CONCEPTUAL FIRE PROTECTION PLAN

for the

Rancho Cielo Estates, Ltd.

"CIELO" RANCHO SANTA FE DEVELOPMENT

TM's 5440 and 5441 EA 86-06-026b

(Rancho Santa Fe Fire Protection District)

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CIELO
FIRE PROTECTION PLAN

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1.0 General Description

Much of the undeveloped portion of California from the coastal valleys and foothills to the inland mountain slopes is classified as High Fire Hazard. The proposed **Cielo Rancho Santa Fe/Cielo Estates** project is located within a very high fire hazard zone eight miles inland at 1,500 feet above sea level in the coastal hills bordering the north side of Del Dios Highway. The overall project will include 528 luxury residences, condominiums and a small commercial area on 1,700 acres. In addition, 800 acres of natural "open space" are included within the 1,700-acre project. This developing community will also be surrounded by several thousand acres of "off project" coastal sage scrub growing on rather steep slopes that will remain as high quality open space. The entire development is located within the Rancho Santa Fe Fire Protection District (RSFFPD). The RSFFPD has designated Cielo as one of five "Shelter In Place Communities".

This particular Fire Protection Plan applies to just two areas within the Cielo project as follows: 1.) TM 5440, known as Rancho Cielo Village Estates consists of 11 condominium units on 1 lot comprising 5.59 acres, 2.) TM 5441, currently known as Parcel "H", consists of 31 condominium Units on 1 lot comprising 14.42 acres. The Condominium Units in TM's 5440 and 5441 are planned for 2 stories to 2 and ½ stories, not to exceed 35 feet in total height (slopes and set backs are discussed in Section 2.2). This Fire Protection Plan (FPP) assesses the overall (on-site and off-site) wildland fire hazards and risks that may threaten life and property associated with these two residential areas. In addition, the Plan establishes specific structural and building material requirements and both the short-term and long-term fuel modification actions required to minimize any projected fire hazards and risks to structures and assigns annual maintenance responsibilities for each of the required fuel modification actions (refer to Section 5 for specific details and requirements).

The purpose of this Plan is to provide Fire Protection requirements for developers, architects, builders, individual Home Owners, the Cielo Home Owners Association (CHOA) and the RSFFPD and County of San Diego Planning Officials to use in making all proposed structures safe from future wildland wildfires. The Plan includes:

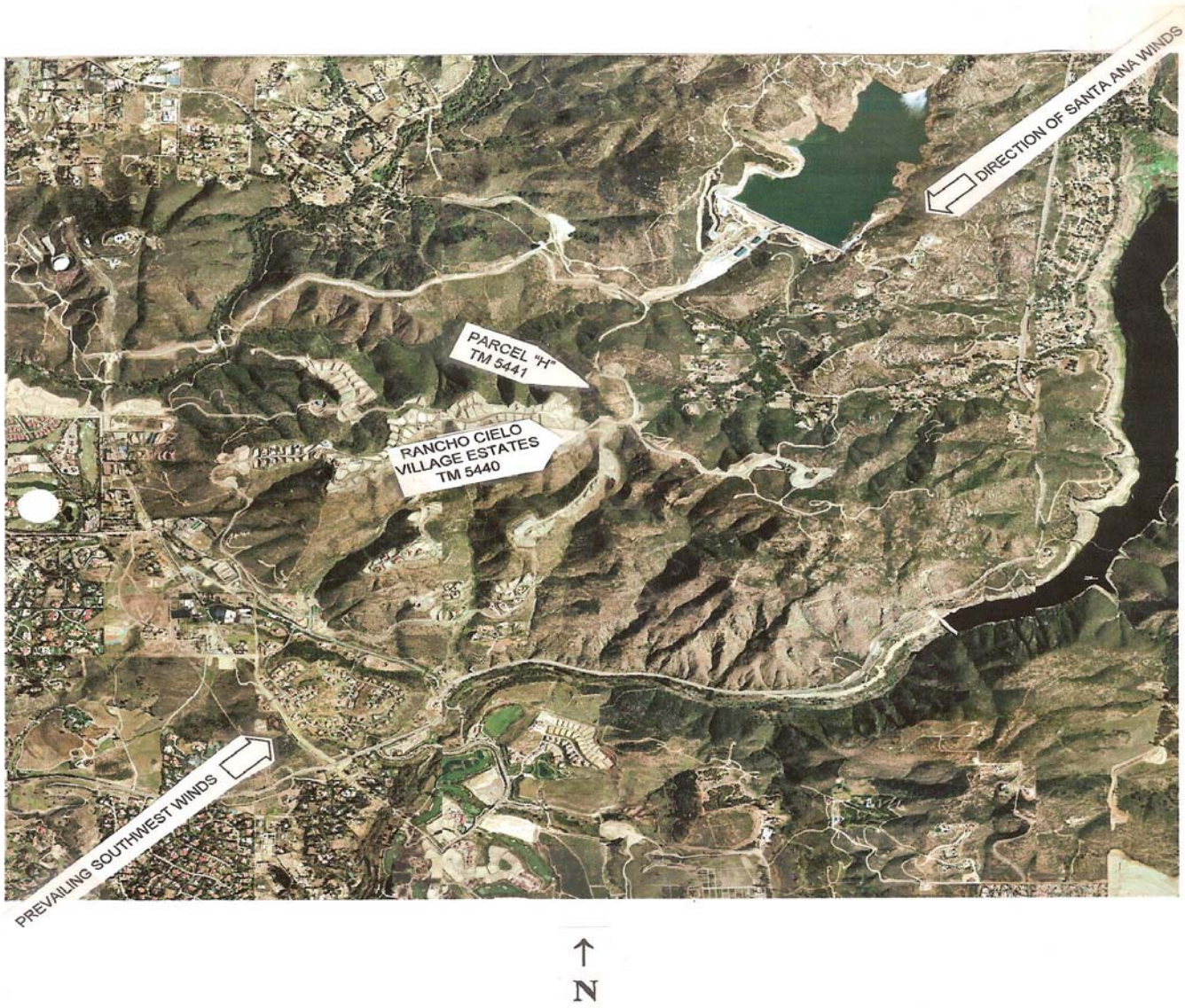
- A wildland fire hazard-rating assessment and expected fire behavior of off-site and on-site native vegetative fuels.
- A long term perimeter vegetative fuel modification treatment and maintenance plan to minimize any loss to residential structures within the proposed development due to wildland wildfire.

- A long-term interior open space fuel modification treatment plan and "*firewise landscaping"* criteria to be deployed around <u>*all*</u> planned structures.

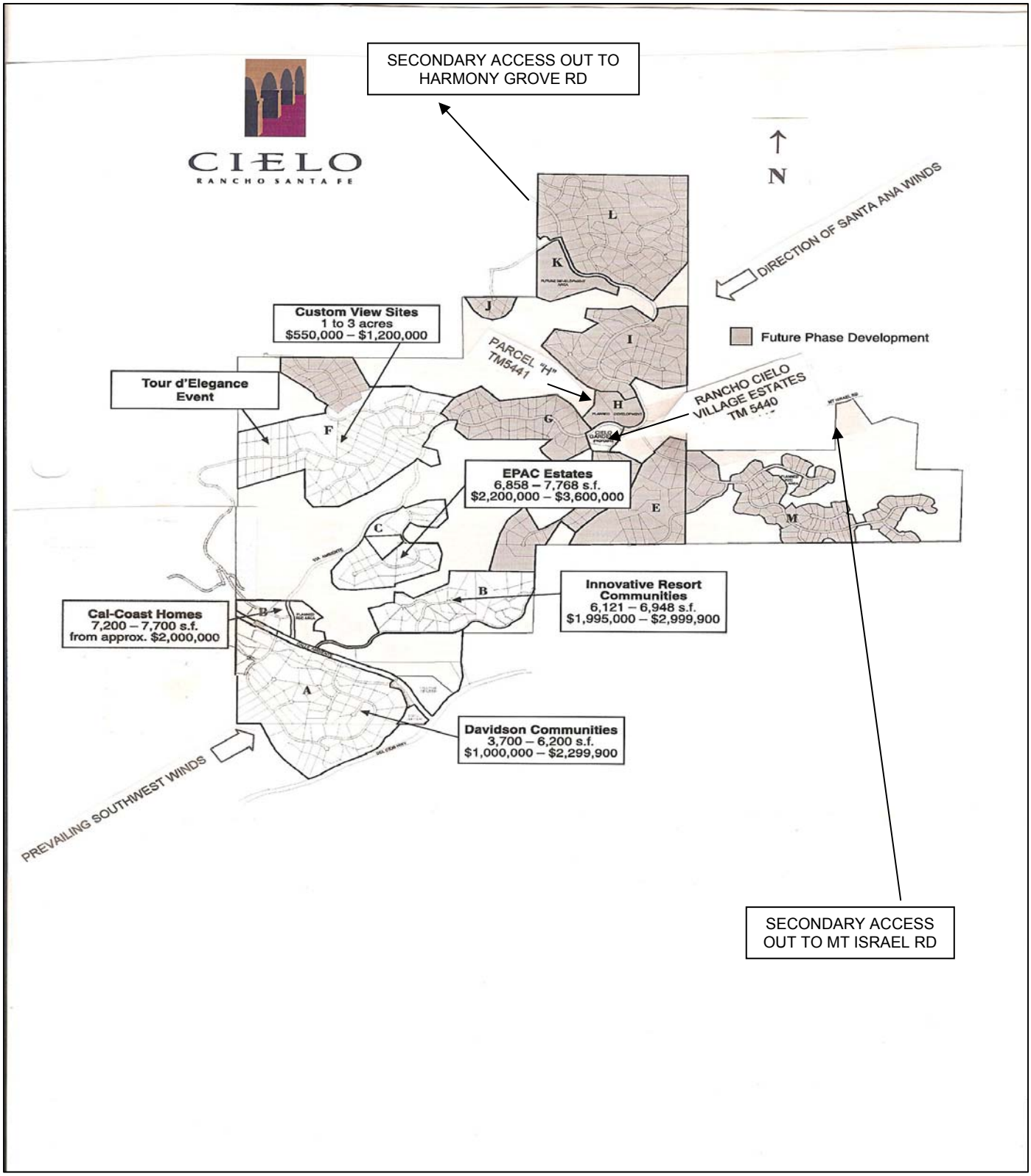
- Basic required construction features for all structures built in Wildland Urban Interface Areas.

This FPP meets or exceeds the requirements of the Cielo Fire Safety Plan, RSFFD ordinances (e.g., Ordinance 2011-01; the current County of San Diego Consolidated Fire Code approved November 13, 2009; Title 9 Construction Codes and Fire Code, Sections 92.1.703A – 92.1.1505.2; California Public Resource Code Sections 4290 and 4291; California Code of Regulations Title 14, Section's 1270-1299 "SRA Fire Safe Regulations"; the ICC International Urban-Wildland Interface Code, 2006 edition; and the criteria listed in the National Fire Protection Association (NFPA) code 1144 – Standard for Protection of Life and Property from Wildfire (2008 Edition).

These two proposed developments are all designed to meet the RSFFPD's "Shelter In Place" requirement where an orderly evacuation may not be possible in an extreme emergency. "Shelter In Place" allows all residents to remain in their fire resistant homes during a wildfire emergency, or other emergency. This would keep evacuating traffic off of the road systems, which would then provide rapid access into Cielo for initial incoming emergency equipment and for follow up incoming engine strike teams. Note that "Shelter-In-Place" is not intended to mean a "stay and defend" community. Residents will not have the training or protective equipment required to be able to aggressively defend their properties. However, homeowners who have stayed in their homes as wildfires burned through their development have emerged after the passage of the fire front and put out small fires on patio furniture, in wood piles, etc. with a garden hose in the 1 to 2 hours following the passage of the fire front. If left unchecked, these small fires would have caused the total loss of the structure.



↑ Figure 1: An aerial photo of the overall Cielo Estates Project. Lake Hodges can be seen along the right hand side of the photo and the relatively new Olivenhain Dam and Reservoir can be seen in the upper right hand area of the photo.

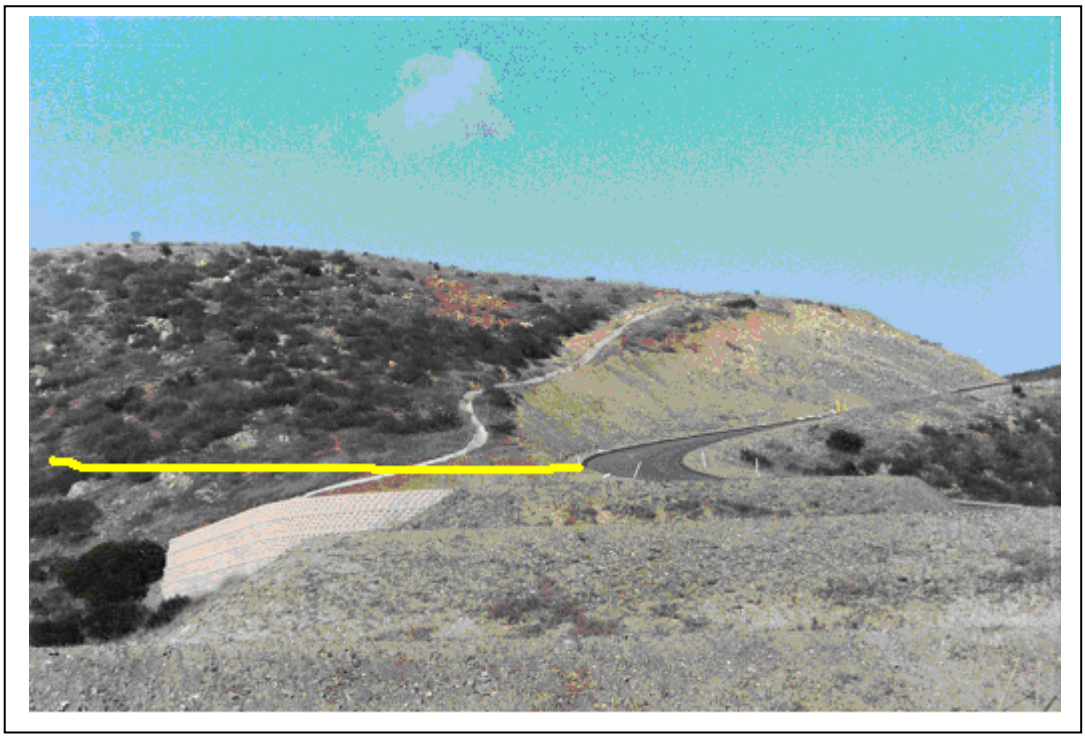


↑ **Figure 2: The layout of the Cielo Rancho Santa Fe Estates Project including the locations of TM 5440, The Rancho Cielo Village Estates and TM 5441, referred to as Parcel H.**

2.0 Wildland Fire Hazard and Risk Assessment

2.1 Off-site Fire Hazard and Risk Assessment

The immediate areas surrounding TM sites 5440 and 5441 are vegetated with highly flammable coastal sage scrub species comprised of common buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), California sagebrush (*Artemisia californica*), about 10% chamise (*Adenostoma fasiculatum*), and moderately flammable Ramona lilac (*Ceanothus tomentosus*); deer weed (*Lotus scoparius*), and scattered clumps of laurel sumac (*Malosma laurina*), lemonade berry (*Rhus integrifolia*) and annual grasses. These vegetative fuels can best be described as an SH5 (A High Fuel Load, Dry Climate Shrub) in the U.S. Forest Service BehavePlus version 3.0.1 Fire Modeling Program. TM 5440 lies to the immediate south of Parcel "H" on the south side of Via Ambiente Street and will be described first.



↑ Photo 1: From El Brazo Street looking north at the Village Estates site, which sits up on top of the ridge. This location calls for 11 condominium units on 5.59 acres. The 100 foot Fuel Modification Zone extends down to El Brazo Street on the east side of the Village Estates. The south side of the Fuel Modification Zone will come down to the curve that can be seen in the middle ground of the photo as indicated by the yellow line.

↑ Photo 2: Looking east along the south side of the Village Estates site at the very light fuel loading on the south and east facing 30% slopes above El Brazo Street. The area to the immediate west of the Village Estates site is a very large, cleared building site. Via Ambiente Street borders the Village Estates site on the north (please refer to the Fuel Treatment Location Map for a graphic depiction of the Fuel Modification Zones).

Parcel "H" (TM 5441) lies to the immediate north of TM 5440 and is physically separated from TM 5440 (The Village Estates site) by Via Ambiente Street. A pictorial depiction of TM 5441 follows:

↑ Photo 3: Looking south along the west side of the Fuel Modification Zone of Parcel "H". The main street, Via Ambiente, goes through the saddle at the top of the drainage. The slopes on the west side of Parcel "H" average 20% to 30%.

↑ Photo 4: From the north side of Parcel "H" looking north at the SH5 fuels on 30% slopes with scattered clumps of laurel sumac and lemonade berry.

↑ Photo 5: From the eastside of Parcel "H" looking northeast at the SH5 fuels consisting of buckwheat and sage interspersed with clumps of laurel sumac and lemonade berry on 30% to 40% slopes. Via Ambiente Street can be seen in the foreground. The road and the vegetation on the east side of the road is outside the Parcel "H" Fuel Modification Zone.

↑ Photo 6: From the south side of Parcel "H" looking south at the coastal sage scrub vegetation less than 2' in height. These fuels are south of the Parcel "H" 100 foot wide Fuel Modification Zone. A fire burning in these fuels under Santa Ana wind conditions would be pushed southwest and away from parcel "H" and the Village Estates site.

