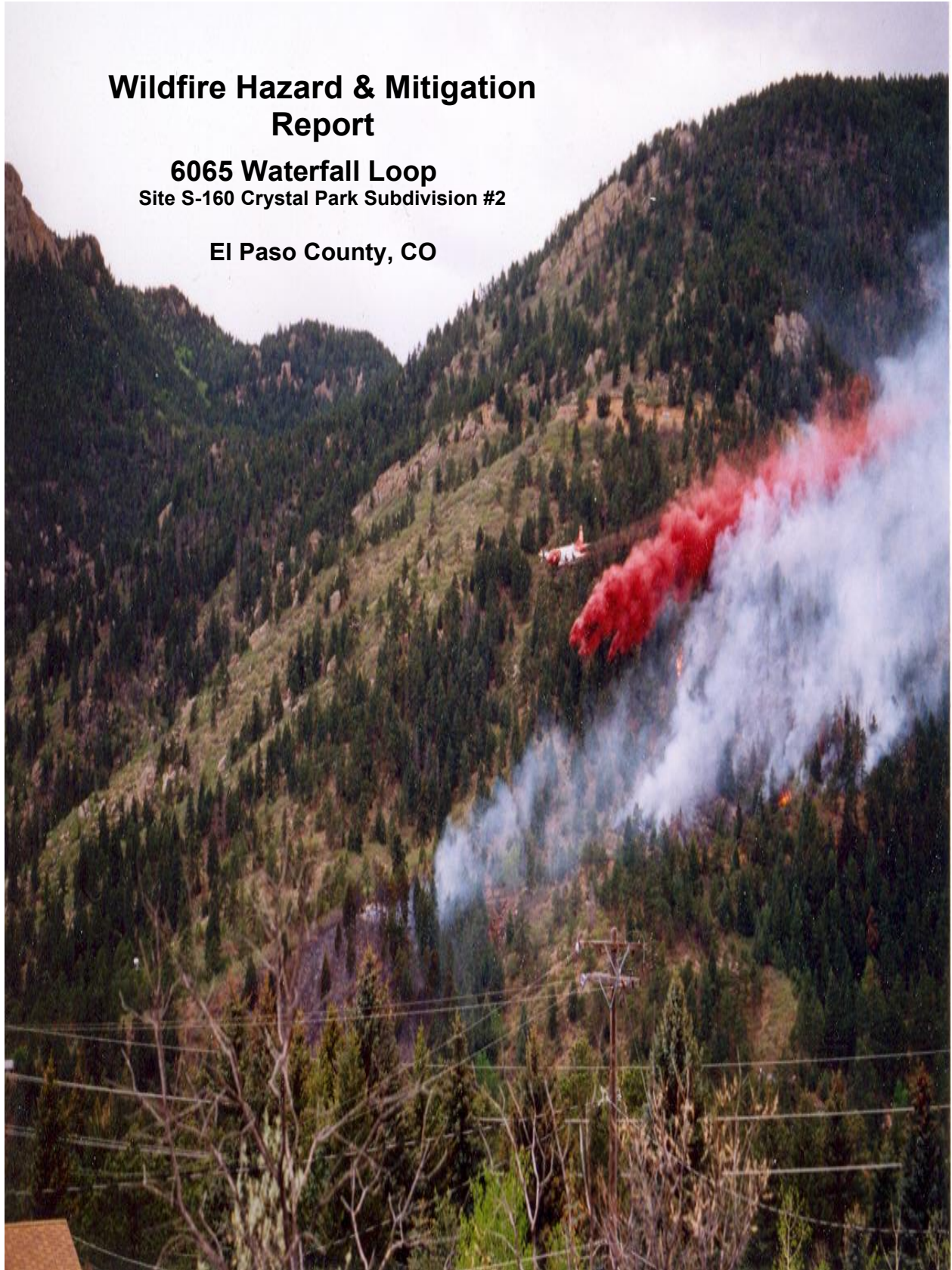


# **Wildfire Hazard & Mitigation Report**

**6065 Waterfall Loop  
Site S-160 Crystal Park Subdivision #2**

**El Paso County, CO**



# Wildfire Hazard Evaluation Report

For the

**6065 Waterfall Loop**  
Site S-160 Crystal Park Subdivision #2

**El Paso County, CO**

Prepared for: **Cole Jolly**  
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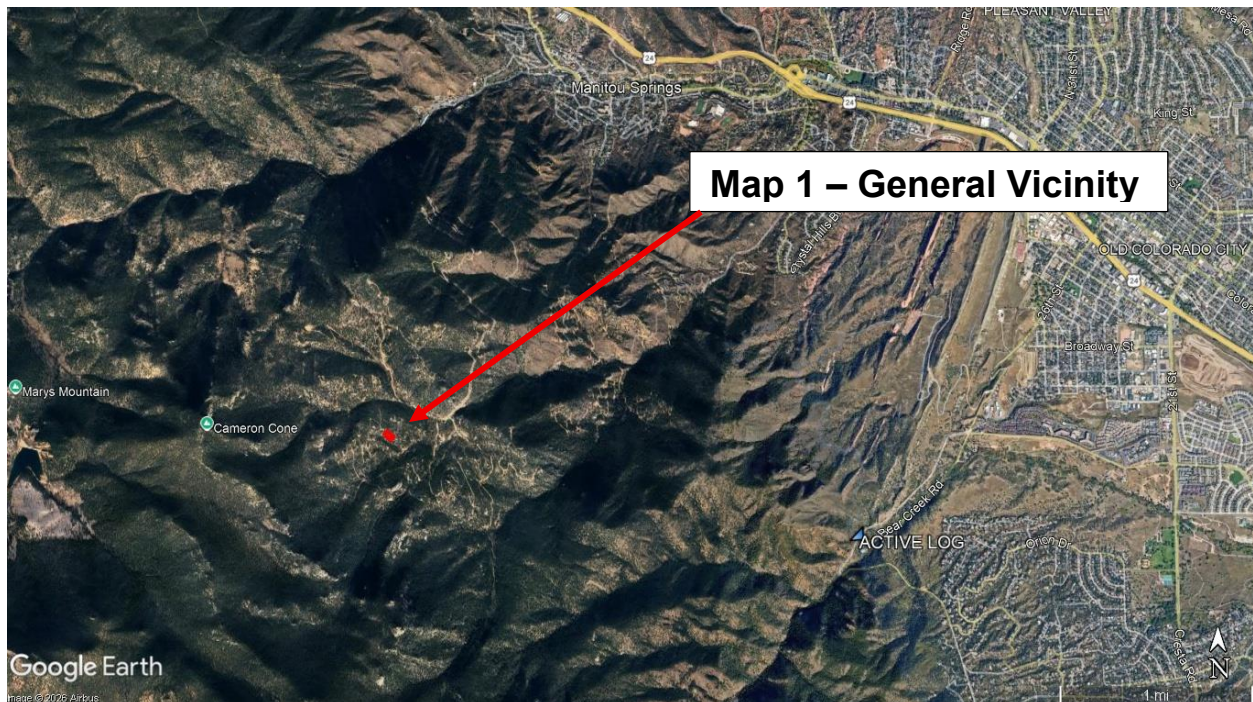
Prepared by: **Stephen J. Spaulding**  
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**(719) 641-0769**

**Warning and Disclaimer:** The degree of protection from wildfire hazards intended to be provided by this plan is considered reasonable for planning purposes. It is based on accepted forestry and fire science methodology. This plan is intended to aid the property at 6065 Waterfall Loop in minimizing the dangers and impacts from wildfire hazards. Fire is a natural force and a historical part of the ponderosa pine and native grassland ecosystems. Therefore, unforeseen or unknown wildfire conditions, natural or man-made changes in conditions such as climate, vegetation, fire breaks, fuel materials, fire suppression or protection devices, and ignition sources may contribute to future damages to structures and land uses even though properly permitted within designated wildfire hazard areas.

*May 2026*

## General Description

The property at 6065 Waterfall Loop is situated in unincorporated El Paso County located within a community better known as Crystal Park. The property is 0.70 acres in size. The development plan is to add a structure separate from the main residence to be utilized as a garage. The parcel number listed under this report is identified with the El Paso County Assessor's as Schedule Number 7418000113.



The subject property lies within the Crystal Hill subdivision and is bordered entirely by private land. There are residences on both the east and west sides of the subject property.

The subject property does lie within the Wildland Urban Interface, and it is considered a severe risk. The Wildland-Urban Interface (WUI) Risk Index layer is a rating of the potential impact of wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts on people and homes.

There is residential development in the area with the assessment giving the housing density a rating of 5. Structures are situated such that there averages one structure per 2 acres of area up to one structure per five acres. This translates to a moderate spacing between structures and tempers the risk of wildfire spreading from structure to structure.

