated in the Open Space Management Plan², “Fuel management on open space parcels “A” and “B” will most likely be accomplished through grazing operations.” Fuel management on Parcel “D” will be accomplished through mechanical methods. On Parcel “D”, the Moraga GHAD will follow the mechanical fuel management requirements of the 2014 Moraga-Orinda Fire District Exterior Hazard Control Standards for Vegetation Management or updated requirements as adopted. We anticipate that if mechanical fuel management methods are required on Parcels “A” and “B”, it would be immediately adjacent to the planned residential parcels.

Parcel “D” would be covered by the Standards for Vegetation Management general requirements and additional requirements for parcels three acres or less in size. As provided in the Standards for Vegetation Management, selected tasks are to be maintained year around and seasonal standards are generally to be completed by June 15 of each year.

In addition, shrubs above the woodland east of structures on the eastern side of Sonora Road will be thinned to remove ladder fuels between the ground to the tree canopy.

If shrubs grow to cover 50 percent of the slope below any road or emergency vehicle access easement, the shrubs will be thinned so they cover less than 20% of the area within 100-ft of the road or emergency vehicle access easement. This requirement does not apply within the Mitigation Area shown in Figure 6, unless permitted by the Open Space Management Plan and the Wetland Mitigation Plan.

G. STANDARDS FOR TRAILSIDE FUEL MANAGEMENT ZONE (ZONE IV)

In any grassland areas adjacent to the emergency vehicle access easement and the access road to the detention basin south of Los Santos Court, a strip 15 feet in width on both sides of the trail will be mowed annual prior to June 20th. If the grass in this strip is already shorter than four inches in height, no further treatment is necessary. This requirement does not apply within the Mitigation Area shown in Figure 6, unless permitted by the Long-Term Open Space Management Plan and the Wetland Mitigation Plan.

² Zenter and Zenter and ENGEEO, Incorporated. 2014. Rancho Laguna Open Space Management Plan.

H. STANDARDS FOR ROADSIDE VEGETATION MANAGEMENT

The standards for Defensible Space/Landscaping (Zone I) will apply to the strip of land within 30 feet of the pavement edge from both sides of the roadways, including Fay Hill Road, Sonora Road, and Los Santos Court. In the Roadside Vegetation Management Zone, there will also need to be an unobstructed vertical clearance of 15 feet along the entire length of the roadway. This requirement does not apply within the Mitigation Area shown in Figure 6, unless permitted by the Open Space Management Plan and the Wetland Mitigation Plan.

I. WETLAND MITIGATION FUEL MANAGEMENT (ZONE III)

Annual grasses will be cut annually once they are dry. Dead material will be inspected on a periodic basis, every three years, and if necessary, treated that same year. The Open Space Management Plan states, "Creating, enhancing, maintaining fuel modification zones in the wetlands (defined as a strip of mowed land or the planting of vegetation possessing low combustibility for purposes of fire suppression) will be prohibited in the wetland areas." However, using hand labor to remove flashy dry annual grasses and accumulated dead material smaller than three inches in diameter is not inconsistent with the restriction noted above.

J. STATEMENT REGARDING COMPLIANCE WITH FIRE SAFETY CODES AND REGULATIONS

With the approval of this Wildfire Hazard Assessment and Plan, the Rancho Laguna project complies with all fire safety codes and regulations relating to exterior risk mitigation

Once the fire-mitigation measures have been implemented, fire behavior in the area within 100 feet of any structure on the lot should exhibit less than two-foot flame lengths. Flame lengths of less than two feet typically do not threaten structure survival. Also, because available fuels will either be kept mowed or will be compact in nature, any ignited fire(s) should travel at easily containable speeds.

Flame lengths produced further away than 100 feet from a structure would be slightly greater but crowning and torching of trees is minimized; fires are expected to quickly subside in intensity in the Defensible Space Zone

**- Section Three -
IMPLEMENTATION MECHANISMS**

**A. HOMEOWNER AND HOMEOWNER ASSOCIATION
RESPONSIBILITIES**

The following requirements shall apply to homeowners, the Homeowner Association, and the GHAD:

- The Rancho Laguna GHAD shall be responsible for inspecting and maintaining the Open Space in compliance with the Plan, and each lot owner shall be responsible for maintaining the individual lot in compliance with the Plan.
- No owner or resident shall permit any condition to exist on his or her lot, including, within limitation, trash piles, or weeds, which creates a fire hazard or is in violation of local fire regulations.
- There shall be no outdoor storage of firewood, kindling, or compost material within 30-feet of any structure, unless the material is stored in an approved bin or enclosure.
- The Homeowner Association shall be responsible for the maintenance of all Open Space improvements within the Development Area from the edges of the streets up to the property line of the Homeowner Association.
- The GHAD will be responsible for maintenance of the portions of the following Fuel Modification Zones that are within the areas managed by the GHAD: Defensible Space Zone, Roadside Fuel Management Zone, Open Space Management Zone, Trailside Fuel Management Zone and the Wetland Mitigation Zone. Fuel management will be consistent with the conservation easement where the Fuel Modifications Zones fall within an area covered by the conservation easement.
- The Homeowner Association shall maintain all the landscaping within the common area as indicated on the Plan. The Homeowner Association shall also maintain the following: The landscaping improvements within common areas and fencing delineating the common areas.
- Homeowners shall be responsible for maintaining the private open space within each lot (with the exception of areas managed by the GHAD), with enforcement authority provided to the Homeowner Association and the Moraga Orinda Fire District.
- If a homeowner fails to maintain and/or repair his lot as provided herein in a manner which the Homeowner Association reasonably deems necessary to preserve the safety, appearance and/or value of the Project, the Homeowner Association may notify the homeowner of the work required and request that it be done within a reasonable and specific period. If the Owner fails to perform such maintenance and/or repairs within

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

said period, the Board shall, subject to the notice and hearing requirements as set forth in the By Laws of the Homeowner Association, have the right to enter upon the lot to cause such maintenance and/or repair work to be performed. Costs of any such maintenance or repair shall be charged to the homeowner.

- Notwithstanding the foregoing, in the event of an emergency arising out of the failure of a homeowner to maintain and/or repair his lot, the Homeowner Association shall have the right, through its agents and employees, to immediately enter the Lot to abate the emergency and individually charge the cost thereof to the homeowner.

B. DELEGATION OF FUEL MANAGEMENT AND CONSTRUCTION RESPONSIBILITIES

The Developer will be responsible for the design and construction of all improvements of the project including site grading, roads, driveways, emergency access roads, fire roads, trails, homes, community facilities, landscape improvements, utilities and improvements in Rancho Laguna.

The HOA will maintain the common area facilities, landscaping and other common area management and maintenance functions within the project area.

C. PHASING OF MAINTENANCE RESPONSIBILITY AND FUEL MANAGEMENT

- Hydrants will be in place before framing begins, or as approved by the Fire Marshal.
- Initial fuel management actions will be completed before construction on the first lot begins. These actions include tree removal, tree pruning, and grass cutting (if construction takes place between June 20 and Nov. 1).
- All required clearing and grass cutting will be completed before June 20th of each year. Mowing must begin as soon as 30% of the grass has cured.
- Grass cuttings and clippings will be removed the day they are cut. No clippings are permitted to remain in piles or scattered, unless so approved by the MOFD Fire Marshal.
- All brush piles and tree clippings are to be removed within one week of cutting. No brush or clippings are permitted to remain in piles, unless so approved by the MOFD Fire Marshal.
- Annual fuel management measures include:
 - Removal of all combustible vegetation along roadways, driveways, access roads, and trails according to stated standards
 - Maintenance of the emergency-access easement
 - Maintenance of the defensible space around structures according to stated standards for the various fuel management zones

D. MECHANISMS FOR COMPLIANCE

Long-Term Financial Assurances

All homeowners are responsible for the maintenance of the Non-Combustible and Defensible/Landscaping Zones inside their lot.

All homeowners within Rancho Laguna will be members of the Rancho Laguna Homeowner Association and will pay HOA assessments to fund the Rancho Laguna Homeowner Association's long-term management costs. These assessments will provide full funding of the long-term management and maintenance of the Roadside Fuel Management Zone, and any Open Space Management Zone in the area controlled by the Homeowner Association.

Long-term, the Moraga GHAD will be responsible for maintenance of the Open Space Management Zone, Roadside Fuel Management Zone and Trailside Fuel Management Zone and Wetland Mitigation Zone in the area controlled by the GHAD. The Moraga GHAD board of Directors shall approve a GHAD Plan of Control for maintenance of required facilities, including financing. The project shall fund the formation of the GHAD.