↑ Photo 7: From Via Ambiente Street looking north along the west side of Parcel "H". Most of the larger clumps are lemonade berry or laurel sumac with some ceanothus on 30% slopes.

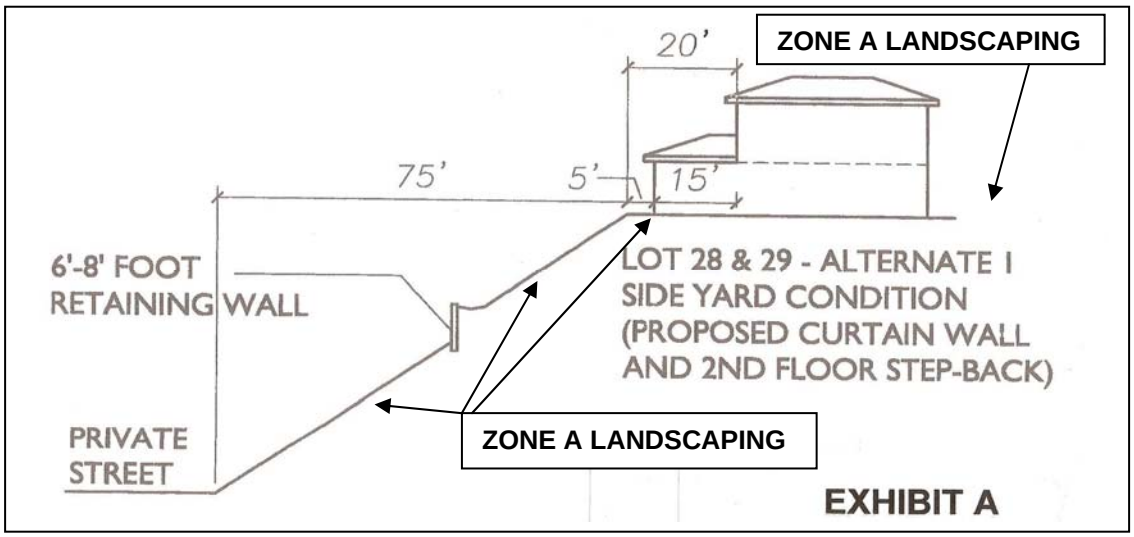
The greatest potential for an off-site wildfire and windblown embers to enter the "Cielo" Rancho Santa Fe project area is under north and east Santa Ana wind conditions and from the south under southwest wind conditions greater than 15 mph. The coastal sage scrub plant community has functioned unimpeded in our Mediterranean climate for thousands of years, with both plants and animals thriving and adapting to the wind-driven wildfires that burned through the coastal plains every twenty to thirty years. Today our world-renowned climate draws thousands of newcomers to southern California each year and particularly to San Diego County. In the endless search for new home sites, more new homes are being built within the coastal sage scrub plant community (**the wildland/urban interface**) where fire will also continue to be a visitor on both a planned and unplanned basis.

2.2 On-site Fire Hazard and Risk Assessment

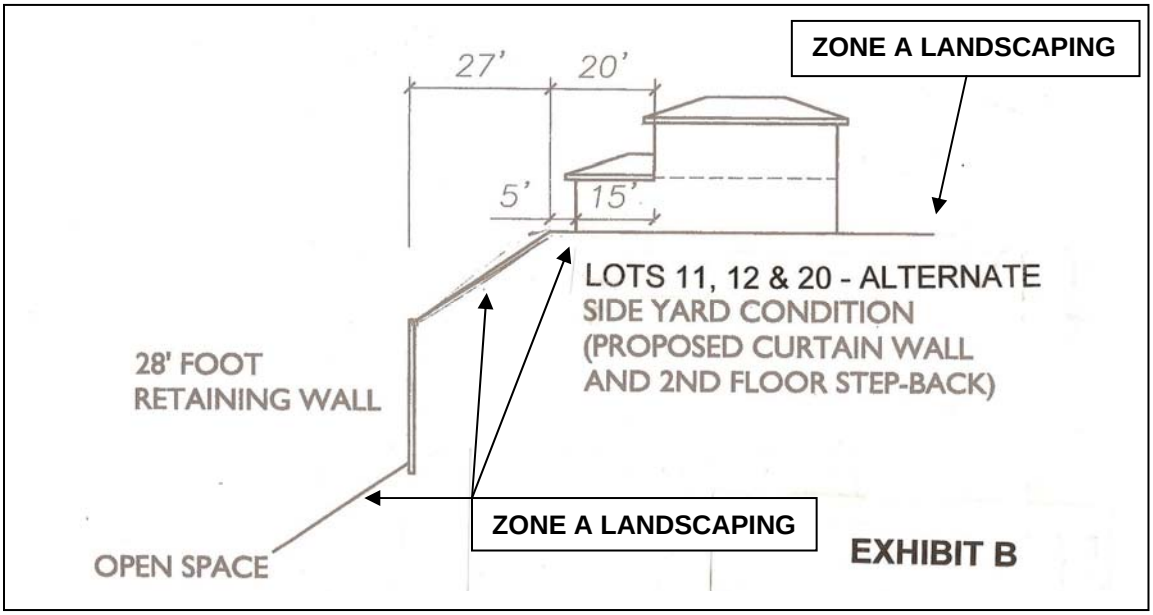
This project is under the jurisdiction of the Rancho Santa Fe Fire Protection District. Portions of the larger project area burned in 1998 and again in October 2007 by the Witch Creek Fire, a Santa Ana wind driven wildfire. The coastal sage scrub vegetation has rapidly re-grown and is currently in a highly flammable state due to the effects of intermittent yearlong droughts. All lots proposed for development under this FPP will be cleared prior to construction thereby eliminating all on-site hazards. Under Santa Ana wind conditions flame lengths could reach a maximum of 56 feet in length. Therefore, 100 feet of required fuel modification will be more than sufficient to buffer the homes from the impacts of direct flame impingement and radiant heating. In the case of TM's 5440 and 5441 there will actually be more than 100 feet of horizontal distance between structures and undisturbed native fuels because of the way the major road system is placed.

2.2.1 Slopes and Structure Setbacks: The irrigated, vegetated manufactured slopes below the condominiums will actually be steeper than the natural slopes below the condominiums, which run between 30% and 40%. A 2:1 manufactured slope equates to a 50% slope. A 1.5:1 manufactured slope equates to a 66% slope. The slopes that cause problems for structures are those slopes at 1:1 or greater, which equates to 100% slopes. A 100% slope, or steeper, greatly accelerates radiant heating of the fuels above the fire, which accelerates the rate of spread up the slope. In the case of the slopes below the planned condominiums, none of them are constant uphill slopes between the undisturbed native fuels and the 2 and ½ story condominiums as the uphill slopes are broken up by wide roads and irrigated fuel modification zones that will dissipate the wind and slope driven radiant heat. In addition, regardless of the exposure, single story homes (usually 15' tall) will require a minimum setback of 15 feet from the edge of the building pad (top of slope). The two-story portion of homes and two-story homes (usually between 23 and 25 feet tall) will require a minimum setback of 30 feet from the edge of the building pad (top of slope) that are above slopes. Where structures are taller than 25 ft, the required set back will be the total height of the building plus 5 feet, so that part of a 35 foot tall structure must be a minimum of 40 feet back from the top edge of the downhill slope. The goal is to keep any part of the structure from being above the projected slope line, thus avoiding the potential exposure of the structure to the devastating impacts of radiant heat (an illustration of the minimum setback requirements for various slopes follows and is also shown on the Fuel Treatment Location Map for Parcel "H" (TM 5441).

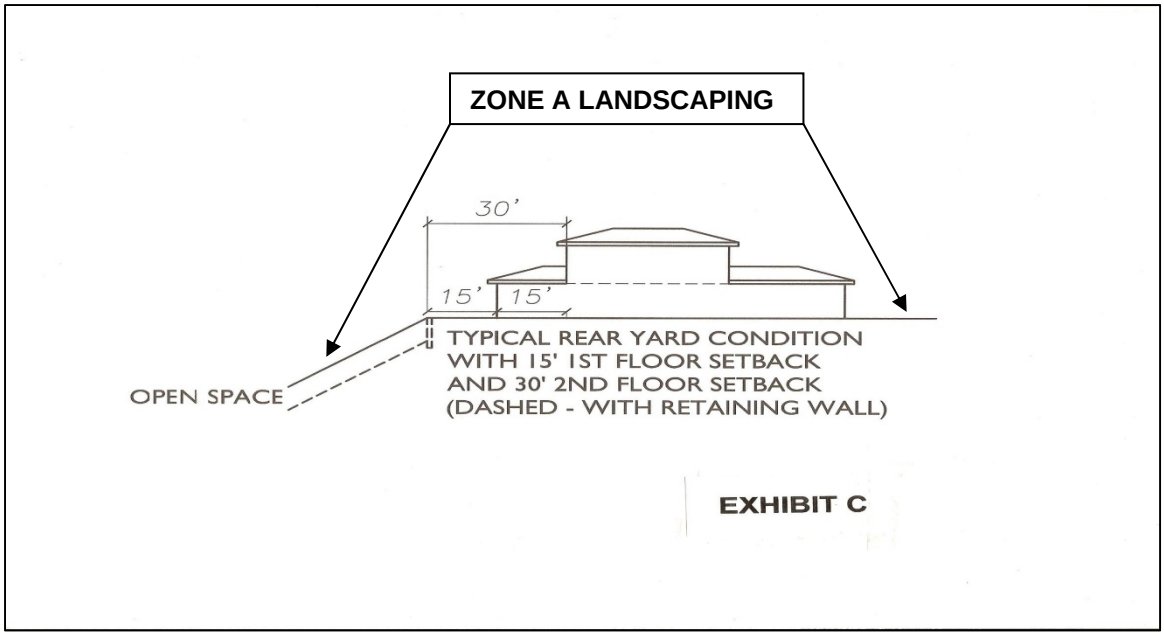
Lots 11, 12, 20, 28 and 29 in TM 5441, Parcel H, have a specific side yard and back yard setback requirement as depicted in the following exhibits; Exhibits A & B:



↑ **Figure 3: The approved setback for Lots 28 & 29 in TM 5441, Parcel H. The single story component of the structure will directly face the slope. The 6 foot to 8 foot tall mid-slope retaining wall will deflect radiant heat over and not into the structure. The slope beneath the structure shall be landscaped all of the way down to Via Ambiente with approved ignition resistant plants. A permanent irrigation system shall also be installed.**



↑ **Figure 4: The approved setback for Lots 11, 12 & 20 in TM 5441, Parcel H. This approved strategy will require the removal of all vegetation on undeveloped lots 204 through 207. Lots 204 through 207 must be routinely maintained as a graded pad (weed free) and the cut and fill slopes must be planted with approved ignition resistant plants all the way to Via Ambiente and irrigated in a manner that prevents soil erosion.**



↑ **Figure 5: Exhibit C illustrates the approved standard structure setback, with or without a retaining wall, for all Lots that set atop of slopes in TM's 5440 and 5441. This required setback will permit the passage of embers and radiant heat to flow over the top of the first and second story levels of the planned structures.**

2.2.2 Roads: All roads within the Cielo Project will require fuel modification on each side of the road to Zone B standards. Thirty feet of fuel modification will be required on each side of each road. The vegetation will need to be thinned and the following native plants removed: chamise, black sage, common buckwheat and California sagebrush. In addition all annual and perennial grasses will need to be mowed or weed whipped by May 15 of each year.

The October and November 60-mile per hour plus Santa Ana winds will be blowing any wildfire burning in the wildland area northeast of Cielo right into the development. Del Dios Highway's numerous travelers, local residents and occasional transient camps provide an abundance of ignition potential during Santa Ana wind events via structure fires, vehicle accidents, carelessly discarded cigarettes, warming fires or intentional starts (arson fires).

With the challenge of allowing the development of well planned home sites interspersed with fully functioning coastal sage scrub habitats the goal is to prevent the loss of homes and personal property when wildfires do occur by requiring FIREWISE COMMUNITIES built with fire safe features using fire resistant materials (see page 23) and properly designed and maintained fuel modification treatments that will provide for survivability and safely mitigate the Wildfire Hazard. The proposed fuel Modification treatments (50 feet of Zone A and 50 feet of Zone B "firewise" landscaping), special restrictions on combustible structures in back yards and yard furniture and "firewise" building construction standards throughout the Development which includes only the use of Class "A" roofs, eaves of heavy timber construction with no attic ventilation openings or ventilation louvers in eave overhangs or between rafters at eaves, dual pane windows and non combustible fire resistive exterior wall materials should significantly mitigate any wildfire risk and loss of homes due to wind driven embers and radiant heat against the eastern, northern and southern boundaries of this development.

2.3 Predicting Wildland Fire Behavior

"Can wildland fire behavior really be predicted? That depends on how accurate you expect the answer to be. The minute-by minute movement of a wildland fire will probably never be totally predictable–certainly not from weather conditions forecast many hours before the fire. Nevertheless, practice and experienced judgment in assessing the fire environment, coupled with a systematic method of calculating fire behavior, yields surprisingly good results (Rothermel 1983)".

The BEHAVE PLUS (Version 3.0.1): Fire Behavior Prediction and Fuel Modeling System–Burn Subsystem, Part 1 by Patricia L. Andrews, is one of the best systematic methods for predicting wildland fire behavior. The BEHAVE fire behavior computer modeling system was developed by USDA–Forest Service research scientists at the Intermountain Forest Fire Laboratory, Missoula, Montana, and is utilized by wildland fire experts nationwide.

"Because the model was designed to predict the spread of a fire, the fire model describes the fire behavior only within the flaming front. The primary driving force in the fire behavior calculations is the dead fuel less than one-fourth inch in diameter; these are the fine fuels that carry the fire. Fuels larger than three (3") inches in diameter are not included in the calculations at all (Andrews 1986)". The BEHAVE fire model describes a wildfire spreading through surface fuels, which are the burnable materials within six (6') feet of the ground and contiguous to the ground.

Regardless of the limitations expressed, experienced wildland fire managers can use the BEHAVE modeling system to project the expected fire intensity, rate-of-spread and flame lengths with a reasonable degree of certainty for use in fire protection planning purposes. The ***FIREWISE*** **2000, Inc**. evaluation team used the computer based BEHAVE Fire Behavior Prediction Model to make the following fire behavior assessments for the "Cielo" Rancho Santa Fe Project.

2.3.1 Wildland Fire Behavior Calculations for the off-site hazardous vegetative fuels.

Wildland fire behavior calculations using BehavePlus, version 3.0.1 have been projected for the hazardous vegetative fuels on the undeveloped sites adjacent to and bordering this proposed development. These projections were based on the following "Worst Case" (extreme) coastal/interior zone fire weather condition assumptions from Escondido and San Marcos and are actually harsher than the conditions observed on the 1996 Harmony Grove Fire and on the 1998 Del Dios Fire:

South, Southwest and West Wind Condition Fuel Moisture Assumptions:
A Typical Prevailing (normal summer) Afternoon Wind Pattern.

* 1-Hour Fine Fuel Moisture of…….4%
* 10-Hour Fuel Moisture of……..…6%
* 100-Hour Fuel Moisture of …….8%
* Live Woody Fuel Moisture of…....….80%

South, Southwest and West Wind Condition Fuel Moisture Assumptions:
A late fire season above-average southwest wind pattern. ***A rare event under the following fuel moisture conditions usually associated with the breakdown of an intense Santa Ana wind episode.***

* 1-Hour Fine Fuel Moisture of …….2%
* 10-Hour Fuel Moisture of……3%
* 100-Hour Fuel Moisture of …….5%
* Live Woody Fuel Moisture of…….....50%

North, Northeast and East Santa Ana Wind Fuel Moisture Assumptions:
An annual event often occurring two or three times a year.

* 1-Hour Fine Fuel Moisture of……2%
* 10-Hour Fuel Moisture of……..3%
* 100-Hour Fuel Moisture of……5%
* Live Woody Fuel Moisture of……..50%

Table's 2.3.1 through 2.3.3 display the expected Rate of Fire Spread (expressed in feet per minute), Fireline Intensity (expressed in British Thermal Parcels per foot per second) and Flame Length (expressed in feet) for three separate BEHAVE–Fire Behavior Prediction and Fuel Modeling System Computer Calculations in sage and buckwheat (SCAL18).

TABLE 2.3.1
Expected fire behavior for a Prevailing Southwest Wind Condition in a SCAL18 Fuel Model (A SCAL18 Fuel Model is a continuous cover of sage species and buckwheat)
RATE OF SPREAD **64.2 feet/minute** **FIRE LINE INTENSITY** **3,989 BTU's/foot/second** **FLAME LENGTH** **20.4 feet in length**
Additional Fire Behavior Calculation Input: • 15 mph 20-foot wind speed (7 mph mid-flame wind speed) • 30 percent slope • 0^{o} direction of wind vector to uphill slope

This equates to 23 acres in 30 minutes and 93 acres in 60 minutes assuming no initial attack.

TABLE 2.3.2
Expected fire behavior for a Late Fire Season Above Average Southwest Wind Condition in a SCAL18 Fuel Model (A SCAL18 Fuel Model is a continuous cover of sage species and buckwheat)
RATE OF SPREAD **177.3 feet/minute** **FIRE LINE INTENSITY** **12,791 BTU's/foot/second** **FLAME LENGTH** **34.9 feet in length**
Additional Fire Behavior Calculation Input: • 30 mph 20-foot wind speed (15.0 mph mid-flame wind speed) • 30 percent slope • 0^{o} direction of wind vector to uphill slope

This equates to 106 acres in 30 minutes and 424 acres in 60 minutes assuming no initial attack.