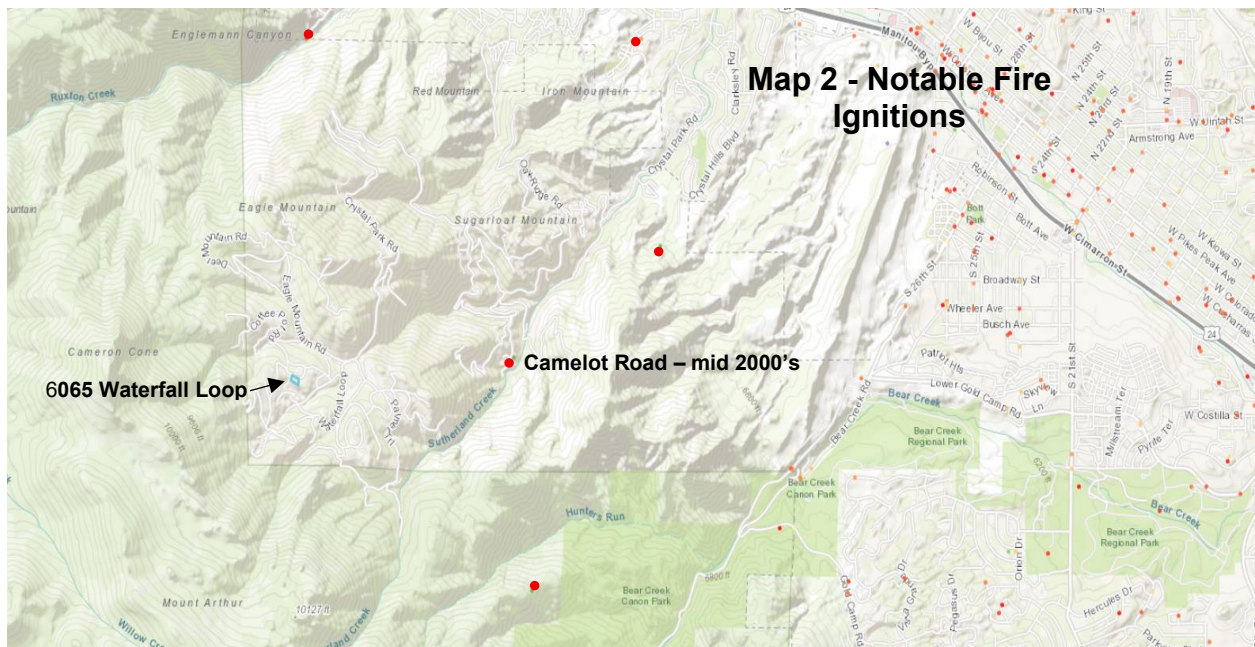
Due to the very steep terrain upon which the subdivision is located, there are locations where there is more density than just one structure per 2 – 5 acres. Where the

topography is relatively flat, more structures tend to be located. Such is the case in the immediate vicinity of the property. There are structures located on either side of the subject property

The area does have a significant wildfire history. The closest large wildfire was the Waldo Canyon Fire that burned in June of 2012. The fire location is approximately 10 miles away from the subject property.

Fire Occurrence is an ignition density heat map that represents the likelihood of a wildfire starting based on historical ignition patterns. The Heat Map for and surrounding the subject property is rated as Very High (8/9).

A review of the historical wildfire ignitions reveals very few federal or non-federal occurrences. This would seem to be somewhat in contradiction to the heat map. It should be noted that all ignitions may not have been included in the assessment or were not reported (see Map 2).



**Note: Point Source for Ignition in proximity to property highlighted in red for easier view. There may be others that were not reported.**