E. FREQUENCY OF FUTURE MAINTENANCE

The frequency of vegetation management is linked to the vegetation type.

Grass will need to be mowed annually when 30% of the grass cover has cured (any time from April 15 - June 20). Should rains occur late in the season and produce more grass growth, the grass may need to be treated again.

The expected frequency of treatment of shrubs is estimated at every three years. Shrubs may need to be pruned of dead wood, shortened, shrub groupings minimized in size, or new shrubs removed under tree canopies. Shrub removal or pruning may be done any time of year. Application of an herbicide to prevent re-sprouting may be more effective in the spring, but will follow the PCA recommendation.

Initial pruning of lower small branches from trees will be a substantial effort. Because trees typically grow from the top and ends of branches, subsequent pruning needs to occur only every five years or so, depending on the rate of growth, and significant events which may cause dead wood to develop or breakage to occur. Pruning of oaks, other trees and tree-like shrubs can be done at any time of the year, depending on recommendations from a professional arborist.

APPENDIX A FUEL TYPE AND FIRE BEHAVIOR IN DIFFERENT FUELS

The term "fuel" is used to describe any material that will burn, whether vegetative or structure component. A single fire may consume shrubs, grasses, trees, woodpiles, and homes as fuels.

Fire managers in virtually all US agencies (as well as in other countries where wildland fire hazards are significant) use fuel model systems for the various computerized fire behavior prediction systems (FBPS). Within the US, information regarding fuel volumes and fire-behavior descriptions is based upon fuel models described in *How to Predict the Spread and Intensity of Forest and Range Fires*, by Richard C. Rothermel (1983), published by the USDA Forest Service Intermountain Forest and Range Experiment Station, General Technical Report INT-143. Fuel models relevant to the Rancho Laguna project include grasslands (each with tall and short grass having different models), shrub lands, and oak woodlands (with and without understory vegetation). Each fuel model is given a number designation, which is interpreted by fire managers across the continent to mean the same thing.

Fuel models describe vegetation structure in addition to typical species composition. The most significant factor is the amount and distribution of smaller-diameter fuels, because these materials generally spread wildland fires.

Another important factor is the amount of dead biomass and the ratio of live-to-dead material in terrain with significant brush and numerous tree stands, since dead biomass contributes fine fuel litter as well as carry flames more readily. Fuel models include these considerations.

This section describes conditions that are planned and conditions that would develop over time without fuel management. For example, all of the existing vegetation, including the eucalyptus, within the Development Areas will be removed by grading operations and thus is not discussed. However, shrubs can be anticipated in the grasslands on the open space hillsides and thus is addressed.

Annual Grasslands (FBPS Fuel Model #1)

The entire Project is currently covered with annual grasses. Grassland also covers the hill to the south of the project site and extends to the east of the Project.

Grass fuels do not produce much heat, but they produce a fire that travels quickly. Therefore, containment is the greatest challenge posed by these fuel types. In particular, grass can serve as a wick for more hazardous fuels whose ignition is apt to cause greater damage. Grass thus provides an avenue for fire to travel to densely vegetated areas, allowing it to build up enough of a "head of steam" to burn into landscaping or other types of fuels under conditions that would not otherwise be fire-sustaining.

Grassland fuels (both annual and perennial) are fairly uniform and homogeneous in comparison to other fuel types. Generally, grasslands have a light total fuel load, consisting entirely of fine

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

herbaceous material that cures in the summertime. This material responds markedly to changes in humidity and ignites easily in dry periods.

Oak Woodland (FBPS Fuel Model #8)

Oak woodlands do not occur on the project site, but on the adjacent lots to the west and north. The understory in most of the closed canopy woodland areas is relatively undeveloped, consisting primarily of leaf duff.

Fire intensity, flame lengths, and scorch heights are usually low in the oak woodlands that do not have a well-developed understory. Oak woodlands are characterized as follows in the USDA Forest Service Fire Behavior Prediction System:

"Slow-burning ground fires (carried in the compact litter layer) with low flame heights are the rule, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand."

The resulting fire behavior is rather benign. Rates of fire spread are slow, approximately 2 feet per minute. Flame lengths are predicted to be one foot. Leisurely spread rates, combined with the relatively short flame lengths of the predicted fire behavior demonstrate a manageable, moderate fire hazard in this fuel type.