TABLE 2.3.3
Expected fire behavior for a North, Northeast and East Santa Ana Wind Condition in a SH7 Fuel Model (a SH7 Fuel Model is a Very High Fuel Load, Dry Climate Shrub; with woody shrubs and shrub litter the primary carrier of fire.)
RATE OF SPREAD **1,041.8 feet/minute** **FIRE LINE INTENSITY** **35,899 BTU's/foot/second** **FLAME LENGTH** **56.0 feet in length**
Additional Fire Behavior Calculation Input: • 60 mph 20-foot wind speed (30.0 mph mid-flame wind speed) • 50 percent slope • 0^{o} direction of wind vector to uphill slope

This equates to 202 acres in 30 minutes and 808 acres in 60 minutes assuming no initial attack.

TABLE 2.3.4
Expected fire behavior for a Prevailing Southwest Wind Condition in a Fuel Model 4 (A Fuel Model 4 is a continuous cover of chaparral vegetation greater than 6' in height)
RATE OF SPREAD **200.3 feet/minute** **FIRE LINE INTENSITY** **9,652 BTU's/foot/second** **FLAME LENGTH** **30.6 feet in length**
Additional Fire Behavior Calculation Input: • 15 mph 20-foot wind speed (7 mph mid-flame wind speed) • 30 percent slope • 270° direction of wind vector to downhill slope

This equates to 231 acres in 30 minutes and 953 acres in 60 minutes assuming no initial attack.

TABLE 2.3.5
Expected fire behavior for a Late Fire Season Above Average Southwest Wind Condition in a Fuel Model 4 (A Fuel Model 4 is a continuous cover of chaparral vegetation greater than 6' in height)
RATE OF SPREAD **783 feet/minute** **FIRE LINE INTENSITY** **45,027 BTU's/foot/second** **FLAME LENGTH** **62.2 feet in length**
Additional Fire Behavior Calculation Input: • 30 mph 20-foot wind speed (15.0 mph mid-flame wind speed) • 30 percent slope • 270° direction of wind vector to downhill slope

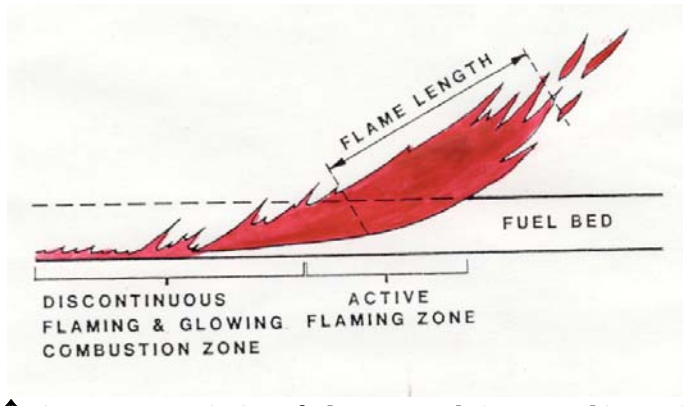
This equates to 2,105 acres in 30 minutes and 8,420 acres in 60 minutes assuming no initial attack.

TABLE 2.3.6
Expected fire behavior for a North, Northeast and East Santa Ana Wind Condition in a Fuel Model 4 (A Fuel Model 4 is a continuous cover of chaparral vegetation greater than 6' in height)
RATE OF SPREAD **2,041 feet/minute** **FIRE LINE INTENSITY** **117,380 BTU's/foot/second** **FLAME LENGTH** **96.7 feet in length**
Additional Fire Behavior Calculation Input: • 60 mph 20-foot wind speed (30.0 mph mid-flame wind speed) • 30 percent slope • 45° direction of wind vector to uphill slope

This equates to 7,952 acres in 30 minutes and 31,809 acres in 60 minutes assuming no initial attack.

The most useful output from this modeling is the flame length calculation, which is used for designing the fuel modification zones. Flame length has a precise definition and is best depicted by the following two illustrations:

↑**Figure 5: Typical Fire Behavior In Chaparral. This Fire Is Burning Under a 10-15 MPH Upslope Wind.**



↑ **Figure 6: Description of Flame Length (expressed in Feet)**

As shown in the previous tables, the flame lengths for each of the six depicted scenarios is as follows: the prevailing summer condition in sage/buckwheat (SCAL18) is 20.4' and 30.6' in chaparral (FM-4), the late summer southwest wind condition is 34.9' for the SCAL18' and 62.2' for the FM-4' and for the north, northeast and east Santa Ana wind condition is 50.0' for the SH7 and 96.7' for the FM-4 (all distances are measured horizontally). Of these six flame length scenarios, the latter four, representing "worst case" conditions, dictate the design of the fuel treatment areas adjacent to planned structures. The details for treatment of the Cielo fuel modification zones are covered in Chapter 5.

Tables' 2.3.7 and 2.3.8 are included below to indicate the change in flame length after the fuel modification plan has been implemented. There is no "fuel model" for the low growing, low fuel volume irrigated landscaping proposed for Zones A and B. For analytical purposes, Fuel Model 1, which is based on 1' tall grass, has been used in the following analysis. In actuality, Zone A and Zone B would be less flammable because of the shorter heights of the irrigated proposed plant material and would produce much shorter flame lengths if these zones were to burn. It is expected that the flame length produced would be less than 33% of the predicted flame length for a fuel Model 1 which is one-foot tall grass.

TABLE 2.3.7

Expected Fire Behavior for a Late Fire Season Above Average Southwest Wind Condition in a modified Fuel Model 1 (A Fuel Model 1 is cured grass one foot tall in height).

RATE OF SPREAD	**732.6 feet/minute**
FIRE LINE INTENSITY	**1,415 BTU's/foot/second**
FLAME LENGTH	**12.7 feet in length**

Additional Fire Behavior Calculation Input:

- 30 mph 20-foot wind speed (12 mph mid-flame wind speed)
- 30 percent slope
- 270° direction of wind vector to downhill slope

Adjustments for actual Zones A and B Fuel Treatments:

Predicted Results For Zone A and B Fuel Treatments

RATE OF SPREAD	**244.2 feet/min**
FIRE LINE INTENSITY	**471.7 BTU's/ft/sec**
FLAME LENGTH	**4.23 feet in length**

TABLE 2.3.8

Expected Fire Behavior for a North, Northeast and East Santa Ana wind condition in a modified Fuel Model 1 (A Fuel Model 1 is cured grass one foot tall in height).

RATE OF SPREAD	**732.6 feet/minute**
FIRE LINE INTENSITY	**1,415 BTU's/foot/second**
FLAME LENGTH	**12.7 feet in length**

Additional Fire Behavior Calculation Input:

- 60 mph 20-foot wind speed (24.0 mph mid-flame wind speed)
- 30 percent slope
- 45° direction of wind vector to uphill slope

Adjustments for actual Zones A and B Fuel Treatments:

Predicted Results For Zone A and B Fuel Treatments

RATE OF SPREAD	**244.2 feet/minute**
FIRE LINE INTENSITY	**471.7 BTU's/ft/sec**
FLAME LENGTH	**4.23 feet in length**

The expected outcome from implementing the Fuel Modification Provisions of this Fire Protection Plan is a decrease in the flame length in accordance with the following table.

TABLE 2.3.9

Summary of Predicted Flame Lengths for the Cielo TM 5440 and 5441 Fuel Treatment Plans.

Condition	Zone	Fuel Model	Predicted Flame Length for 12" Tall Grass Condition	Predicted Flame Length for Proposed Fuel Treatment	Percent Reduction in Predicted Flame Length Achievable By Decreased Grass Height
Southwest Wind	A, B	1	12.7'	4.23'	67%
North, Northeast, East Santa Ana Wind	A, B	1	12.7'	4.23'	67%

Conclusion: This Fire Protection Plan provides a more than adequate level of fire protection for the proposed project. In addition, the worst possible 56.0' flame lengths for these two proposed developments within Cielo will never reach the proposed structures due to an absence of available fuels. Although we ran a Fuel Model 4 calculation for heavy chaparral fuels greater than 6' in height, in reality, there are no FM-4 Fuels on the north side of TM 5441. The native fuels that will be present here are best characterized by the SH7 Fuel Model.

3.0 Assessing Structure Ignitions in the Wildland/Urban Interface (Intermix)

Structure ignitions during wildfires come from two sources of heat, windblown embers and radiant heat. During periods of high fire intensity and strong, dry winds, windblown embers can be transported over great distances ranging from several hundred feet up to several miles. Establishing generous and properly maintained fuel modifications zones is the first step in preventing structure ignition from flame impingement and radiant heat. This includes landscaping all developed areas with fire resistant plant materials. For the purpose of this FPP, Zone A extends out to 50 feet from each side of each structure. Zone B extends out an additional 50 feet for a total of 100 feet. The second step in preventing structure ignition is guarding against the impact of windblown embers through the use of fire resistant designs and building materials. Details for Zone A and Zone B landscape requirements and construction materials are found in Section 5. In addition, all structures will be sprinklered in the event an interior fire starts from a windblown ember.

The eventual homeowner and HOA must maintain the property to Zone A and Zone B fuel modification standards and keep roofs and any rain gutters free of leaves, twigs and other combustible debris, all firewood and other combustible materials must be properly stored away from the structure so that burning embers falling on or near the structure have no suitable host and in the event of a wildfire all doors and windows must be kept closed with interior draperies pulled away from the windows.

"*Firewise*" landscaping is the act of converting native vegetation from a highly flammable and high intensity state to a more fire resistant and lower intensity condition by removing all native vegetation within 100 feet of each structure. The comparisons of the untreated fuels in either Tables 2.3.1, 2.3.2 and Tables 2.3.4, 2.3.5 with Table 2.3.7 and Table 2.3.3 and Table 2.3.6 with Table 2.3.8 ("*Firewise*" Landscaping) demonstrates how "*firewise*" landscaping substantially reduces flame lengths and fireline intensity to an acceptable level for home protection. ***Other than non-combustible roofing and building materials, "firewise" landscaping has proven to be the most effective treatment for minimizing structure losses due to wildfire radiant heat.***

A USDA-Forest Service research study entitled the "Structure Ignition Assessment Model (SIAM)" by Jack D. Cohen, Intermountain Fire Science Laboratory, Missoula, Montana has helped to validate how much distance is required to keep structures from igniting due to wildfire radiant heat. Preliminary SIAM results suggest that for reducing structure ignitions from radiant heat, vegetation modification beyond 100 feet distance from a structure has no significant benefit unless there is supporting data justifying more than 100-feet of vegetation modification. In this case the worst possible flame lengths are 56.0 feet. In regard to just these two proposed developments within Cielo, 100 feet of fuel modification will be more than sufficient to protect the proposed structures from ignition during a wildfire. The SIAM Ignition Study indications and the personal experience of the ***FIREWISE*** **2000, Inc.** evaluation team aided in the establishment of the fuel modification recommendations found in Section 5.0: Fuel Modification Descriptions, Required Treatments and Fuel Treatment Location Map.

3.1 Terminology. Although any plant will burn, Wildland Fire Research has shown over and over that some types of plants, including many natives, are more fire resistant than others. The recommended plant list in Appendix "A" includes a listing of these low fuel volume, non-oily, non-resinous plants that are commonly referred to as "Fire Resistant". This term comes with the proviso that each spring these plants are pruned, all dead wood is removed and all grasses or other plant material are removed from beneath the circumference of their canopies.

4.0 Fire Department Response Times

TM's 5440 and 5441 are within the 5-minute response zone of the RSFFPD Engine Companies at Station # 4. Newly constructed Station # 4 is located at the immediate entrance to the Rancho Cielo Development. The distance from Station # 4 to TM's 5440 and 5441 is 2.2 miles and at 30 MPH it takes exactly 5 minutes to reach these two sites. The actual travel time will be even less when all of Via Ambiente is paved. However, given the reality that when a wildfire occurs on southern California wildlands there are usually multiple fires occurring and fire fighting resources can be quickly drawn down and unavailable for extensive periods of time as additional new fires occur.

Although RSFFPD Fire Station # 4 is less than 6 minutes away from any part of TM's 5440 and 5441, there is absolutely no assurance that the Engine Companies will be in their station the day a wildfire threatens the 42 condominiums in these two TM's from an ignition outside the development. **This is why Firewise Communities (see Firewise.org) use "*Survivable Space*" strategies that enable their communities to survive wildfires on their own without the loss of any structures or lives and without the intervention of the Fire Department that is now free to contain the wildfire instead of defending unsafe structures surrounded by improperly maintained and inappropriate landscaping in Wildland-Urban Interface Zones.**

5.0 Fuel Modification Descriptions, Required Treatments and Fuel Treatment Location Maps

5.1 Fuel Modification Descriptions.

All distances in this report are measured horizontally. This FPP requires 100 feet of fuel modification as measured from the outer edge of each dwelling unit on each side of each unit. These distances are depicted as a dashed line with two dots in the dash interval on the two Fuel Treatment Location Maps included herein as Exhibit A and B. In addition, structure set backs are depicted as a dashed red line on Exhibit A and B, , where structures are placed above slopes of continuous native fuels below the building pad (see also Exhibit A-1 and Exhibit B-1 for setback depiction). Prior to the delivery of any flammable building materials (e.g. lumber drop) on any building site within the Cielo project, the fuel modification buffer surrounding that building site shall be in place and accepted by the RSFFPD Fire Marshal. Multi-family residential construction will also require a first layer of asphalt and temporary address identification before any combustible materials arrive on site. In addition, building pads and at least 50 feet of clearance around the structure footprint shall be kept free of all flammable re-growth as an interim fuel modification zone.

5.1.1 Fuel Modification Zone A.

Defined: Zone A is the area immediately adjacent to each and every dwelling unit. Zone A includes all of the building pad areas and manufactured slopes out to 50 feet.

Required Landscaping: All existing native plants within Zone A shall be removed. Landscaping in all Zone A areas shall be irrigated and planted with a fire resistant plant palette taken from the list shown in Appendix "A". Plantings in Zone A usually consist of a mixture of green lawn and low growing bedding plants and maintained, fire resistant native or ornamental plantings less than 18 inches in height, and may contain occasional well spaced fire resistant trees. The outer edge of the canopy of a mature tree can be no closer than 10 feet to the edge of the structure and must have a minimum of 6 feet of vertical separation from low growing irrigated vegetation beneath the canopy of the tree. In addition, single, well-spaced ornamental shrubs up to 24 inches in height, located no closer than 5 feet from the structure are allowed provided these plants will not carry fire to the structure. This plant palette applies to each and every structure in the TM 5440 and 5441 projects.

Plants in Zone A shall not include any pyrophytes that are high in oils and resins such as pines, eucalyptus, cedar, cypress or juniper species or retain an abundance of dead plant material such as fan palms and pepper trees.

All landscaping plans shall be submitted and approved by the RSFFPD.

Required Maintenance: The CHOA will maintain all Zone A and Zone B landscaping around the condominiums covered by TM 5440 and 5441. In addition, Zone A (irrigated, replanted landscaping) will be required behind lots 11, 12 and 20 on off project lots 204 through 207 until such time that these properties are developed.

Construction Standards: All structures shall be constructed to the County Building Code Chapter 7A Ignition-Resistant Exterior Construction ordinance requirements in effect at the time of Building Plan submittal.

5.1.2 Fuel Modification Zone B.

Defined: Zone B is the area from the edge of Zone A out to 100 feet.

Required Landscaping: All native sage, chamise, buckwheat and California sagebrush plants shall be removed within Zone B. Any remaining vegetation should be thinned to provide a 50% canopy cover. Zone B is not irrigated. Temporary irrigation may be required where new plant establishment is necessary. Where planting is required a plant palette from the list in Appendix "A" of fire resistant low growing, low fuel volume, prostrate plants (less than 8 inches in height) interspersed with well spaced native trees such as sycamores, oaks, alders and cottonwoods is preferred. If trees are planted there must be a 20 foot separation between the crowns of all trees (mature condition) and a minimum vertical clearance of 6-10 feet (mature condition) from low growing (less than 8 inches in height) fire resistant ground fuels or hydro-seeding Zone B with native annual and perennial grasses, in lieu of low growing, low fuel volume prostrate plants, and

interspersed with well spaced native trees. Planting native grasses is offered as a low maintenance option in Zone B since native grasses require less year round maintenance and will not require as much water once established if water should become limited in the future. Grasses must be weed whipped to a 4 inch stubble height by May 1 of each year.

The restriction listed in Zone A for no pyrophytes also applies to Zone B.

All landscaping plans shall be submitted and approved by the RSFFPD.

Required Maintenance: The Zone B areas around the condominiums shown on the Parcel "H" map and the Village Estates map will be maintained by the CHOA. The slopes below structures on lots 20-29 in Parcel H will be permanently maintained manufactured slopes from the top edge of the slope to Via Ambiente. In addition, Zone A (irrigated, replanted landscaping will be required off lot on lots 204 through 207 for lots 11, 12 and 20 until such time that these properties are developed.

Year-round maintenance of all Zone B areas shall be required.

If the option of hydro-seeded native grasses is chosen the grasses should be weed whipped down to a 4" stubble height after heading out (producing viable seed) and curing. Weed whipping would need to take place by June 1 of each year and as needed. Irrigation would be needed only to establish the cover of annual and perennial native grasses and to mimic winter rain patterns during drought years. Over watering will only bring on a flush of growth of undesirable species that will compete with the native grasses and will need to be manually removed.

Other Information: No structure or material storage is allowed in Zone B.

5.1.3 Roadsides.

Defined: All roads within the Cielo Planned Community not already included in a fuel treatment zone.