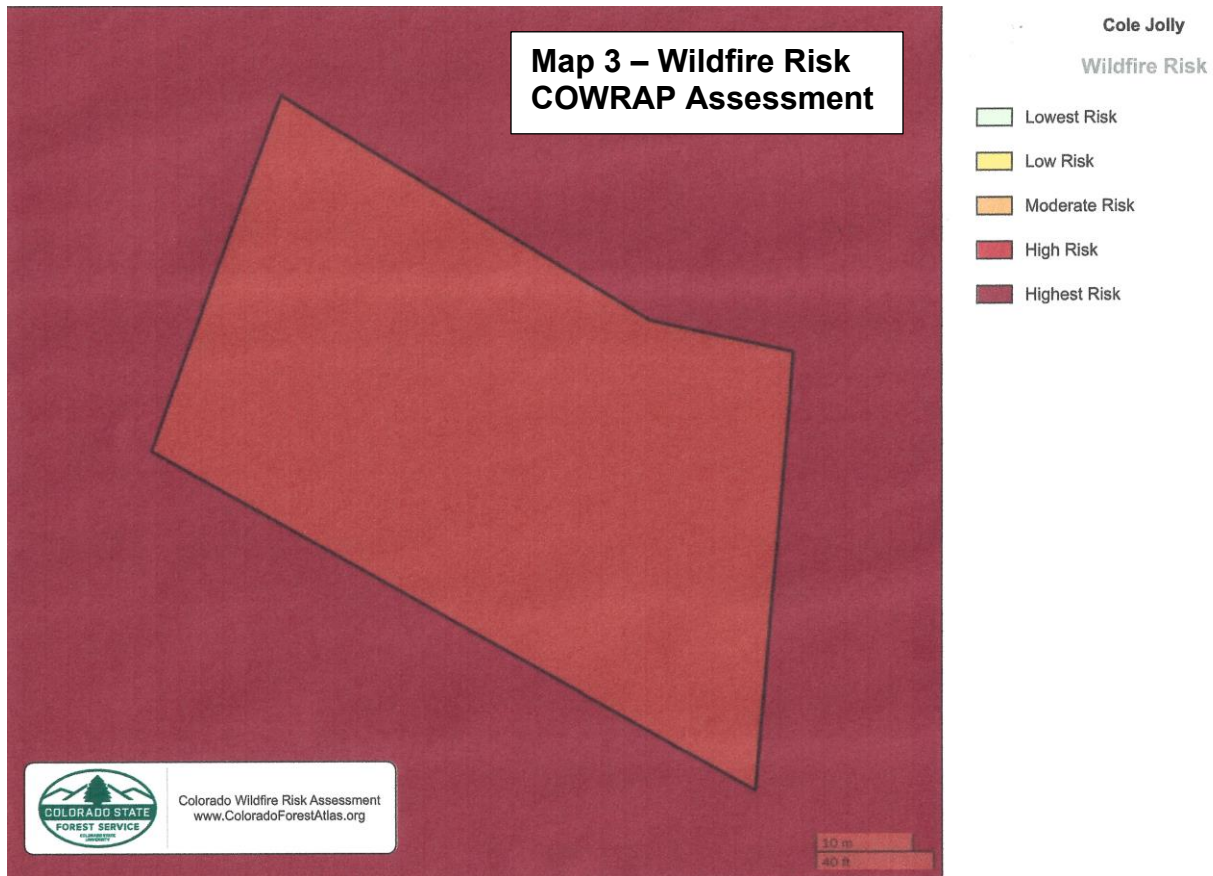
## Wildfire Hazard

The Colorado State Forest Service developed a wildfire risk assessment tool in 2012 referred to as the Colorado Wildfire Risk Assessment Web Portal (CO-WRAP). This assessment was recently updated to include wildfire events and acres mitigated up to 2017. A copy is attached to this report.

Within the assessment report, the Wildfire Risk to Assets within the property is considered as having the Highest (see Map 3). Wildfire risk is a composite rating which identifies the probability of loss or harm from a wildfire. Risk identifies the greatest impacts from a wildfire to a range of assets, such as the level of Wildland Urban Interface. Wildfire Risk is determined uniformly across the entire state.

The Highest Rating is probably a result of two factors. The first being the large number of structures in the subdivision. Currently there are 360 homes situated on 2,000 acres. These homes may be somewhat isolated or in clusters where the topography permits. The second is the fuel type, which is designated as a shrub in the assessment, which may be incorrect.

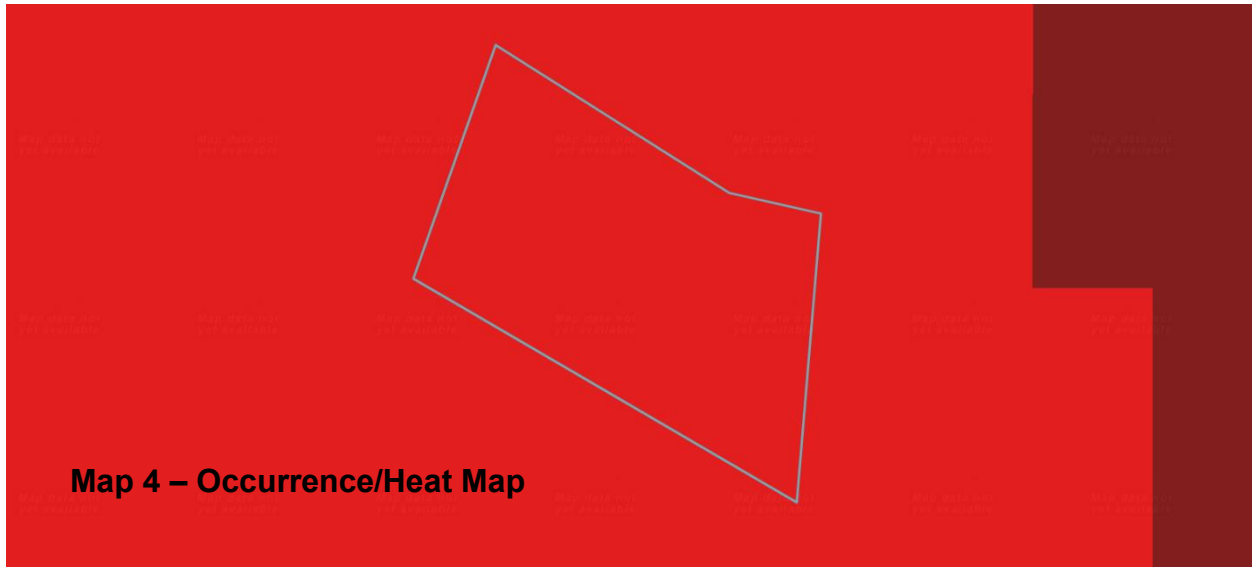
The Burn Probability is the annual probability of any location becoming subjected to a wildfire event. The assessment assigns a Very High rating (see Appendix C). This is unexpected as there appears to be a small number of ignitions in the area. It would be reasonable to anticipate ignitions occurring from residential traffic. In the last twenty years there has been only one reported ignition incident in the subdivision (see Map 2).