Fuel conditions in the oak woodland vary with the slope, age, height, and canopy closure of the overstory, the depth of the litter and density of understory shrub cover. Ground-layer and understory fuel loads beneath dense canopy may be minimal (well under one ton per acre), but horizontal fuels may be continuous and ladder fuels present where the vertical distribution of foliage is continuous. The foliage of both bay and coast live oak is very flammable late in the fire season, should the fire reach the crowns.

North Coastal Scrub (FBPS Fuel Model # 5)

North Coastal Scrub occurs off the project site, on slopes to the south, southeast and east. However, as young shrubs scattered in the annual grasslands to the south of the project start to develop in size and cover (in approximately 10-15 years), this fuel model will become even more significant. All areas of annual grass will gradually (over a span of 15-25 years) convert into this fuel type without some sort of disturbance (which may be in the form of gophers, grazing animals, or mechanical mowers).

This fuel type can be characterized by the FBPS Fuel Model #5. Total fuel loads are approximately 5 ton/ac, with most of the fuels occurring in the smaller diameter fuels. A preponderance of dead fuels can be found in the smallest size class, those under 1/4 inch in diameter. The dead to live ratio of mature stands is usually quite high - an equal proportion of living and dead material is often found. Additionally, live foliage on the plants comprises over half of the total fuel load.

WILDFIRE HAZARD ASSESSMENT & PLAN Rancho Laguna

During the mid-1980s, the fuel volumes, structure, and distribution of size classes of 16 scrub sample sites from the East Bay Regional Park District were inventoried. Total fuel loading averaged 3.18 tons/acre, equally distributed between fine fuels (smaller than 1/4 inch in diameter), kindling (from 1/4 to 1 inch in diameter) and larger. Typically the amount of dead material in the scrub is almost one-half the total volume, and sometimes exceeds 50 percent.

Fire behavior is not normally explosive; however, it was this fuel type that fueled the Oakland Fire of 1991 on Saturday, October 19, and the morning of October 20th. Rates of spread are quite fast, but flame lengths are low (usually under five feet) and heat output minimal under normal conditions. Obviously, under extreme weather conditions erratic and explosive fire behavior can result.

Landscaped Areas (No FBPS #)

Landscaping will occur throughout the Project site. The site is currently bare of landscaping plants, plans call for screening plants and establishment of landscaping for visual appeal. Adjacent lots to the north and east have well-established, mature landscapes; those to the west are newer, with young, sparse landscaping. Because this type of vegetation is situated nearest structures and evacuation routes, this fuel type can be the most damaging or provide an additional layer of safety/protection.

Domestic landscapes typically incorporate fall into a spectrum of fire hazards:

1. Landscapes are moist, and therefore won't burn; or
2. They contain large amounts of fuel, which will burn with great intensity; or
3. They contain fire-resistant plants, and will burn slowly with little resistance to control,
or
4. They are maintained to be of low fuel volume, so provide little heat when they do burn.

Problems to avoid in landscaped areas are poor maintenance, breakage in irrigation pipes, and unremoved dead plant material. These problems can result in a large dead-fuel component amounting to a large volume of fuel.

See also Appendix C for a discussion of the properties of fire resistant plants.

APPENDIX B SPECIES LIST FOR PROHIBITED LANDSCAPING PLANTS

Due to their combustible nature, these plants shall be prohibited from the project area. These plants will not be allowed as replacement plants. This is a partial list; see also <http://www.diablofiresafe.org/tolerance.html> for more lists of fire resistance ratings of landscaping plants.

<u>Botanical Name</u>	<u>Common name</u>
<i>Abies spp.</i>	fir
<i>Acacia spp.</i>	acacia
<i>Adenostoma fasciculatum</i>	chamise
<i>Adenostoma sparsifolium</i>	red shanks
<i>Artemisia californica</i>	California sage
<i>Baccharis pilularis consanguinea</i>	coyote brush
<i>Bamboo spp.</i>	bamboo
<i>Cedrus spp.</i>	cedar
<i>Cortaderia selloana</i>	pampas grass
<i>Cupressus spp.</i>	cypress
<i>Dodonaea viscosa</i>	hopseed bush
<i>Erigonom fasciculatum</i>	California buckwheat
<i>Eucalyptus cladocalyx</i>	sugar gum
<i>Eucalyptus globulus</i>	blue gum
<i>Eucalyptus viminalis</i>	Manna gum
<i>Hedera canariensis</i>	Algerian ivy
<i>Juniperus spp.</i>	juniper
<i>Pennisetum setaceum</i>	fountain grass
<i>Picea spp.</i>	spruce
<i>Pinus spp.</i>	pinus
<i>Salvia mellifera</i>	black sage
<i>Schinus spp.</i>	California pepper tree