Required Landscaping: All roads will be a minimum of 32feet in width. A minimum 30-foot wide fuel modification zone is required on both sides of each road and shall be treated to Zone B standards per the Fire Protection District's Fire Code. In this case the roadsides would be either permanently irrigated and planted with low fuel volume, low growing ground covers, or cleared and replanted with native annual and perennial grasses that would be weed whipped to a 4-inch stubble height by May 1 of each year. Roadsides may contain well-spaced native trees. In addition, all roadways and driveways shall have a minimum 13' 6" of unobstructed vertical clearance. The roadside fuel modification zones will be maintained by the CHOA.

5.1.4 County Building Code, Chapter 7A and Amendments, Requiring Ignition Resistant Fire Protection Features For All Structures. Since the Cielo Development is within a Wildland Urban Interface Area, all of the County of San Diego ignition resistant features are required for all structures within the Cielo project. All proposed structures within the Cielo project shall be constructed in compliance with the County Building Code Chapter 7A Ignition-Resistant Exterior Construction Requirements and Amendments in effect at the time of Building Plan submittal. ***On TM's 5440 and 5441***

double pane windows are required on all sides of each structures with one of the panes being tempered glass. Window screens must consist of a metal frame and a metal heat resistant mesh screen. In addition, all multi-family residential units require an interior fire sprinkler system that meets the NFPA 13R Standard.

5.1.5 Water Supply. The Cielo project will be served by the Olivenhain Municipal Water District. All water storage and hydrant locations, mains and water pressures will be designed to fully comply with San Diego County Fire Code Fire Flow Requirements and the Fire Flow Requirements of the RSFFPD.

5.1.6 Fire Hydrants. Fire hydrants shall be of a type and design approved by the RSFFPD. Water supply must meet a 2-hour fire flow requirement of 2,500 g.p.m. with 20-psi residual pressure, which must be over and above the daily maximum water requirements for the overall development.

In multi-family areas, fire hydrants shall be installed at intersections, at the beginning radius of cul-de-sacs, and every 300 feet of fire access roadways, regardless of parcel size. Fire hydrants shall be installed every 350 feet for residential parcels less than ½ acre and 500 feet for parcels ½ acre or larger in size. Fire hydrant locations will be marked in the street with a blue reflector.

5.1.7 Access Roads. All streets, cul-de-sacs and hammerhead T turn a rounds and road grades will be designed to fully comply with County of San Diego and RSFFPD Road Standards, whichever is more restrictive. All streets and cul-de-sacs have been designed to County of San Diego standards, including, but not limited to, the following requirements:

1) All private road easements serving four or more parcels shall be named. Road name signs shall comply with County of San Diego Department of Public Works Design Standard #DS-13.

2) Fire apparatus access roads shall have an unobstructed width of not less than 32 feet on a 40 foot Right-of-Way, except for single-family residential driveways serving no more than 2 single family dwellings which shall have a minimum of 16 feet of unobstructed improved width with a turnaround at the structure.

3) Fire apparatus roads shall be 32 feet in width on a 40 foot Right-of-Way and shall have parking confined to only one side of the road. The other side of the road shall have permanent “No Parking” signs installed.

4) Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus (not less than 75,000 lbs.) and shall be provided with an approved surface so as to provide all-weather driving conditions.

5) The turning radius of a fire apparatus access road shall be a minimum of a 28 foot width as measured to the inside edge of the improvement width.

6) Road gradients for fire apparatus access roadways shall not exceed 20 %. Grades exceeding 15% (incline or decline) shall not be permitted without mitigation such as a Portland cement surface with a deep broom finish, perpendicular to the direction of travel to enhance traction. The angle of departure and angle of approach of a fire access roadway shall not exceed 7 degrees or 12 percent.

7) The maximum length of a dead-end road shall not exceed 800 feet for parcels zoned for less than one acre and 1,320 feet for parcels zoned for 1 acre to 4.99 acres. All dead end roads shall have a cul-de-sac. Cul-de-sacs shall be a minimum of 36' radius or a 72-foot diameter bulb.

8) All automatic access gates shall be equipped with approved emergency key-operated switches overriding all command functions for opening the gate(s) or have an approved emergency control-activating strobe if serving more than four residences.

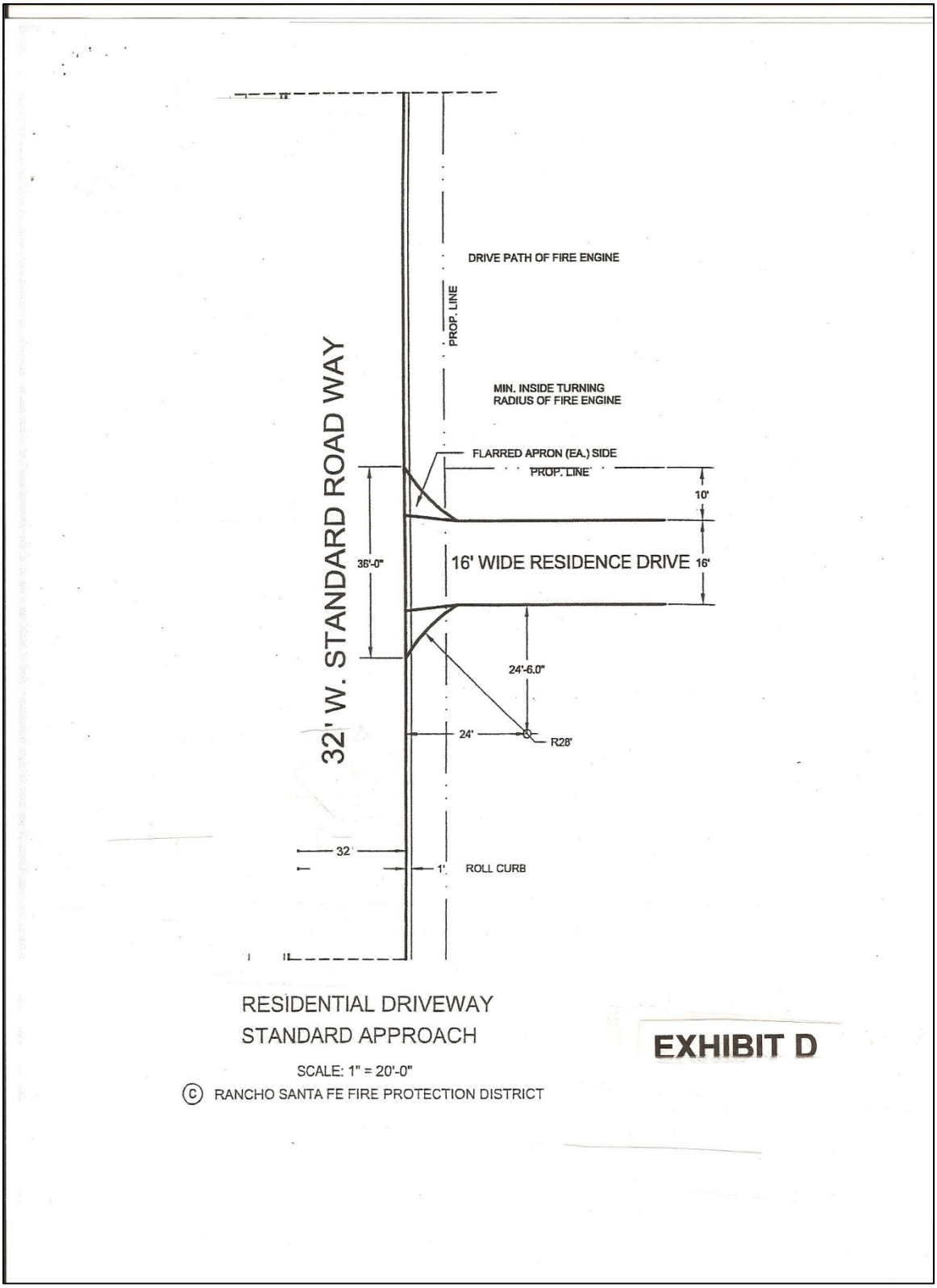
9) The operation of gates on emergency access/evacuation routes will be conditioned to be in full compliance with the then current County Fire Code requirements and shall allow remote operation by either Rancho Cielo Security or a third party security company if and when evacuation becomes necessary.

10) Turn a rounds for Emergency Fire Equipment must be provided at the end of each driveway exceeding 150 feet in length.

11) Thirty feet of Fuel Treatment to Zone B standards are required on each side of all fire access roads, including driveways, for that part of each driveway not already in a fuel treatment zone.

12) All roadways shall have an unobstructed vertical clearance of 13.6 feet from road edge to road edge. This area shall be free of all over hanging tree branches, vegetation, signs, gates and other obstructions to permit unencumbered two-way traffic for evacuation and emergency vehicle access.

13) Entrance to driveways shall be tapered to a 36-foot width as shown on the following Exhibit D on page 25.



↑ **Figure 6: The RSFFPD approved Standard Residential Driveway Approach.**

5.1.8 Required Secondary Alternate Access/Evacuation Road.

Secondary access will be available for the Village Estates and Parcel "H" developments by going north on Via Ambiente to Harmony Grove Road or by going east through Parcel M on Via Rancho Cielo to Avenida Apice to a yet unnamed connecting road to Mt. Israel Road to the north and then out to Del Dios Highway. Neither of these evacuation routes are recommended for use in the event of wildfires burning north and east of the Cielo Project during a Santa Ana wind condition. Under Santa Ana wind conditions the best evacuation route is out to the west via the primary in place road system to Del Dios Highway when wildfires are burning to the north or east of this project.

The operation of gates on these emergency access/evacuation routes will be conditioned to be in full compliance with the then current County Fire Code requirements and shall allow remote operation by either Rancho Cielo Security or a third party security company if and when evacuation becomes necessary.

5.2 Responsibilities of the CHOA

The CHOA has responsibility for ongoing Road Maintenance and off lot Fuel Treatment. The organization (CHOA) responsible for ongoing Road Maintenance and Fuel Treatment cannot be dissolved or unfunded. The annual funding obligations must be shared by all project property owners, including occupants of multi-family units. The responsibility to participate in the funding and decision making of the CHOA conveys with property transfer to subsequent owners. Failure to maintain road elements or common fuel treatment areas in compliance with fire codes subjects property owners to potential fines, and forced abatement by the fire agency or the County, with charges, including administrative costs and penalties, liened against the subject property.

5.3 Responsibilities of the Cielo Property Owners.

Cielo property owners are responsible for keeping their property in a fire resistant condition. No property owners may deviate from the plantings listed on the approved plant list. Failure to maintain homes, yards and fuel treatment areas in compliance with fire codes subjects the property owner to potential fines, and forced abatement by the fire agency or the County, with charges, including administrative costs and penalties, liened against the subject property.

5.4 Notes for Inclusion in the CC&R's.

Every prospective homeowner must receive a copy of this Fire Protection Plan and sign an acknowledgement that they are aware of the restrictions contained herein and that they acknowledge they are buying their home in a high fire hazard area. In addition, every homeowner shall receive a lot exhibit showing the fuel modification zone and structure set back requirements. The CHOA has authority for enforcing required fuel treatment measures on all lots and restrictions on unsuitable plants as well as the restriction on the use of combustible patio furniture.

1) Fuel Treatment Zones that extend beyond existing Cielo property boundaries, as shown on the Fuel Treatment Map, will be recorded as permanent easements.

2) All condominium owners are members of the CHOA and will financially support the annual maintenance of all required Fuel Treatment Areas surrounding and within the Cielo Development.

3) The CHOA shall have authority for enforcing the ban on trash dumping and disposal of yard trimmings in the biological open space areas and in the fuel treatment zones.

4) The CHOA is responsible to the RSFFPD Fire Marshal for the completion of all required Fuel Treatments as needed and prior to the annual fire season.

5) All individual lot landscaping plans, including additional structures, must be approved by the CHOA and the RSFFPD.

↑ Photo 13: A home that incorporated all of the Special Fire Safe Construction Measures and landscaping requirements noted in Section 5. This home was one of several that survived the 1993 Laguna Fire during a severe Santa Ana wind episode where hundreds of homes within a coastal sage scrub plant community were destroyed (note all of the foundations in the foreground; this home also survived the radiant heat given off by the adjacent homes that caught fire and burned).

5.5 Proposed Fuel Treatment Location Map.

The following page is a folder containing the FUEL TREATMENT LOCATION MAPS depicting the location of all proposed fuel modification treatment locations on and adjacent to all lots. In addition to the Fuel Treatment Location Map all fuel modification zones shall be permanently marked on the ground for the purpose of guiding annual fuel management maintenance operations. The most reliable markers are steel fence posts with a baked on painted finish. The upper half of the above ground portion of the fence post is then painted white or a bright "day glo" orange to improve visibility. These Fuel

Treatment Zone markers must be spaced so that the markers on each side of an installed marker can be seen from that marker. Fuel Treatment Markers shall be installed at least every 500 feet or at changes in direction.

END

COUNTY OF SAN DIEGO
ACCEPTABLE PLANTS FOR FUEL MODIFICATION ZONES IN FIRE PRONE AREAS
(Wildland/Urban Interface/Intermix Areas)

ALL PLANTS ON THE FOLLOWING LIST are considered to be drought-tolerant in the particular climate zone noted. Those that grow best in riparian areas, as indicated by the (R), are the least drought-tolerant plants on the list.

SPECIAL NOTE: When planting, it is necessary to water deeply to encourage the plant roots to seek natural moisture in the soil. This watering should continue for at least three years to allow the plants to naturalize. More water should be provided in summer and less (if any) in the winter. These plants should be weaned off the supplemental irrigation and become less dependent on it over the establishment period.

No plant is totally fire resistant. The plants listed were chosen to due to their high water content, minimum amount of flammable resins and/or low fuel volume.

Definitions:

Survivable Space: The area around a structure, where material capable of causing fire has been cleared, reduced or changed, to act as a barrier between an advancing fire and the structure.

Drought-Tolerant Plant Materials: Trees, shrubs, groundcovers, and other vegetation capable of sustained growth and reproduction with only natural moisture. Occasional supplemental irrigation is necessary only in extreme drought situations.

Establishment Period: The time it takes for a plant to become drought-resistant. This is usually a period of three years and is the time when supplemental irrigation is necessary.

Native or Naturalizing Plant Species: Plant species native to the region or introduced, which, once established, are capable of sustaining growth and reproduction under local climatic conditions without supplemental irrigation.

San Diego County Climate Zone Key:

C - Coast
D – Desert
I. -. Inland
M - Mountain
(**R**) – Riparian

LANDSCAPE PLANTING CONSIDERATIONS

SUGGESTED/RECOMMENDED PLANT LIST

Brahea armata, Melaleuca spp. and sage spp. are unacceptable and should not be on this list.

SUGGESTED PLANT LIST FOR A DEFENSIBLE SPACE

BOTANICAL NAME	COMMON NAME	Climate Zone
TREES		
Acer		
platanoides	Norway Maple	M
rubrum	Red Maple	M
saccharinum	Silver Maple	M
saccarum	Sugar Maple	M
macrophyllum	Big Leaf Maple	C/ (R)
Alnus rhombifolia	White Alder	C/I/M (R)
Arbutus		
unedo	Strawberry Tree	All zones
Archontophoenix		
cunninghamiana	King Palm	C
Arctostaphylos spp.**	Manzanita	C/I/D
Brahea		
armata	Blue Hesper Palm	C/D
edulis	Guadalupe Palm	C/D
Ceratonia siliqua	Carob	C/I/D
Cerdidium floridum	Blue Palo Verde	D
Cercis occidentalis**	Western Redbud	C/I/M
Cornus		
nuttallii	Mountain Dogwood	I/M
stolonifera	Redtwig Dogwood	I/M
Eriobotrya		C/I/D
japonica	Loquat	C
Erythrina caffra	Kaffirboom Coral Tree	I/M
Gingko biloba "Fairmount"	Fairmount Maidenhair Tree	I/D/M
Gleditisia triacanthos	Honey Locust	
Juglans		I
californica	California Walnut	C/I
hindsii	California Black Walnut	I/D/M
Lagerstroemia indica	Crape Myrtle	I
Ligustrum lucidum	Glossy Privet	C/I/M
Liquidambar styraciflua	Sweet Gum	I
Liriodendron tulipifera	Tulip Tree	
Lyonothamnus floribundus		C
ssp. Asplenifolius	Fernleaf Catalina Ironwood	C/I/D
Melaleuca spp.	Melaleuca	C/I
Parkinsonia aculeate	Mexican Palo Verde	
Pistacia	Chinese Pistache	
chinensis	Pistachio Nut	C/I/D

vera	Pistachio Nut	I
Pittosporum		
phillyraeoides	Willow Pittosporum	C/I/D
viridiflorum	Cape Pittosporum	C/I
Platanus		
acerifolia	London Plane Tree	All zones
racemosa**	California Sycamore	C/I/M
Populus		
alba	White Poplar	D/M
fremontii**	Western Cottonwood	I
trichocarpa	Black Cottonwood	I/M
Prunus		
xblireiana	Flowering Plum	M
caroliniana	Carolina Laurel Cherry	C
ilicifolia**	Hollyleaf Cherry	C
lyonii**	Catalina Cherry	C
serrulata ‘Kwanzan’	Flowering Cherry	M
yedoensis ‘Akebono’	Akebono Flowering Cherry	M
Quercus		
agrifolia**	Coast Live Oak	C/I
engelmannii	Engelmann Oak	I
** suber	Cork Oak	C/I/D
Rhus		
lancea**	African Sumac	C/I/D
Salix spp.**	Willow	All zones (R)
Tristania conferta	Brisbane Box	C/I
Ulmus		
parvifolia	Chinese Elm	I/D
pumila	Siberian Elm	C/M
Umbellularia californica**	California Bay Laurel	C/I