The CO-WRAP assessment uses a detailed and distinct series of fuel models. This is a more dynamic approach, but it does not delineate between smaller fuel beds but considers them uniform across large areas. So even though there may be clusters of shrubs or grasses present, a refined timber fuel model might be described incorporating these variations.

A field inspection was performed on May 2<sup>nd</sup>, 2026 to determine if any change should be made to the CO-WRAP assessment.

The Heat Map which represents fire occurrence, is an ignition density map that displays the likelihood of a wildfire starting based on historical ignition patterns. While the map indicates the highest risks, the number of actual ignitions reported seems low in comparison.



*Dark red indicates the highest probability. Red represents the next lowest probability.*

The Burn Probability of High to the Highest is confirmed. It would appear the most likely scenario for a wildfire ignition is by a lightning strike. Another factor is the slope heading uphill from Coffee Pot/Eagle Mtn. Roads. The slope exceeds 25%, which is considered extreme regarding wildfire behavior.

Based upon the field inspection coupled with the COWRAP assessment, **the wildfire risk was confirmed as the Highest.**

## Wildfire Behavior

This rating considers the role of the three major components that affect wildfire behavior: fuels, topography and weather. These three components will be examined in relation to the Hancock II subdivision.

### Fuels

The area was field checked, and the results of the COWRAP Assessment were adjusted based upon the observed fuel models on the property. The USDA – Forest Service Intermountain Forest and Range Experiment Station in Ogden, Utah, developed these fuel model descriptions. They are used as aids in estimating fire behavior (see Appendix A).

The criteria for choosing a fuel model reflects that wildfire will burn in that fuel type which best supports that fire to spread. There may be more than one fuel model represented on any given area of land. In addition, current and expected weather conditions will influence the condition of these fuels.

From the COWRAP assessment the area in and around the property is considered as Very High Load, Dry Climate Shrub (SH7). The SH7 model describes woody shrubs and shrub litter as the main carrier of a fire to other locations. There is a very heavy shrub load with a fuel bed depth of 4 to 6 feet. The spread rate can be high and flame lengths are very high.

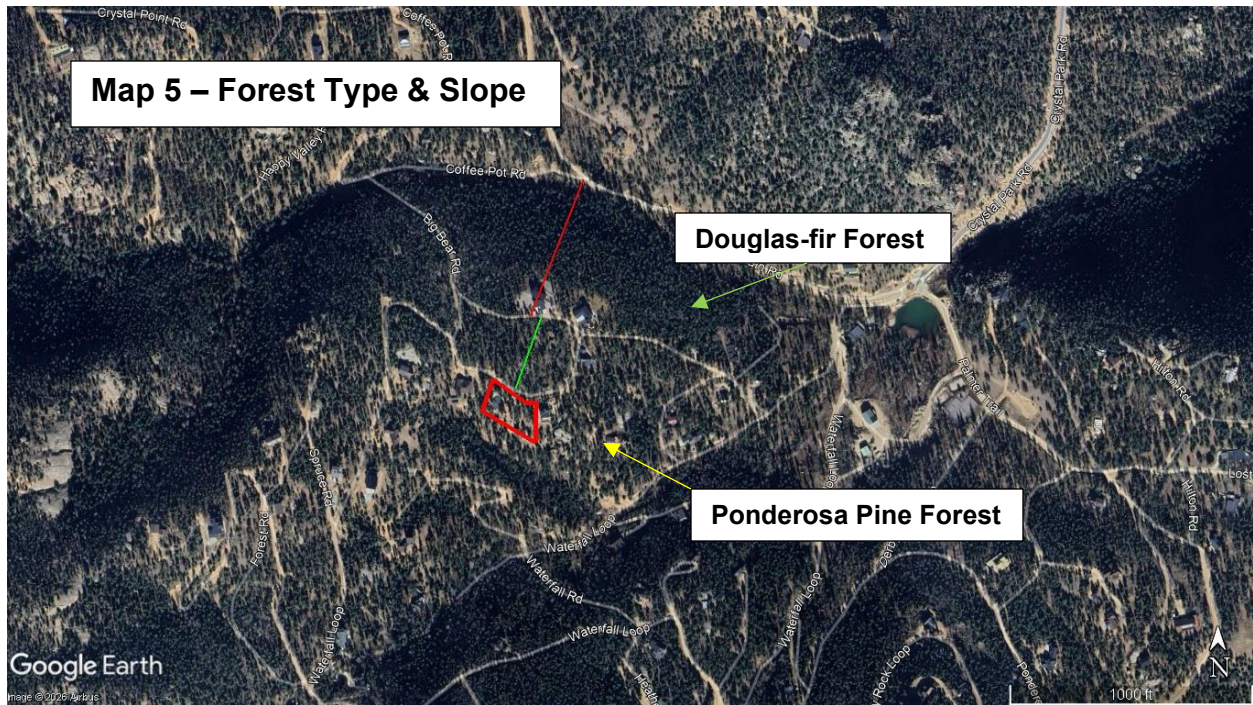
However, the assessment may be incorrect in selecting this fuel model. Photo 1 shows the absence of a quantity of shrubs growing on the property that would be representative of SH7. The area to the north and downslope from the property would more closely represent this fuel model. The area is comprised of a Douglas-fir forest and there would be fir reproduction that would be considered as the shrub component (see Map 5).