In addition, plans should not be established which could invade the neighboring park and open spaces. Refer to the Vegetation Management Almanac for the East Bay Hills (published by the Hills Emergency Forum, and available from the Tilden Nature Center) for a list of species which should not be planted because of their invasive nature. The list includes:

Blackwood acacia	ivy
coyote bush	holly
Pampas grass	Monterey pine
cotoneaster	pyracantha
Italian hawthorn	blackberry
eucalyptus	vinca major
broom	
mayten	

APPENDIX C SELECTION OF FIRE RESISTANT LANDSCAPING

Factors that must be considered in rating the fire performance of plants include:

- ❖ **Total volume.** The greater the volume of plant material (potential fuel) present, the greater the fire hazard.
- ❖ **Moisture content.** The moisture content of plants is an important consideration; high levels of plant moisture can both lower fire risk and act as a heat sink if a fire occurs, reducing its intensity and spread.
- ❖ **Amount and distribution of dead material.** The amount of dead material in a given plant influences the total amount of water in the overall plant; the dead material is usually much drier than living tissue. Whereas dead material rarely has a moisture content higher than 25%, live foliage moisture content ranges from 60 to 80% for chaparral species in xeric conditions to a high of 200 to 400% for succulent plants or plants under irrigation.
- ❖ **Size of leaves, twigs, and branches.** Materials with large surface areas (such as needles, twigs, or large flat leaves) dry more rapidly under fire conditions than materials with lower surface ratios (such as branches and fleshy leaves).
- ❖ **Geometry and arrangement of the plant (overall spatial distribution of the biomass).** The shape of a plant and the way in which the biomass is distributed throughout the plant is important because this bulk density affects the air flow and heat transfer through the plant. The arrangement of material within the plant affects its fuel continuity and its tendency to undergo preheating and promote fire spread.
- ❖ **Plant maintenance.** The significance of proper plant and landscape maintenance cannot be overemphasized. *Poorly maintained landscapes can easily become fire hazards, even if many of the plants are favorably recommended for fire performance.*

All of the above-mentioned plant characteristics are related to maintenance issues. Plants with higher moisture content generally have a lower fire risk. For example, the moisture content of a plant is absolutely influenced by regular and proper irrigation, and large amounts of dead material lower the plant's overall moisture content. To increase the plant's overall moisture content, it is important to remove and properly dispose of dead material. In addition, regular fire-prevention maintenance should include thinning or pruning to reduce fuel volume and improve plant geometry.

The positioning of plants relative to each other and to structures is also very important. Design landscapes to discourage the creation of "fuel ladders"—a continuous fuel path by which a fire can climb from the ground to a shrub, to a tree, and ultimately to the structure. Continuous removal of any potential fuel ladders needs to be part of routine landscape maintenance.

An appropriately landscaped and maintained defensible space will reduce the fire hazard and the fire risk to structures. A landscape environment that is inconsistently or improperly maintained does not function as defensible space, and it contributes to the fire hazard. Consult a nursery or landscape professional for their recommendations on plant spacing, pruning, aeration, fertilization, irrigation, and other cultivation practices.

APPENDIX D
KEY TERMINOLOGY

defensible space – the area within the perimeter of a parcel, neighborhood or community that provides a key point of defense from an approaching wildfire or defense against encroaching wildfires or escaping structure fires

fire intensity – the amount of heat released by a fire in an area in any given time period. Fire intensity is usually related to the flame lengths of a fire.

fuel break – an area in which flammable materials have been cleared away or thinned out to minimize fire spread to structures and/or natural resources

fuel – anything that will burn easily, such as vegetation or small woody material

topography – geographic elements on an area, such as slope steepness, aspect, existence of hills, canyons and rough terrain

wildland – areas which are not developed or farmed

WILDFIRE HAZARD ASSESSMENT & PLAN
Rancho Laguna

APPENDIX E
HYDRANT/FIRE SERVICE REQUIREMENTS