SHRUBS		
Agave	Century Plant	D
americana	Century Plant	D
deserti	Shawis Century Plant	D
shawi**		
Amorpha fruticosa**	False Indigobush	I
Arbutus		
menziesii**	Madrone	C/I
Arctostaphylos spp.**	Manzanita	C/I/D
Atriplex**		
canescens	Hoary Saltbush	I
lentiformis	Quail Saltbush	D
Baccharis**		
glutinosa	Mule Fat	C/I
pilularis	Coyote Bush	C/I/D
Carissa grandiflora	Natal Plum	C/I
Ceanothus spp.**	California Lilac	C/I/M
Cistus spp.	Rockrose	C/I/D
Cneoridium dumosum**	Bushrue	C
Comarostaphylis**		
diversifolia	Summer Holly	C
Convolvulus cneorum	Bush Morning Glory	C/I/M
Dalea		
orcuttii	Orcutt's Delea	D
spinosa**	Smoke Tree	I/D
Elaeagnus		
pungens	Silverberry	C/I/M
Encelia**		
californica	Coast Sunflower	C/I
farinose	White Brittlebush	D/I
Eriobotrya		
deflexa	Bronze Loquat	C/I
Eriophyllum		
confertiflorum**	Golden Yarrow	C/I
staechadifolium	Lizard Tail	C
Escallonia spp.	Escallonia	C/I
Feijoa sellowiana	Pineapple Guava	C/I/D
Fouqueria splendens	Ocotillo	D
Fremontodendron**		
californicum	Flannelbush	I/M
mexicanum	Southern Flannelbush	I
Galvezia		
juncea	Baja Bush-Snapdragon	C
speciosa	Island Bush-Snapdragon	C
Garrya		
elliptica	Coast Silktassel	C/I
flavescens**	Ashy Silktassel	I/M

Heteromeles arbutifolia**	Ashy Silktassel	I/M
Lantana spp.	Toyon	C/I/M
Lotus scoparius	Lantana	C/I/D
Mahonia spp.	Deerweed	C/I
	Barberry	C/I/M
Malacothamnus		
clementinus		
	San Clemente Island Bush Mallow	C
fasciculatus**		
	Mesa Bushmallow	C/I
Melaleuca spp.		
Mimulus spp.**	Melaleuca	C/I/D
Nolina	Monkeyflower	C/I (R)
parryi		
parryi ssp. wolfii	Parry's Nolina	I
Photinia spp.	Wolf's Bear Grass	D
Pittosporum	Photinia	All Zones
crassifolium		
rhombifolium		CI/I
tobira 'Wheeleri'	Queensland Pittosporum	C/I
undulatum	Wheeler's Dwarf	C/I/D
viridiflorum	Victorian Box	C/I
Plumbago auriculata	Cape Pittosporum	C/I
Prunus	Cape Plumbago	C/I/D
caroliniana		
ilicifolia**	Carolina Laurel Cherry	C
lyonii**	Hollyleaf Cherry	C
Puncia granatum	Catalina Cherry	C
Pyracantha spp.	Pomegranate	C/I/D
Quercus	Firethorn	All Zones
dumosa**		
Rhamus	Scrub Oak	C/I
alaternus		
californica**	Italian Blackthorn	C/I
Rhaphiolepis spp.	Coffeeberry	C/I/M
Rhus	Rhaphiolepis	C/I/D
integrifolia**		
laurina	Lemonade Berry	C/I
lentii	Laurel Sumac	C/I
ovata**	Pink-Flowering Sumac	C/D
trilobata**	Sugarbush	I/M
Ribes	squawbush	I
viburnifolium		
speciosum**	Evergreen Currant	C/I
Romneya coulteri	Fuschia-Flowering Gooseberry	C/I/D
Rosa	Matilija Poppy	I
californica**		
minutifolia		

	Salvia spp.**	California Wild Rose	C/I
	Sambucus spp.**	Baja California Wild Rose	C/I
	Symphoricarpos mollis**	Sage	All Zones
	Syringa vulgaris	Elderberry	C/I/M
	Tecomaria capensis	Creeping Snowberry	C/I
	Teucrium fruticans	Lilac	M
	Toxicodendron**	Cape Honeysuckle	C/I/D
	diversilobum	Bush Germander	C/I
	Verbena		
	lilacina	Poison Oak	I/M
	Xylosma congestum		
	Yucca**	Lilac Verbena	C
	schidigera	Shiny Xylosma	C/I
	whipplei		
		Mojave Yucca	D
		Foothill Yucca	I

GROUNDCOVERS		
Achillea**	Yarrow	All Zones
Aptenia cordifolia	Apteria	C
Arctostaphylos spp.**	Manzanita	C/I/D
Baccharis**		
pilularis	Coyote Bush	C/I/D
Ceanothus spp.**	California Lilac	C/I/M
Cerastium tomentosum	Snow-in-Summer	All Zones
Coprosma kirkii	Creeping Coprosma	C/I/D
Cotoneaster spp.	Redberry	All Zones
Drosanthemum hispidum	Rosea Ice Plant	C/I
Dudleya		
brittonii	Brittonis Chalk Dudleya	C
pulverulenta**	Chalk Dudleya	C/I
virens	Island Live Fore-ever	C
Eschscholzia californica**	California Poppy	All Zones
Euonymus fortunei		
‘Carrierei’	Glossy Winter Creeper	M
‘Coloratus’	Purple-Leaf Winter Creeper	M
Ferocactus viridescens**	Coast Barrel Cactus	C
Gaillardia grandiflora	Blanket Flower	All Zones
Gazania spp.	Gazania	C/I
Helianthemum spp.**	Sunrose	All Zones
Lantana spp.	Lantana	C/I/D
Lasthenia		
californica**	Common Goldfields	I
glabrata	Coastal Goldfields	C
Lupinus spp.**	Lupine	C/I/M
Myoporum spp.	Myoporum	C/I
Pyracantha spp.	Firethorn	All zones
Rosmarinus officinalis	Rosemary	C/I/D
Santolina		
chamaecyparissus	Lavender Cotton	All Zones
virens	Santolina	All Zones
Trifolium frageriferum	O’Connor’s Legume	C/I
Verbena		
rigida	Verbena	All Zones
Viguiera laciniata**	San Diego Sunflower	C/I
Vinca		
minor	Dwarf Periwinkle	M

VINES		
Antigonon leptopus	San Miguel Coral Vine	C/I
Distictis buccinatoria	Blood-Red Trumpet Vine	C/I/D
Keckiella cordifolia**	Heart-Leaved Penstemon	C/I
Lonicera		
japonica 'Halliana'	Hall's Honeysuckle	All Zones
subspicata**	Chaparral Honeysuckle	C/I
Solanum		
jasminoides	Potato Vine	C/I/D

PERENNIALS		
Coreopsis		
gigantean	Giant Coreopsis	C
grandiflora	Coreopsis	All Zones
maritime	Sea Dahlia	C
verticillata	Coreopsis	C/I
Heuchera maxima	Island Coral Bells	C/I
Iris douglasiana**	Douglas Iris	C/M
Iva hayesiana**	Poverty Weed	C/I
Kniphofia uvaria	Red-Hot Poker	C/M
Lavandula spp.	Lavender	All Zones
Limonium californicum		
var. mexicanum	Coastal Statice	C
perezii	Sea Lavender	C/I
Oenothera spp.	Primrose	C/I/M
Penstemon spp.**	Penstemon	C/I/D
Satureja douglasii	Yerba Buena	C/I
Sisyrinchium		
bellum	Blue-Eyed Grass	C/I
californicum	Golden-Eyed Grass	C
Solanum		
xantii	Purple Nightshade	C/I
Zauschneria**		
californica	California Fuschia	C/I
cana	Hoary California Fuschia	C/I
'Catalina'	Catalina Fuschia	C/I

ANNUALS		
Lupinus spp.**	Lupine	C/I/M

PLANTS THAT ARE UNDESIRABLE BECAUSE OF THEIR

HIGH FLAMMABILITY

Brahea armata, Melaleuca spp. and sage spp. should be added to the Undesirable list.

PLANTS THAT ARE PROHIBITED BECAUSE OF THEIR

HIGHLY INVASIVE NATURE

Lantana spp., Foeniculum vulgare and Ricinus communis should be added to the invasive list.

UNDESIRABLE PLANT LIST

The following species are highly flammable and should be avoided when planting within the first 50 feet adjacent to a structure. The plants listed below are more susceptible to burning, due to rough or peeling bark, production of large amounts of litter, vegetation that contains oils, resin, wax, or pitch, large amounts of dead material in the plant, or plantings with a high dead to live fuel ratio. Many of these species, if existing on the property and adequately maintained (pruning, thinning, irrigation, litter removal, and weeding), may remain as long as the potential for spreading a fire has been reduced or eliminated.

BOTANICAL NAME	COMMON NAME
Abies species	Fir Trees
Acacia species	Acacia (trees, shrubs, groundcovers)
*Adenostoma sparsifolium***	Red Shanks
*Adenostoma fasciculatum***	Chamise
Agonis juniperina	Juniper Myrtle
Araucaria species	Monkey Puzzle, Norfolk Island Pine
*Artemesia californica***	California Sagebrush
Bambusa species	Bamboo
Cedrus species	Cedar
Chamaecyparis species	False Cypress
Coprosma pumila	Prostrate Coprosma
Cryptomeria japonica	Japanese Cryptomeria
Cupressocyparis leylandii	Leylandii Cypress
*Cupressus forbesii***	Tecate Cypress
Cupressus glabra	Arizona Cypress
Cupressus sempervirens	Italian Cypress
Dodonea viscosa	Hopseed Bush
*Eriogonum fasciculatum***	Common Buckwheat
Eucalyptus species	Eucalyptus
*Heterotheca grandiflora***	Telegraph Plant
Juniperus species	Junipers
Larix species	Larch
Lonicera japonica	Japanese Honeysuckle
Miscanthus species	Eulalia Grass
*Muehlenbergia species***	Deer Grass
Palmae species	Palms
Picea species	Spruce Trees
*Pickeringia Montana***	Chaparral Pea
Pinus species	Pines
Podocarpus species	Fern Pine
Pseudotsuga menziesii	Douglas Fir
Rosmarinus species	Rosemary
*Salvia mellifera***	Black Sage
Taxodium species	Cypress
Taxus species	Yew
Thuja species	Arborvitae
Tsuga species	Hemlock
*Urtica urens***	Burning Nettle

** San Diego County native species

References: Gordon, H. White, T.C. 1994. Ecological Guide to Southern California Chaparral Plant Series. Cleveland National Forest.

Willis, E. 1997. San Diego County Fire Chief's Association. Wildland/Urban Interface Development Standards

City of Oceanside, California. 1995. Vegetation Management. Landscape Development Manual. Community Services Department, Engineering Division.

City of Vista, California 1997. Undesirable Plants. Section 18.56.999. Landscaping Design, Development and Maintenance Standards.

www.bewaterwise.com. 2004. Fire-resistant California Friendly Plants.

www.ucfpl.ucop.edu. 2004. University of California, Berkeley, Forest Products Laboratory, College of Natural Resources. Defensible Space Landscaping in the Urban/Wildland Interface. A Compilation of Fire Performance Ratings of Residential Landscape Plants.

County of Los Angeles Fire Department. 1998. Fuel Modification Plan Guidelines. Appendix I, Undesirable Plant List, and Appendix II, Undesirable Plant List.

INVASIVE PLANT LIST

The following species are considered invasive (i.e., those capable of reproducing and spreading into native, non-irrigated areas and displacing those communities). Non-native plant species are prohibited in all areas adjacent to open space lands. Noxious weeds that have been introduced to San Diego County over the years tend to be more widespread and therefore more difficult to contain. The plants listed below have been identified as invasive and/or as noxious weeds and should not be planted or allowed to sprout in any transitional landscapes (landscapes planted with non-native species next to undeveloped areas).

BOTANICAL NAME	COMMON NAME
Ailanthus altissima	Tree of Heaven
*Anthemis cotula****	Mayweed, Stinking Chamolile
Arctotheca calendola	Cape Weed
Arundo donax	Giant Cane
Atriplex semibaccata	Australian Saltbush
*Brassica species****	Mustard
*Cardaria draba****	Hoary Cress, Perennial Peppergrass
Carpobrotus edulis	Ice Plant
Centaurea solstitialis	Yellow Starthistle
*Cirsium vulgare****	Wild Artichoke
Conium maculatum	Poison Hemlock
*Conyza Canadensis****	Horseweed
Cortaderia selloana	Pampas Grass
Cotoneaster lacteus	Cotoneaster
Cupressus macrocarpa	Monterey Cypress
*Cynara cardunculus****	Artichoke Thistle
Cytisus species	Scotch Broom, French Broom, etc
Elaeagnus angustifolia	Russian Olive
Eucalyptus globulus	Eucalyptus Blue Gum
*Gensita species****	Broom
Hedera helix	English Ivy
Hypericum perforatum	St. John's Wort
Ilex aquifolium	English Holly
*Lactuca serriola****	Prickly Lettuce
Lepidium latifolium	Perennial Pepperweed
Myoporum parvifolium	Trailing Myoporum
Nerium oleander	Oleander
Nicotiana species	Tree Tobacco
Olea europaea	Olive
Pennisetum setaceum	Fountain Grass
Ricinus communis	Castor Bean
Robinia pseudoacacia	Black Locust
*Salsola australis****	Russian Thistle, Tumbleweed
Schinus molle	California Pepper
Schinus terebinthifolius	Brazilian Pepper
*Silybum marianum****	Milk Thistle
Spartium junceum	Spanish Broom

Tamarix species	Tamarisk
*Ulex europea***	Gorse
Vinca major	Periwinkle

*** Introduced Weeds to San Diego County

References: Bell, Carl, Regional Advisor – Invasive Plants. 2004. University of California Cooperative Extension.

California Exotic Pest Plant Council. October, 1999. Exotic Pest Plants of Greatest Ecological Concern in California. Most Invasive Wildland Pest Plants. www.caleppc.org/info/99lista.html.

Literature Referenced In This. Conceptual Fire Protection Plan

1. Behave: Fire Behavior Prediction and Fuel Modeling System – BURN Subsystem, Part 1. General Technical Report INT-194. January 1986. Patricia L. Andrews, United States Department of Agriculture – Forest Service, Intermountain Station, Ogden, Utah, 84401.

2. Behave: Fire Behavior Prediction and Fuel Modeling System – BURN Subsystem, Part 2. General Technical Report INT-360. May 1989. Patricia L. Andrews and Carolyn H. Chase, United States Department of Agriculture – Forest Service, Intermountain Station, Ogden, Utah, 84401.

3. *BehavePlus Fire Modeling System, Version 2.0* General Technical Report RMRS-GRT-106WWW. June 2003. Patricia L. Andrews, Collin D. Bevins & Robert C. Seli. United States Department of Agriculture - Forest Service, Rocky Mountain Research Station, Missoula, Montana.

4. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153, June 2005. Joe H. Scott, Robert E. Burgan, United States Department of Agriculture – Forest Service, Rocky Mountain Research Station.

5. How to Predict the Spread and Intensity of Forest and Range Fires. General Technical Report INT-1943. May 1989. Richard C. Rothermel, United States Department of Agriculture – Forest Service, Intermountain Station, Ogden, Utah, 84401.

6. 2001 California Fire Code, California Code of Regulations Title 24, Part 9, which is based upon the 2000 Uniform Fire Code, Article 86 – Fire Protection Plan – Wildland Interface (WUI) Areas, Section 8601.

7. California State Senate Bill 1369 – *Amends Section 51182 of the Government Code and Section 4291 of the Public Resource Code Relating to Fire Protection*.

8. County of San Diego, County Consolidated Fire Code, adopted November 14, 2010.

9. National Fire Protection Association - NFPA 1144 *Standard for Protection of Life and Property from Wildfire* (2002).

10. Firewise Communities, Where We Live, How We Live; From The Forward by J. Randall Ismay, pg 7, a publication of the National Wildland/Urban Interface Working Team, April 2003.

11. International Urban-Wildland Interface Code, 2006.

12. RSFFPD Ordinance No. 03-01.

13. RSFFPD Ordinance No. 2004-003.

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FIRE RESISTANT BUILDING MATERIALS

FOR

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ER-5851

Issued September 1, 2002

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Filing Category: FIRE-RETARDANT-TREATED WOOD

FRX EXTERIOR FIRE-RETARDANT-TREATED WOOD

CHEMCO, INC.
POST OFFICE BOX 875
FERNDALE, WASHINGTON 98248

1.0 SUBJECT

FRX Exterior Fire-retardant-treated Wood.

2.0 DESCRIPTION

2.1 General:

Chemco, Inc., FRX fire-retardant-treated lumber and plywood are pressure-impregnated with FRX fire-retardant chemicals, in accordance with approved quality control procedures, and are for use in exterior applications, other than roofing applications, where the 1997 *Uniform Building Code*™ (UBC) or the 2000 *International Building Code*® (IBC) permit the use of wood or fire-retardant-treated wood.

2.2 Materials:

FRX is a fire-retardant chemical used in a pressure-treatment process for structural grade southern yellow pine and Douglas fir lumber.

The FRX treatment also applies to Structural 1 exterior-grade plywood of any species.

2.3 Limitations:

FRX treated wood products are not permitted to be used in contact with the ground, in roofing applications, or in interior locations.

2.4 Flame Spread:

FRX fire-retardant-treated lumber and plywood have a flame-spread rating of 25 or less when tested in accordance with UBC Standard 8-1 (ASTM E 84), and as modified by Section 207 of the UBC and Section 2303.2 of the IBC.