The area around the property should be considered as a ponderosa pine forest. This could be expected as the top of the slope is drier being more exposed to winds and direct solar radiation. This would favor the establishment of the pine over the fir. The Douglas-fir is found mostly on the cooler and shaded north facing slopes.

The fuel model that best represents this area may be TL1, Low Load Compact Conifer Litter. The pine litter layer is expected to be the fire carrier across the property. The depth of this fuel bed can be one (1) to two (2) inches deep. The spread rate should be very low as well as the flame length.



***Photo 1. A view of the ground fuels looking across the property towards the south/southeast. Note the absence of a shrub fuel load. The gray area is exposed bedrock (blue arrow).***



**The green line represents a slope of approximately 5%. The red line represents a slope greater than 25%.**

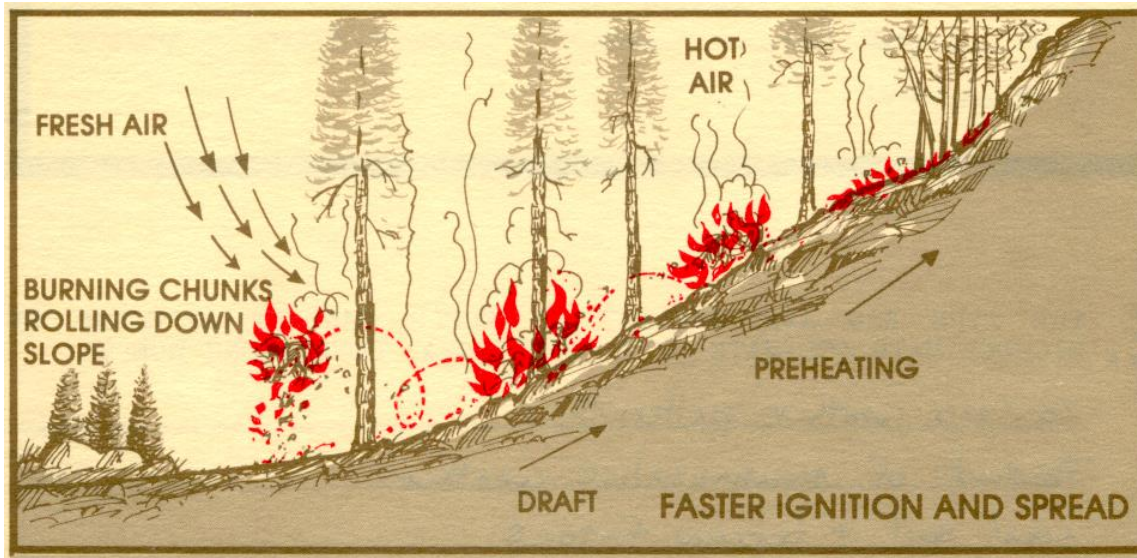
Based on the observed vegetation present and its current condition, the fuel model is best described as TL1. This could allow the wildfire risk to be lowered.

## Topography

The topography of the site is one of the main factors that will influence the spread of fire. The aspect or compass direction that any slope faces influence the fuel type that exists and the amount of preheating these fuels receive by the sun. Aspect can also influence the effects of diurnal winds, as they move upslope during the daylight hours and down slope during the evening and early morning hours.

As the percentage of slope increases, the rate of fire spread by convection increases. In other words, wildfire burns faster moving uphill (see Figure 1).

**Figure 1. Slope Affects Fire Spread**



The slope approaching the property from Cross Country Trail to Waterfall Loop is relatively flat. The slope across this area is calculated at approximately 5.7%. This should not significantly influence the spread or intensity of wildfire and may reduce flame lengths and the rate of spread from the steep slope below.