2.5 Structural Adjustment Factors:

The strength properties of lumber, when treated with FRX fire-retardant chemicals and used in applications at ambient temperatures up to 80°F (26.7°C), are subject to the design factors shown in Table 1.

Plywood, when treated with FRX fire-retardant chemicals and used in applications at temperatures up to 80°F (26.7°C), is subject to the span limitations shown in Table 2.

2.6 Fasteners:

Fasteners used in FRX fire-retardant-treated lumber and plywood must be hot-dipped galvanized steel, stainless steel, silicon bronze or copper, and are subject to the strength adjustments indicated in Table 1.

2.7 Hygroscopicity:

FRX-treated lumber and plywood are not recognized for use in interior locations.

2.8 Installation:

Structural systems that include FRX fire-retardant-treated lumber or plywood must be designed and installed in accordance with the applicable code, using the appropriate lumber design value adjustment factors and plywood spans from Tables 1 and 2 of this report.

FRX lumber must not be ripped or milled, since this will alter the surface-burning characteristics and invalidate the flame-spread classification.

2.9 Identification:

Lumber and plywood treated with FRX fire-retardant chemicals must be identified by the structural grade mark of an approved agency. In addition, all treated lumber and plywood are stamped with the name of the quality control agency (Fire Tech Services, Inc.); the Chemco, Inc., name and address; the flame-spread rating; the treating date; and the evaluation report number (ICBO ES ER-5851). (See Figure 1.)

3.0 EVIDENCE SUBMITTED

Reports of tests conducted in accordance with the ICBO ES Acceptance Criteria for Fire-retardant-treated Wood (AC66), dated January 2002, and a quality control manual.

4.0 FINDINGS

That the FRX fire-retardant-treated lumber and plywood described in this report comply with the 1997 *Uniform Building Code*™, the 2000 *International Building Code*® and the 2000 *International Residential Code*®, subject to the following conditions:

4.1 Strength calculations are subject to the design factors or span ratings shown in Tables 1 and 2.

4.2 The strength design factors and span ratings given in this report are only used for unincised dimensional lumber and plywood of the species noted in this report.

4.3 The treated lumber and plywood are used where the fire-retardant-treated wood is permitted for exterior use under UBC Section 601.5.4, Item 2, and IBC Section 603.1, Item 1.2.

4.4 The treated lumber and plywood are not used in roofing applications.

Attachment No.5

4.5 The treated wood is not used in contact with the ground.

4.6 The treated lumber is not ripped or milled, since this will alter the surface-burning characteristics and invalidate the flame-spread classification.

4.7 The lumber and plywood are treated at Ferndale, Washington, under a quality control program with inspections by Fire Tech Services, Inc. (AA-641).

This report is subject to re-examination in one year.

TABLE 1—STRENGTH DESIGN FACTOR
RATIOS OF FRX FIRE-RETARDANT-TREATED LUMBER COMPARED TO UNTREATED LUMBER
APPLICABLE AT TEMPERATURES UP TO 80°F (26.7°C)[1,2]

PROPERTY	SOUTHERN YELLOW PINE	DOUGLAS FIR
Compression parallel to grain	1.00	1.00
Horizontal shear	0.91	1.00
Tension parallel to grain	0.78	0.88
Bending: modulus of elasticity	1.00	0.96
Bending: extreme fiber stress	1.00	1.00
Fasteners/connectors	0.90	0.90

[1]Duration of load adjustments for snow loads, seven-day (construction) loads, and wind loads are as specified in the UBC or IBC.
[2]FRX-treated lumber is not permitted in roof framing applications.

TABLE 2—ALLOWABLE TOTAL SHEATHING LOAD (psf)
FOR FRX-TREATED PLYWOOD[1,2,3,4]

PLYWOOD THICKNESS (inch)	PLYWOOD RATING	SPAN (inches)								
		12	16	19.2	24	30	32	36	40	48
5/16	20/0	185	104	67	47					
3/8	24/0	280	161	103	71	28				
15/32, 1/2	32/16	409	231	145	102	65	57			
19/32, 5/8	40/20	641	361	231	160	103	88	57	46	
23/32, 3/4	48/24	805	453	290	202	128	114	71	61	41

For SI: 1 inch = 25.4 mm, 1 psf = 47.9 N/m^2.

[1]Fastener size and spacing must be as required in the code for untreated plywood of the same thickness.
[2]Plywood is Structural 1, exterior-grade.
[3]FRX-treated plywood is not permitted in roofing applications.
[4]Values are based on a reduction factor of 0.88.

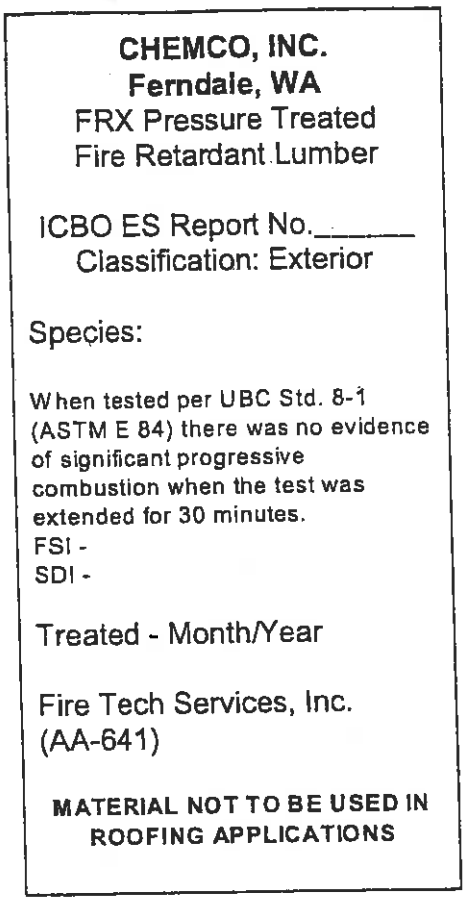

FIGURE 1—LUMBER STAMP

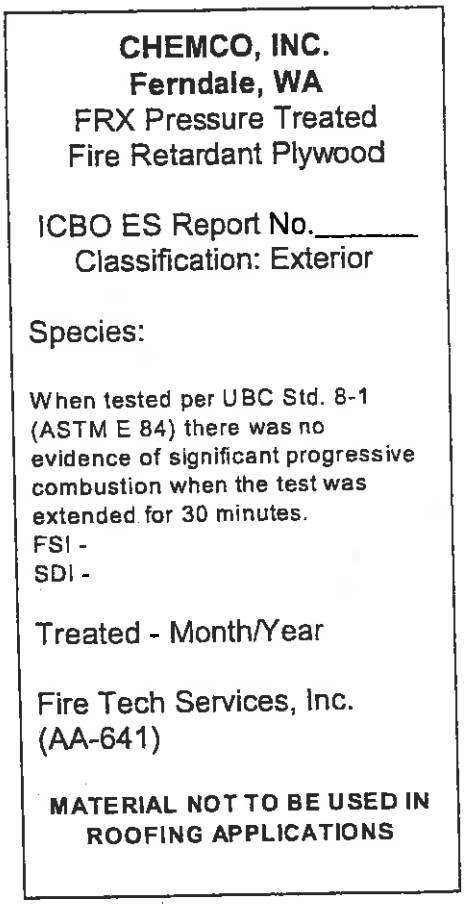

FIGURE 2—PLYWOOD STAMP

ESR-1791
ES REPORT™
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ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

DIVISION: 06—WOOD AND PLASTICS
Section: 06070—Wood Treatment

REPORT HOLDER:

HOOVER TREATED WOOD PRODUCTS, INC.
154 WIRE ROAD
THOMSON, GEORGIA 30824
(706) 595-7355
www.frtw.com

EVALUATION SUBJECT:

PYRO-GUARD® FIRE-RETARDANT-TREATED WOOD

ADDITIONAL LISTEES:

JASPER WOOD PRODUCTS, LLC
37385 JASPER LOWELL ROAD
JASPER, OREGON 97438

KILFOYLE KRAFTS
1510 SOUTH HIGHWAY 10
PRICE, UTAH 84501

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2003 *International Building Code®* (IBC)
- 2003 *International Residential Code®* (IRC)
- 1997 *Uniform Building Code™* (UBC)
- BOCA® *National Building Code*/1999 (BNBC)
- 1999 *Standard Building Code®* (SBC)

Properties evaluated:

- Flame spread
- Structural strength
- Corrosion
- Hygroscopicity

2.0 USES

PYRO-GUARD® fire-retardant-treated wood is used in areas not exposed to the weather or wetting where the code permits the use of wood or fire-retardant-treated wood.

3.0 DESCRIPTION

3.1 General:

PYRO-GUARD® fire-retardant-treated wood is lumber and plywood that is pressure impregnated with the Hoover Treated Wood Products, Inc., fire retardant chemical PYRO-GUARD®. PYRO-GUARD® fire-retardant-treated lumber and plywood is produced in accordance with an approved quality control procedure at facilities listed in Section 5.9 of this report.

PYRO-GUARD® treated lumber of the following species is recognized as being fire-retardant-treated wood: alpine fir, balsam fir, black spruce, Douglas fir, Englemann spruce, hem-fir, jack pine, lodgepole pine, ponderosa pine, red spruce, southern pine, spruce-pine-fir (SPF), western hemlock, white fir, and white spruce.

PYRO-GUARD® treated plywood fabricated with face and back veneers of the following species is recognized as being fire-retardant-treated wood: southern pine and Douglas fir for structural applications, and lauan for interior applications.

3.2 Flame Spread:

PYRO-GUARD® fire-retardant-treated wood, when tested in accordance with ASTM E 84 modified in accordance with Section 2303.2 of the IBC, has a flame-spread index of 25 or less.

3.3 Structural Strength:

The structural performance of PYRO-GUARD® fire-retardant-treated wood has been evaluated using ASTM D 5516 and D 6305 for plywood and ASTM D 5664 and D 6841 for lumber. The effects of the PYRO-GUARD® treatment on the strength of treated lumber shall be accounted for in the design of wood members and their connections. Load-duration factors greater than 1.6 shall not be used in design.

3.3.1 Lumber: The design value adjustments in Table 2 shall be used to modify the design values for untreated lumber found in the AF&PA National Design Specification (NDS) Supplement Design Values for Wood Construction, for the applicable species, use and property. Southern pine and Douglas fir have been evaluated for use in roof framing and shall be subjected to the adjustments indicated in Table 2 for roof framing. Other softwood species described in Section 3.1 shall be subjected to the design adjustments indicated in Table 2 for service temperatures up to 100°F (38°C).

3.3.2 Plywood: The maximum loads and spans shown in Table 1 shall be used to modify the panel span rating for untreated plywood described in the applicable codes, as determined by thickness and construction. The adjusted maximum loads and spans are based on tests of southern pine and Douglas fir and are applicable to all softwood species.

3.4 Corrosion:

The corrosion rate of aluminum, carbon steel, galvanized steel, copper or red brass in contact with wood is not increased by PYRO-GUARD® fire-retardant treatment when the product is used as recommended by Hoover Treated Wood Products.

Attachment No.6

3.5 Hygroscopicity:

The moisture content of PYRO-GUARD® fire-retardant-treated lumber and plywood is less than 28 percent when evaluated in accordance with ASTM D 3201 at 92 percent relative humidity (Section 2303.2.4 of the IBC). PYRO-GUARD® is suitable for use in interior conditions where sustained relative humidity is 92 percent or less and condensation does not occur.

4.0 DESIGN AND INSTALLATION

Structural systems that include PYRO-GUARD® fire-retardant-treated lumber or plywood shall be designed and installed in accordance with the applicable code using the appropriate lumber design value adjustment factors and plywood spans from Tables 1 and 2 of this report. Ventilation shall be provided in compliance with the applicable codes.

Fasteners used in PYRO-GUARD® fire-retardant-treated wood shall be hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper, in accordance with IBC Section 2304.9.5 , IRC Section R319.3, UBC Section 2304.3, and SBC Section 2306.3, and shall be subject to the design value adjustments indicated in Table 2 of this report.

5.0 CONDITIONS OF USE

The PYRO-GUARD fire-retardant-treated wood described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 All strength calculations shall be subject to the design factors or span ratings shown in Tables 1 and 2 of this report.

5.2 The strength design factors and span ratings given in this report shall only be used for unincised dimensional lumber and plywood of the species noted in this report.

5.3 All of the wood species listed in Section 3.1 of this report are permitted for interior applications and have been evaluated for structural performance for interior applications where the service temperature does not exceed 100°F (37.8°C). Southern pine and Douglas fir have been evaluated for structural performance for roof framing applications as indicated in Table 2 of this report. Southern pine and Douglas fir plywood are permitted for structural applications limited to the spans and loads indicated in Table 1 of this report.

5.4 PYRO-GUARD treated wood shall not be installed where it will be exposed to weather or damp or wet conditions.

5.5 PYRO-GUARD treated wood shall not be used in contact with the ground.

5.6 Except for the following, PYRO-GUARD lumber shall not be ripped or milled, as this may alter the surface-burning characteristics and invalidate the flame-spread classification: End cuts, holes, and joints such as tongue and groove, bevel, scarf and lap may be used.

5.7 Exposure to precipitation during storage or installation shall be avoided. If material does become wet, it shall be replaced or permitted to dry (maximum 19 percent moisture content for lumber and 15 percent moisture content for plywood) prior to covering or enclosure by wallboard or other construction materials (except for protection during construction).

5.8 The strength design factors and plywood spans in Tables 1 and 2 of this report are applicable under elevated temperatures resulting from cyclic climatic conditions in the continental United States. They are not applicable under continuous elevated temperatures resulting from manufacturing or other processes which shall require special consideration in design. Such conditions are outside the scope of this report.

5.9 Treatment is at the facilities of Hoover Treated Wood Products, Inc., in Thomson, Georgia, Pine Bluff, Arkansas, Milford, Virginia, Detroit, Michigan, and Winston, Oregon, and the Jasper Wood Products facility in Jasper, Oregon; and the Kilfoyle Krafts facility in Price, Utah; under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668) and Timber Products Inspection Inc. (AA-696).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fire-retardant-treated Wood (AC66), dated November 2005.

7.0 IDENTIFICATION

Lumber and plywood treated with PYRO-GUARD® fire-retardant chemicals shall be identified by the structural grade mark of an approved agency. In addition, all treated lumber and plywood shall be stamped with the name of the inspection agency [Underwriters Laboratories Inc. (AA-668) or Timber Products Inspection Inc. (AA-696)], the Hoover Treated Wood Products, Inc., name and address, labeling information in accordance with Section 2303.2.1 of the IBC, and the evaluation report number (ESR-1791).

TABLE 1— MAXIMUM LOADS AND SPANS FOR PYRO-GUARD® TREATED PLYWOOD

PLYWOOD[8] THICKNESS (Inches)	UNTREATED ROOF/SUBFLOOR SPAN RATING	PYRO-GUARD[®1,2,3,4,5,9,11,12] ROOF SHEATHING MAX. LIVE LOAD (psf)				PYRO-GUARD[®2,10]
		Span (Inches)	Climate Zone[6,7]			Span (inches)
			1A	1B	2	
$^{15}/_{32}$, $^{1}/_{2}$	32/16	24	19	30	43	16
$^{19}/_{32}$, $^{5}/_{8}$	40/20	24 32	42 20	64 32	87 45	20 20
$^{23}/_{32}$, $^{3}/_{4}$	48/24	32 48	34 10	51 18	71 27	24 24
$^{7}/_{8}$	—	48	12	20	30	—
$1^{1}/_{8}$	—	48	21	33	47	48

For **SI:** 1 inch = 25.4 mm, 1 psf = 48 N/m^2.

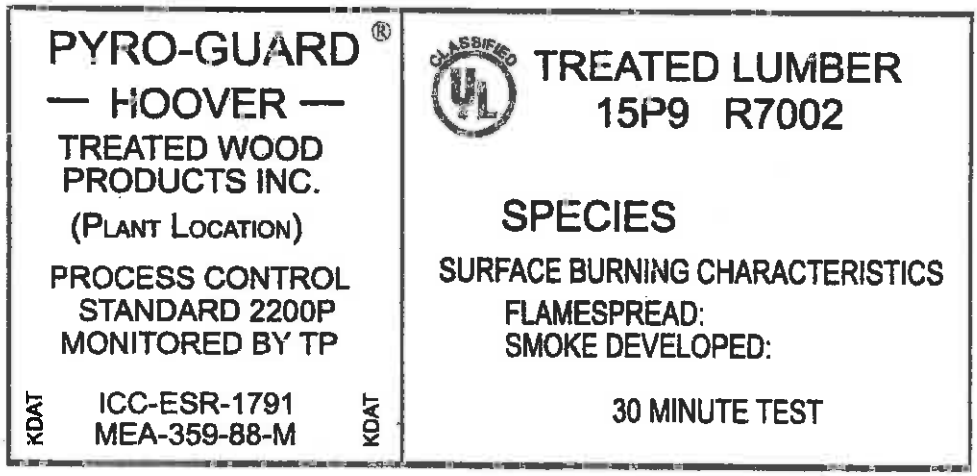
[1]All loads are based on two-span condition with panels 24 inches wide or wider, strength axis perpendicular to supports.
[2]Fastener size and spacing shall be as required in the applicable building code for untreated plywood of the same thickness; except that roof sheathing shall be fastened with (1) minimum 8d common or 8d deformed shank nails spaced a maximum 6 inches o.c. at edges and a maximum of 12 inches o.c. at intermediate supports for panels on 24- and 32-inch spans and spaced a maximum of 6 inches o.c. on all supports for panels on a 48-inch span, or (2) other fasteners with comparable withdrawal and lateral load capacities at the same maximum spacings. For $1^{1}/_{8}$-inch roof sheathing panels, use minimum 10d common or deformed shank nails.
[3]Roof spans and loads apply to roof systems having the minimum ventilation areas required by the applicable building code. Fifty percent of required vent area shall be located on upper portion of sloped roofs to provide natural air flow.
[4]For low-sloped or flat roofs with membrane or built-up roofing having a perm rating less than 0.2, use rigid insulation having a minimum *R* value of 4.0 between sheathing and roofing, or use next thicker panel than tabulated for the span and load (e.g., $^{19}/_{32}$ for 24 inches, $^{23}/_{32}$ for 32 inches); and use a continuous ceiling air barrier and vapor retarder with a perm rating less than 0.2 on the bottom of the roof framing above the ceiling finish.
[5]Panel edge clips are required for roof sheathing: one midway between supports for 24-inch and 32-inch spans, two at $^{1}/_{3}$ points between supports for 48-inch span. Clips shall be specifically manufactured for the plywood thickness used.
[6]Tabulated loads for Zone 1A are based on a duration of load adjustment for 7-day (construction) loads of 1.25. Tabulated loads for Zone 1B and Zone 2 are based on a duration of load adjustment for snow of 1.15. All values within the table are based on a dead load (DL) of 8 psf. If the DL is less than or greater than 8 psf, the tabulated live load shall be increased or decreased by the difference. Applicable material weights, psf: asphalt shingles - 2.0, $^{1}/_{2}$-inch plywood - 1.5, $^{5}/_{8}$-inch plywood - 1.8, $^{3}/_{4}$-inch plywood - 2.2.
[7]Climate Zone definition:
1 - Minimum design roof live load or maximum ground snow load up to 20 psf:
A - Southwest Arizona, Southeast Nevada (Las Vegas-Yuma-Phoenix-Tucson triangle)
B - All other qualifying areas of the continental United States
2 - Minimum ground snow load over 20 psf
[8]PYRO-GUARD® treated plywood shall not be used as roof sheathing if a radiant shield is used beneath the roof sheathing.
[9]The $^{19}/_{32}$-inch and $^{5}/_{8}$-inch thickness are limited to performance rated 4-ply or 5-ply. $^{23}/_{32}$- and $^{3}/_{4}$-inch thicknesses are limited to performance rated 5-ply or 7-ply.
[10]Subfloor applications are limited to 100 psf maximum live load, except $1^{1}/_{8}$-inch thickness on 48-inch span limited to 65 psf total load.
[11]Deflection of roof sheathing at tabulated maximum live load is less than $^{1}/_{240}$ of the span, and under maximum live load plus dead load is less than $^{1}/_{180}$ of the span.
[12]Staples used to attach asphalt shingles shall be minimum $^{15}/_{16}$-inch crown and minimum 1-inch leg, or otherwise comply with the applicable code, with the quantity of fasteners adjusted in accordance with Table 2 of this report.

TABLE 2—DESIGN VALUE ADJUSTMENTS FOR PYRO-GUARD® TREATED LUMBER

PROPERTY	SERVICE TEMPERATURE[4] TO 100°F/38°C			PYRO-GUARD® ROOF FRAMING, CLIMATE ZONE[1,2,5]					
	SP	DF	Other	1A		1B		2	
				SP	DF	SP	DF	SP	DF
Extreme fiber in bending	0.91	0.97	0.88	0.80	0.90	0.85	0.93	0.89	0.96
Tension parallel to grain	0.88	0.95	0.83	0.80	0.80	0.84	0.87	0.88	0.93
Compression parallel to grain	0.94	1.00	0.94	0.94	0.94	0.94	0.98	0.94	1.00
Horizontal shear	0.95	0.96	0.93	0.92	0.95	0.93	0.95	0.94	0.96
Modulus of elasticity	0.95	0.96	0.94	0.95	0.96	0.95	0.96	0.95	0.96
Compression perp. to grain	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Fasteners/connectors	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90

[1]Climate Zone definition:
1 - Minimum design roof live load or maximum ground snow load up to 20 psf:
A - Southwest Arizona, Southeast Nevada (Las Vegas-Yuma-Phoenix-Tucson triangle)
B - All other qualifying areas of the Continental United States
2 - Minimum ground snow load over 20 psf

[2]Duration of load adjustments for snow loads, 7-day (construction) loads, and wind loads given in the National Design Specifications for Wood Construction apply.
[3]Where lumber decking serves as both exposed ceiling and roof sheathing, use extreme fiber in bending adjustments of 0.84, 0.83, and 0.89 for southern pine zones 1A, 1B, and 2, respectively; 0.92, 0.92, and 0.96 for Douglas fir zones 1A, 1B, and 2, respectively; except that where insulation having a minimum *R* value of 4.0 is installed above the decking, extreme fiber in bending adjustments of 0.91 for southern pine and 0.97 for Douglas fir are permitted in all zones.
[4]Modulus of elasticity values apply to all treated lumber decking.
[5]Roof framing adjustment factors apply to roof systems with minimum ventilation areas per applicable code. Locate 50 percent of required vent area on upper portion of sloped roofs to provide natural air flow.
[6]Species: SP - southern pine; DF - Douglas fir; Other softwoods - limited to those species listed in Section 3.1 of this report.



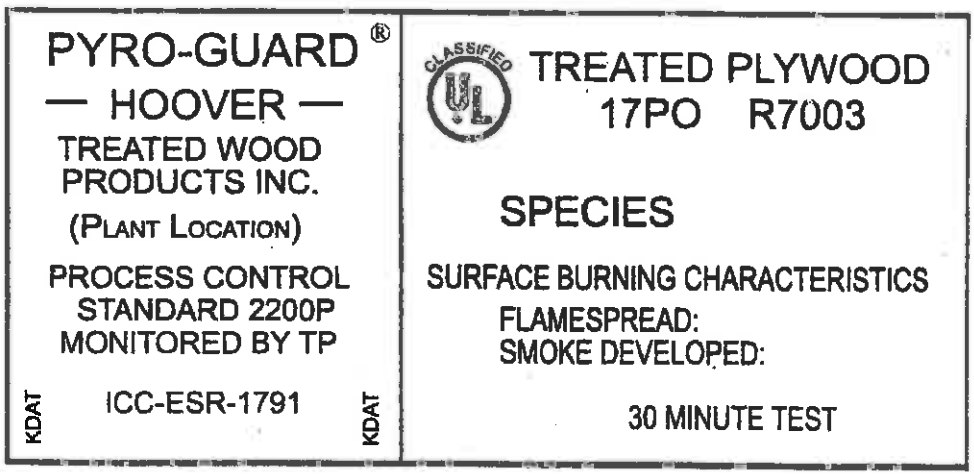


FIGURE 1—LUMBER AND PLYWOOD STAMPS

FIRE BEHAVIOR CALCULATIONS

(43 pages)

Modules: SURFACE, SIZE

Description: TM 5440, 5441 ? under a prevailing SW wind

Fuel/Vegetation

Fuel Model		SCAL18

Fuel Moisture

1-h Moisture	percent	4
10-h Moisture	percent	6
100-h Moisture	percent	8
Live Herbaceous Moisture	percent	80
Live Woody Moisture	percent	80

Weather

20-ft Wind Speed	mi/h	15
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the west sides of TM 5440, 5441 & 2 on the Cielo Development. Each of these three locations are surrounded by sage/buckheat fuels (SCAL18) generally less than 2' in height, under a mid summer, 15 mph prevailing SW wind on a 30% up slope.

TM 5440, 5441 [illegible] under a prevailing SW wind

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded > > >
0.5	64.2	3730	3989	20.4	0	No
1.0	64.2	3730	3989	20.4	0	No

TM 5440, 5441 ... under a prevailing SW wind

< Elapsed Time	Fire Area	Fire Perimeter
< h	ac	ft
0.5	23.3	4404
1.0	93.2	8807

Modules: SURFACE, SIZE

Description: TM 5440, 5441 under an above average SW wind

Fuel/Vegetation

Fuel Model		SCAL18

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	50
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	30
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the west sides of TM 5440, 544[illegible] on the Cielo Development. Each of these three locations are surrounded by sage/buckwheat fuels (SCAL18) generally less than 2' in height, under a late season, 30 mph SW wind on a 30% up slope.

TM 5440, 5441 [illegible] nder an above average SW wind

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded > > >
0.5	177.3	4329	12791	34.9	0	No
1.0	177.3	4329	12791	34.9	0	No

TM 5440, 5441 (! under an above average SW wind

< Elapsed Time	Fire Area	Fire Perimeter
< h	ac	ft
0.5	105.9	11304
1.0	423.7	22608

Modules: SURFACE, SIZE

Description TM 5440, 5441 under a NE Santa Ana wind.

Fuel/Vegetation

Fuel Model		SCAL18

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	50
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	60
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the east sides of TM 5440, 5441 a[illegible]n the Cielo Development. Each of these three locations are surrounded by sage/buckwheat fuels (SCAL18) generally less than 2' in height, under a 60 mph NE Santa Ana wind on a 30% up slope.

TM 5440, 5441 [illegible] under a NE Santa Ana wind.

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded > > >
0.5	327.6	4329	23637	46.2	0	No
1.0	327.6	4329	23637	46.2	0	No

TM 5440, 5441 [illegible] under a NE Santa Ana wind.

< Elapsed Time h	Fire Area ac	Fire Perimeter ft
0.5	202.1	20101
1.0	808.4	40202

Modules: SURFACE, SIZE

Description: TM 5440, 5441 under a NE Santa Ana wind.

Fuel/Vegetation

Fuel Model		SCAL18

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	50
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	60
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	180

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the east sides of TM 5440, 5441 [illegible] the Cielo Development. Each of these three locations are surrounded by sage/buckwheat fuels (SCAL18) generally less than 2' in height, under a 60 mph NE Santa Ana wind on a 30% down slope.

TM 5440, 5441 ... under a NE Santa Ana wind.

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded > > >
0.5	313.8	4329	22641	45.3	180	No
1.0	313.8	4329	22641	45.3	180	No

TM 5440, 5441 ... under a NE Santa Ana wind.

< Elapsed Time h	Fire Area ac	Fire Perimeter ft
0.5	193.4	19289
1.0	773.6	38579

Modules: SURFACE, SIZE

Description	TM 5440, 5441,	for a FM4 under a prevailin

Fuel/Vegetation, Surface/Understory

Fuel Model		4

Fuel Moisture

1-h Moisture	percent	4
10-h Moisture	percent	6
100-h Moisture	percent	8
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	80

Weather

20-ft Wind Speed (upslope)	mi/h	15
Wind Adjustment Factor		0.5

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ft/min) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

Fireline Intensity (Btu/ft/s) [SURFACE]

Flame Length (ft) [SURFACE]

Direction of Maximum Spread (from upslope) (deg) [SURFACE]

Midflame Wind Speed (upslope) (mi/h) [SURFACE]

Max Eff Wind Exceeded? [SURFACE]

Area (ac) [SIZE]

Perimeter (ft) [SIZE]

(continued on next page)

Input Worksheet (continued)

Notes

This BehavePlus run calculates the flame length for 3 sites on the west sides of TM 5440, 5441 on the Cielo Development. This run is at the request of RSFFPD who indicated that north slope fuels behave like a FM-4. FM-4 fuels consist of continuous chaparral over 6 feet in height. This run depicts a mid summer 15mph prevailing wind on a 30% up slope.

TM 5440, 5441, ... for a FM4 under a prevailing SW wind

Elapsed Time	ROS (max)	Heat per Unit Area	Fireline Intensity	Flame Length	Direction Max ROS	Midflame Wind Speed
h	ft/min	Btu/ft2	Btu/ft/s	ft	deg	mi/h
0.5	200.3	2892	9652	30.6	0	7.5
1.0	200.3	2892	9652	30.6	0	7.5

TM 5440, 5441. . . . FM4 under a prevailing SW wind

< Elapsed Time	Max Wind Exceeded	Fire Area	Fire Perimeter
< h		ac	ft
0.5	No	231.5	13794
1.0	No	925.9	27588

Modules: SURFACE, SIZE

Description TM 5440, 5441, for a FM4 under an above av

Fuel/Vegetation, Surface/Understory

Fuel Model		4

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	30
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ft/min) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

Fireline Intensity (Btu/ft/s) [SURFACE]

Flame Length (ft) [SURFACE]

Direction of Maximum Spread (from upslope) (deg) [SURFACE]

Midflame Wind Speed (mi/h) [SURFACE]

Max Eff Wind Exceeded? [SURFACE]

Area (ac) [SIZE]

(continued on next page)

Input Worksheet (continued)

Perimeter (ft) [SIZE]

Notes

This BehavePlus run calculates the flame length for 3 sites on the west sides of TM 5440, 5441 [illegible] on the Cielo Development. This run is at the request of RSFFPD who indicated that north slope fuels behave like a FM-4. FM-4 fuels consist of continuous chaparral over 6 feet in height. This run depicts a late season above average 30 mph SW wind on a 30% up slope.

TM 5440, 5441, [illegible] for a FM4 under an above ave SW wind

Elapsed Time	ROS (max)	Heat per Unit Area	Fireline Intensity	Flame Length	Direction Max ROS	Midflame Wind Speed	>
h	ft/min	Btu/ft2	Btu/ft/s	ft	deg	mi/h	>
0.5	783.0	3450	45027	62.2	0	15.0	
1.0	783.0	3450	45027	62.2	0	15.0	

TM 5440, 5441, [illegible] for a FM4 under an above ave SW wind

< Elapsed Time	Max Wind Exceeded	Fire Area	Fire Perimeter
< h		ac	ft
0.5	No	2104.9	50013
1.0	No	8419.7	100027

Modules: SURFACE, SIZE

Description: TM 5441 in a FM-4 under a 60 MPH Santa Ana wind

Fuel/Vegetation, Surface/Understory

Fuel Model		4

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	60
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ft/min) [SURFACE]

Heat per Unit Area (Btu/ft2) [SURFACE]

Fireline Intensity (Btu/ft/s) [SURFACE]

Flame Length (ft) [SURFACE]

Direction of Maximum Spread (from upslope) (deg) [SURFACE]

Midflame Wind Speed (mi/h) [SURFACE]

Max Eff Wind Exceeded? [SURFACE]

Area (ac) [SIZE]

(continued on next page)

Input Worksheet (continued)

Perimeter (ft) [SIZE]

Notes

This BehavePlus run calculates the flame length for 3 sites on the north side of TM 5441. This run is at the request of RSFFPD who indicated that north slope fuels behave like a FM-4. FM-4 fuels consist of continuous chaparral over 6 feet in height. This run depicts a late season Santa Ana wind on a 30% up slope.

TM 5440, 5441, ... for a FM4 under an 60 mph Santa Ana wind

Elapsed Time	ROS (max)	Heat per Unit Area	Fireline Intensity	Flame Length	Direction Max ROS	Midflame Wind Speed >
h	ft/min	Btu/ft2	Btu/ft/s	ft	deg	mi/h >
0.5	2041.2	3450	117380	96.7	0	30.0
1.0	2041.2	3450	117380	96.7	0	30.0

TM ~~5440~~, 5441; for a FM4 under a ~~above ave SW~~ wind Compit santa Ana

< Elapsed Time	Max Wind Exceeded	Fire Area	Fire Perimeter
< h		ac	ft
0.5	No	7952.2	125304
1.0	No	31808.7	250607

Modules: SURFACE, SIZE

Description		TM 5440, 5441 under a prevailing SW wind

Fuel/Vegetation

Fuel Model		1

Fuel Moisture

1-h Moisture	percent	4
10-h Moisture	percent	
100-h Moisture	percent	
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	

Weather

20-ft Wind Speed	mi/h	15
Wind Adjustment Factor		0.4
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the west sides of TM 5440, 5441 & 2 on the Cielo Development. Each of these three locations are surrounded by native annual and perennial grasses 1' in height, under a mid summer, 15 mph prevailing SW wind on a 30% up slope.

TM 5440, 5441 [illegible] under a prevailing SW wind

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded >
0.5	188.5	96	301	6.2	0	No
1.0	188.5	96	301	6.2	0	No

TM 5440, 5441 [illegible] under a prevailing SW wind

< Elapsed Time	Fire Area	Fire Perimeter
< h	ac	ft
0.5	241.7	13456
1.0	966.9	26912

Modules: SURFACE, SIZE

Description TM 5440, 5441 - under an above average SW wind

Fuel/Vegetation

Fuel Model		1

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	
100-h Moisture	percent	
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	

Weather

20-ft Wind Speed	mi/h	30
Wind Adjustment Factor		0.4
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the west sides of TM 5440, 5441 . '2 on the Cielo Development. Each of these three locations are surrounded by native annual and perennial grasses 1' in height, under a late season, 30 mph SW wind on a 30% up slope.

TM 5440, 5441 ... under an above average SW wind

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded >
0.5	732.1	116	1415	12.7	0	Yes
1.0	732.1	116	1415	12.7	0	Yes

TM 5440, 5441 ... 2 under an above average SW wind

< Elapsed Time h	Fire Area ac	Fire Perimeter ft
0.5	2439.4	48413
1.0	9757.5	96825

Modules: SURFACE, SIZE

Description: TM 5440, 5442 under a NE Santa Ana wind.

Fuel/Vegetation

Fuel Model		1

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	
100-h Moisture	percent	
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	

Weather

20-ft Wind Speed	mi/h	60
Wind Adjustment Factor		0.4
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	30

Fire

Elapsed Time	h	.5, 1

Run Options

Calculations are only for the direction of maximum spread.
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations.
Wind and spread directions are degrees clockwise from upslope.
Wind direction is the direction the wind is pushing the fire.