This area is considered as ponderosa pine forest with compressed conifer litter on the surface. This area is approximately three hundred (300) feet wide and could be considered as a fuel break extending to the front of the property on Waterfall Loop. The presence of this area could also lower the wildfire risk.

The rear portion of the subject as a steep slope of 27% running from the floor of the drainage to the back deck of the residence. This is a short pitch of approximately one hundred (100) feet (see Photo 2). Based on the modification of the fuels, this should not be considered a high risk in supporting a fire's spread.

Only slopes greater than 25% are considered extreme slopes in their effect on wildfire behavior. This is the case in the Douglas-fir covered slope below the property which is upwards of 28%.

## **Weather**

Weather is the most variable of all the factors. The accumulative effects of weather over time can influence vegetation curing and fuel moisture content.

Grass, for example, are described as being one-hour time lag fuels. Time lag is a measure of the rate at which a given dead fuel gains or loses moisture. Hence grasses tend to be influenced by the weather conditions on an hourly basis. Wood fuels that are

three inches in diameter or larger are considered 1,000-hour time lag fuels. This type of fuel requires a long period of dry or wet weather to affect its combustibility.



**Photo 2. This is a cross-section view of the slope behind the residence. Note the wide spaced trees and lack of ladder fuels (red arrows).**

Winds can influence the direction and rate of spread of wildfire. Of greater concern is the short spotting of the fire by embers transported by winds ahead of the main fire.

The effect of wind on a fire was on display most dramatically during the Marshall Fire in Boulder County (December - 2021) . This fire grew to over 6,200 acres and destroyed 1,084 homes. The wind gusts of up to 115 miles per hour were reported. The wildfire reached the town of Superior, three miles away, in just one hour.

It should be noted that this level of high wind activity is not uncommon in northern portions of El Paso County. Finally, it should not be assumed that the main periods of fire danger would be in the summer months. As history has shown, out of season fire events are much more common than might be expected by the public. The dry weather conditions of 2025 – 2026 provides an excellent example.

While the weather may contribute greatly to a wildfire event, it is immune to outside influences.

## Predicted Fire Behavior

Using the USDA – Forest Service BehavePlus fuel modeling system 5.05, the following predictions can be made based upon an 80-degree temperature day with a relative humidity of 18% with little cloud cover at 1:00 p.m. in the month of July.

Using the inputs of the 1-hour dead moisture being 7%, the 10-hour and 100-hour dead fuels are both set at 10%; live herbaceous (grasses) and live woody stems are set at 200%. This would be an expectation of mid-summer growth. It could be a windy day, or the site is experiencing strong downdrafts from thunderstorms, so the windspeed is set at 10 mph. Slopes steepness is set at 6%.

Based on these inputs, wildfire would spread at a rate of approximately 46 feet per hour with a flame length of one-half (0.5) to one (1) feet (6-12 inches).

The fuel model input is changed to reflect the lower steep slope below the property (SH7). Using this fuel model and keeping the same scenario as previous, except for increasing the slope to 20%, The rate of spread increases substantially to 2,013 feet per hour or 33 feet per minute. The flame length approaches ten (10) feet in length.

Assuming drought conditions as currently being experienced, the 1-hour dead fuel moisture is lowered by 3%. The 10-hour and 100-hour dead fuels have dried to 5%. The live fuel moisture is 50%, reflecting an early dry growing season.

The wind speed of 10 mph and a slope of 20% remain the same as in the previous example. With the drier conditions, flame lengths could reach up to twenty (20) feet. The rate of spread accelerates up to 5,525 feet per hour or 92 feet per minute.

The probability of fuels igniting in advance of the fire front is 86% with spotting from embers travelling 0.3 miles or over 1,500 feet. In the time that it may take for the fire to be noticed, reported to the fire department's dispatch office and for the arrival of the initial attack force, assume 15 minutes, the fire could have traveled over 1,000 feet.

It is predicted that local suppression forces will not be able to contain the initial fire outbreak with mobile engines and hand constructed control lines. This assumes a severe case scenario using fuel model SH7.

It should be noted that these predictions are based upon normal weather conditions prevailing over the course of a year. Weather conditions that were exhibited from the winter of 2022 through the present date have been outside of normal conditions resulting in the catastrophic losses experienced throughout the western United States this past fire season. Again, the Marshall Fire provides an insight into what fire behavior might occur even in the winter season.

If such conditions are present on or in the vicinity of the proposed development site, any wildfire event can be predicted to be more severe and resistant to initial control efforts.

## Wildfire Mitigation

It should be noted here that the occurrence of a wildland fire on this property and any subsequent spread of a wildfire to adjacent land could never be eliminated. In the Spaatz Fire, near Monument, suppression forces were able to arrive on scene in approximately four minutes after the fire was reported. Even with this rapid response, the wildfire reached a size of 67 acres before it was controlled.