Output Variables

Rate of Spread (maximum) (ft/min)
Heat per Unit Area (Btu/ft2)
Fireline Intensity (Btu/ft/s)
Flame Length (ft)
Direction of Maximum Spread (from upslope) (deg)
Maximum Wind Exceeded?

(continued on next page)

Input Worksheet (continued)

Area (ac)

Perimeter (ft)

Notes

This BEHAVE PLUS run calculates the flame length for 3 sites on the east sides of TM 5440, 5441 [illegible] on the Cielo Development. Each of these three locations are surrounded by native annual and perennial grasses 1' in height, under a 60 mph NE Santa Ana wind on a 30% up slope.

TM 5440, 5441 . . .2 under a NE Santa Ana wind.

Elapsed Time h	ROS (max) ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length ft	Direction Max ROS deg	Max Wind Exceeded > > >
0.5	732.1	116	1415	12.7	0	Yes
1.0	732.1	116	1415	12.7	0	Yes

TM 5440, 5441 [illegible] under a NE Santa Ana wind.

< Elapsed Time	Fire Area	Fire Perimeter
< h	ac	ft
0.5	2439.4	48413
1.0	9757.5	96825

Modules: SURFACE, SIZE

Description Cielo Shrub comparisons under a NE Santa Ana wind

Fuel/Vegetation, Surface/Understory

~~Fuel Model~~		~~SCAL13~~

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	50
Live Woody Moisture	percent	50

Weather

~~20-ft Wind Speed~~	~~mi/h~~	~~60.0~~
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	50

Fire

Elapsed Time	h	1.0

Run Option Notes

~~Calculations are only for the direction of maximum spread~~ [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

(continued on next page)

Input Worksheet (continued)

Notes

Run #1 This run is the first of three where we are comparing the flame lengths and intensities for three different shrub models to represent the most severe conditions on Rancho Cielo. The Fire Marshal agrees the fuel is not an FM 4, chaparral vegetation over 6' in height, however he is concerned that an SCAL18 may underestimate the flame length and intensity of the fuels on the Cielo east, south and west facing slopes. This run is for an SCAL18. All other inputs remain constant for each run.

Cielo Shrub comparisons under a NE Santa Ana wind SCA118, sh5, sh7

Surface Rate of Spread (maximum)	339.9	ft/min
Fireline Intensity	24521	Btu/ft/s
Flame Length	47.0	ft
Direction of Maximum Spread (from upslope)	0	deg
Midflame Wind Speed	30.0	mi/h
Area	839.3	ac
Perimeter	41647	ft

Modules: SURFACE, SIZE

Description: Cielo Shrub comparisons under a NE Santa Ana wind

Fuel/Vegetation, Surface/Understory

Fuel Model		sh5

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	60.0
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	50

Fire

Elapsed Time	h	1.0

Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

(continued on next page)

Input Worksheet (continued)

Notes

Run #2 This run is the second of three where we are comparing the flame lengths and intensities for three different shrub models to represent the most severe conditions on Rancho Cielo. The Fire Marshal agrees the fuel is not an FM 4, chaparral vegetation over 6' in height, however he is concerned that an SCAL18 may underestimate the flame length and intensity of the fuels on the Cielo east, south and west facing slopes. This run is for an sh5. All other inputs remain constant for each run.

Cielo Shrub comparisons under a NE Santa Ana wind SCA118, sh5, sh7

Surface Rate of Spread (maximum)	1041.8	ft/min
Fireline Intensity	35899	Btu/ft/s
Flame Length	56.0	ft
Direction of Maximum Spread (from upslope)	0	deg
Midflame Wind Speed	30.0	mi/h
Area	8105.0	ac
Perimeter	127787	ft

Modules: SURFACE, SIZE

Description Cielo Shrub comparisons under a NE Santa Ana wind

Fuel/Vegetation, Surface/Understory

Fuel Model		sh7

Fuel Moisture

1-h Moisture	percent	2
10-h Moisture	percent	3
100-h Moisture	percent	5
Live Herbaceous Moisture	percent	
Live Woody Moisture	percent	50

Weather

20-ft Wind Speed	mi/h	60.0
Wind Adjustment Factor		0.5
Direction of Wind Vector (from upslope)	deg	0

Terrain

Slope Steepness	percent	50

Fire

Elapsed Time	h	1.0

Run Option Notes

Calculations are only for the direction of maximum spread [SURFACE].

Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

(continued on next page)

Input Worksheet (continued)

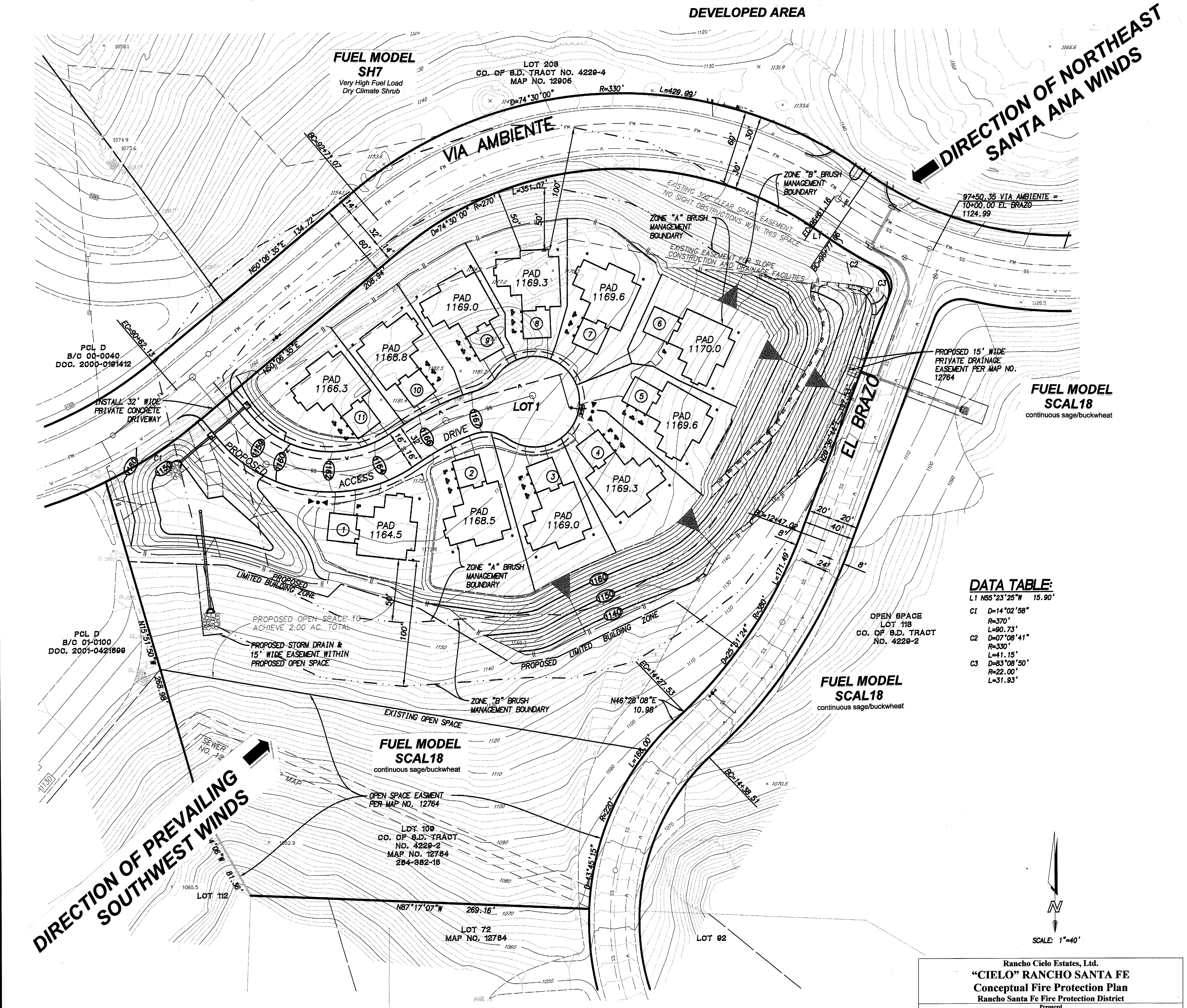
Notes

Run #3 This run is the third of three where we are comparing the flame lengths and intensities for three different shrub models to represent the most severe conditions on Rancho Cielo. The Fire Marshal agrees the fuel is not an FM 4, chaparral vegetation over 6' in height, however he is concerned that an SCAL18 may underestimate the flame length and intensity of the fuels on the Cielo east, south and west facing slopes. This run is for an sh7. All other inputs remain constant for each run.

Cielo Shrub comparisons under a NE Santa Ana wind SCAl18, sh5, sh7

Surface Rate of Spread (maximum)	664.3	ft/min
Fireline Intensity	30752	Btu/ft/s
Flame Length	52.2	ft
Direction of Maximum Spread (from upslope)	0	deg
Midflame Wind Speed	30.0	mi/h
Area	3285.4	ac
Perimeter	81471	ft

RANCHO CIELO VILLAGE ESTATES
FUEL TREATMENT LOCATION MAP



LEGEND

ITEMS	SYMBOL
TRACT BOUNDARY	
RIGHT OF WAY	
LOT LINE	
CUT/FILL SLOPE 1.5:1 OR AS NOTED	
EXISTING CONTOUR	
PROPOSED CONTOUR	
DAYLIGHT LINE	C F
BRUSH MANAGEMENT LINE	
LOT NUMBER	1
UNIT NUMBER	2
PAD ELEVATION	PAD 1119
EXISTING STORM DRAIN	
PROPOSED STORM DRAIN (PVT.)	
PROPOSED SEWER MAIN (PVT.)	SS
PROPOSED WATER MAIN (PVT.)	W
PROPOSED FIRE HYDRANT ASSEMBLY	
EXISTING FIRE HYDRANT ASSEMBLY	
EXISTING CONCRETE BROW DITCH	
PROPOSED CONCRETE BROW DITCH	
INDICATES DIRECTION OF FLOW	
RETAINING WALL	
INDICATES TOP OF WALL ELEVATION	TW 1120
INDICATES FINISHED GROUND ELEVATION	FG 1112
INDICATES TOP OF BERM ELEVATION	TB 1115.5
INDICATES PAVEMENT ELEVATION	P 1115.2
INDICATES FINISH GRADE ELEVATION	FG 1116.3
INDICATES FLOW LINE ELEVATION	FL 1116

NOTE:
SAN DIEGO COUNTY DESIGN STANDARDS DS-1 THROUGH DS-16, DS-20A AND DS-20B APPLY TO THIS PROJECT.

NOTE:
ALL RETAINING WALLS SHALL BE MODULAR SEGMENTAL CONCRETE SYSTEMS. RANGING IN HEIGHT FROM 1' TO 21' TALL AS DESIGNATED ON THE PLAN

"CIELO" TM 5440, Village Estates
Fuel Treatment Location Map

LEGEND

Zone A extends out 50 feet from each side of each structure. Zone A is comprised of irrigated lawn and bedding plants and low growing fire resistant shrubs and well-spaced fire resistant trees with mature tree crowns no closer than 10 feet to the structure. Maintenance will be by the Cielo HOA.

Zone B extends from the edge of Zone A out an additional 50 feet for a total of 100 feet from each side of each structure. The "black dashed line with two intermediate dots" delineates the edges of Zone B. Zone B maintenance will be by the Cielo HOA. Zone B requires the removal of all California sagebrush, buckwheat, black sage and chamise. The remaining vegetation is thinned to provide up to a 50% canopy coverage and annual grasses are weed whipped to a 4 inch stubble height. Well-spaced fire resistant trees from the Approved Plant List in Appendix "A" may also be planted in Zone B provided vegetation is removed from beneath the drip line of the tree canopy plus 10 feet.

Fire Hydrant locations.

CERTIFIED BY

David C. Bacon

Dated: **August 2, 2011**

PREPARED BY

Michael J. Rogers
California Registered Professional Forester # 787
California Certified Urban Forester # 109

***FIREWISE* 2000, Inc.**

NO.	DATE	REVISION

Rancho Cielo Estates, Ltd.
"CIELO" RANCHO SANTA FE
Conceptual Fire Protection Plan
Rancho Santa Fe Fire Protection District
Prepared By
FIREWISE 2000, INC.
26337 Sky Drive • Escondido, CA 92026 • Telephone: (760) 745-3947

ENGINEER OF WORK

FUSCOE ENGINEERING - SAN DIEGO, INC.
6390 GREENWICH DRIVE, STE. 170
SAN DIEGO, CA 92122
(858)554-1500

ROBERT A. CHASE RCE 41903 DATE

REGISTERED PROFESSIONAL ENGINEER ROBERT A. CHASE No. RCE 41903 EXP. 03-31-12 Civil STATE OF CALIFORNIA

FUSCOE ENGINEERING
6390 Greenwich Drive, Suite 170
San Diego, California 92122
tel 858.554.1500 • fax 858.597.0335
www.fuscoe.com

Plotted by: bchase

M:\PROJECTS\2711\CIELO\01-007\LONG LEAD\AREA VC\GRADING PLAN\2711.01-PRG03PRG VC.DWG (06-23-11 9:13:41PM)

SHEET 3 OF 3 SHEETS

RANCHO CIELO PARCEL "H"

FUEL TREATMENT LOCATION MAP

LEGEND

ITEMS	SYMBOL
TRACT BOUNDARY	
RIGHT OF WAY	
LOT LINE	
CUT/FILL SLOPE 1.5:1 OR AS NOTED	C.L. F.
EXISTING CONTOUR	1110
PROPOSED CONTOUR	665
DAYLIGHT LINE	C F
LOT NUMBER	1
PAD ELEVATION	PAD 1119
EXISTING STORM DRAIN	
PROPOSED STORM DRAIN (PVT.)	
PROPOSED SEWER MAIN (PVT.)	SS
PROPOSED WATER MAIN (PVT.)	W
PROPOSED FIRE HYDRANT ASSEMBLY	
EXISTING FIRE HYDRANT ASSEMBLY	
EXISTING CONCRETE BROW DITCH	
PROPOSED CONCRETE BROW DITCH	
INDICATES DIRECTION OF FLOW	
RETAINING WALL	
INDICATES TOP OF WALL ELEVATION	TW 1120
INDICATES FINISHED GROUND ELEVATION	FG 1112
INDICATES TOP OF BERM ELEVATION	TB 1115.5
INDICATES PAVEMENT ELEVATION	P 1115.2
INDICATES FINISH GRADE ELEVATION	FG 1116.3
INDICATES FLOW LINE ELEVATION	FL 1116
BRUSH ZONE "A" BOUNDARY	
BRUSH ZONE "B" BOUNDARY	
BUILDING NUMBER	2

NOTE:
SAN DIEGO COUNTY DESIGN STANDARDS DS-1 THROUGH DS-16, DS-20A AMD DS-20B APPLY TO THIS PROJECT.

NOTE:
ALL RETAINING WALLS SHALL BE MODULAR SEGMENTAL CONCRETE SYSTEMS. RANGING IN HEIGHT FROM 1' TO 21' TALL AS DESIGNATED ON THE PLAN

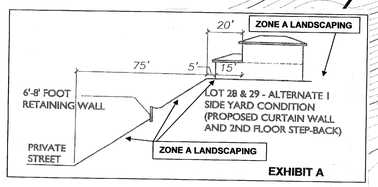


EXHIBIT A

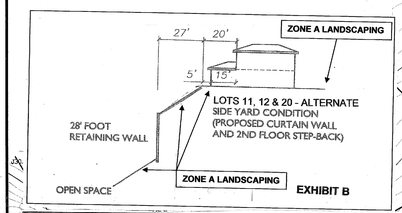


EXHIBIT B

"CIELO" TM 5441, Parcel "H"
Fuel Treatment Location Map

LEGEND

Zone extends out 50 feet from each side of each structure. Zone A is comprised of irrigated lawn and bedding plants and low growing fire resistant shrubs and well-spaced fire resistant trees with mature tree crowns no closer than 10 feet to the structure. Maintenance will be by the Cielo HOA.

Zone B extends from the edge of Zone A out an additional 50 feet for a total of 100 feet from each side of each structure. The "black dashed line with two intermediate dots" delineates the edges of Zone B. Zone B maintenance will be by the Cielo HOA. Zone B requires the removal of all California sagebrush, buckwheat, black sage and chamise. The remaining vegetation is thinned to provide up to a 50% canopy coverage and annual grasses are weed whipped to a 4 inch stubble height. Well-spaced fire resistant trees from the Approved Plant List in Appendix "A" may also be planted in Zone B provided vegetation is removed from beneath the drip line of the tree canopy plus 10 feet.

Fire Hydrant locations.

CERTIFIED BY

David C. Bacon

Dated: August 2, 2011

PREPARED BY

Michael J. Rogers
California Registered Professional Forester # 787
California Certified Urban Forester # 109

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"CIELO" RANCHO SANTA FE
Conceptual Fire Protection Plan
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26337 Sky Drive • Escondido, CA 92026 • Telephone: (760) 745-3947

FUEL MODEL SH7
Very High Fuel Load
Dry Climate Shrub

DIRECTION OF PREVAILING SOUTHWEST WINDS

DIRECTION OF NORTHEAST SANTA ANA WINDS

N

SCALE: 1"=40'

DATA TABLE

L1 N55°23'25"W 15.90'

NO.	DATE	REVISION

FUSCOE ENGINEERING
6390 Greenwich Drive, Suite 170
San Diego, California 92122
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