**The potential for loss can be reduced, and the odds can be improved that initial response forces can be successful in keeping a wildfire to the smallest size possible and structure loss to a minimum. But even with the best efforts of suppression forces, there will always exist a level of risk of loss to wildfire.**

The only way to reduce the risk of loss from wildfire is to modify the factors that influence fire behavior. Of the three factors discussed previously, the only factor that could be modified prior to a wildland fire is the fuels. The efforts in modifying fuels can be targeted to their arrangement, continuity and availability.

### • Arrangement

The arrangement of fuel considers the size, shape and compactness of the fuel itself. Smaller fuel sizes have greater surface area exposure for preheating. If these smaller sized fuels are only lightly compacted in spacing this results in easier ignition and increased combustion.

Fuels that are tightly compacted and larger in size have lower surface areas. This reduces ignition and combustion.

One technique in reducing the readily ignitable fuel level would be to remove fuels, such as dead leaves, fallen limbs and other small organic debris, from the garage construction site. However, it is not practical to remove these types of fuels from the entire property.

During the construction phase of the garage, the most likely source of ignition will come from personnel and activities. These sources of ignition may come from flammable chemicals, improperly discarded cigarettes, shorts in electrical equipment, and other means.

It is suggested here that the reduction of the readily ignitable fuel be performed in areas that are within fifty feet of the pad of the garage. This will reduce the amount of readily ignitable fuel in proximity to the structure and the main residence. It will also retard the spread of a fire and provide suppression forces additional time to contain a fire quickly.

Once a structure is built, a Home Ignition Zone should be established. Based on observations from the field visit, this has been mostly established. Home Ignition zones coupled with Defensible Space are intended to slow a fire down so that it may be controlled and extinguished. There are three zones that comprise a Home Ignition Zone. Detailed information these concepts can be found on the Colorado State Forest Service website at the following link: [Protect Your Home & Property from Wildfire | Colorado State Forest Service | Colorado State University](#)

The first zone is the one that contains the most opportunity for modification. This zone is designed to prevent flames from coming in direct contact with the structure and extends out for a minimum of five feet from any structure. A brief synopsis of the steps that can reduce the risk of ignition of a structure from a fire is found below.

Use non-flammable, hard surface materials in this zone, such as rock, gravel, sand, cement, bare earth or stone/concrete pavers. Remove all flammable vegetation, including shrubs, slash, mulch and other woody debris. Do not store firewood or other combustible materials inside this zone.

The second zone extends from 5 to 10 feet from any structure. To retard the spread of fire in Zone 2 may include all or some of the following steps described below.

Mow grasses to 4 inches tall or less where practical. About the windbreaks or conservation plantings of Eastern red cedar, these groups of trees may be left in areas of Zone 2. Spacing of 30 feet should be maintained between remaining tree groups to ensure a fire does not jump from one group to another, which is currently the case. Remove ladder fuels under remaining trees. Prune tree branches to a height of 6-10 feet from the ground or a third of the total height of the tree, whichever is less. Due to the short height of the surface fuel bed, the Eastern red cedar has already been sufficiently pruned (see Photo 3). Remove stressed, diseased, dead or dying trees or shrubs as necessary.

Zone 3 is mostly concerned with improving forest health. Any locations within this zone with excessive fuel load should receive treatments as described in Zone 2. This is where additional mitigation could be most effective. The area to the north of the property should continue to be mitigated in conjunction with the Crystal Park Volunteer Fire Department. This may include cleaning the forest floor of heavy fuels and separating the forest canopy where appropriate.

Additional information on the development of wildfire safety zones is available through the Colorado State Forest Service at the following link: [2021 CSFS HIZGuide Web.pdf](#)

- **Continuity**

The second factor affecting fuels that can be modified is their continuity. Is the fuel continuous or patchy in nature? Is the fuel layered in such a manner that it can leave the ground and spread into a vegetative canopy?

In this instance, the fuels in the compressed forest litter fuel model are continuous.

- **Availability**

The final consideration is the availability of the fuel to be physically burned. This factor is influenced by the weather on a daily or yearly basis and cannot be readily influenced.

While a heavy spring storm deposited a layer of snow just prior to the field inspection, the current weather patterns have contributed to a long-term drought situation. This has influenced the availability of fuel to ignite and burn. The trend of above average daytime temperatures and below normal precipitation levels have allowed fuels to reach a higher state of availability than might normally be the case, particularly during winter months. This may result in wildfire acting in a manner that might be more characteristic of mid-to-late summer burning conditions.

## **Other Considerations**

### ***Firebrands & Secondary Ignitions***

It is becoming more apparent that structure loss is not occurring during the passage of a burning wildfire front but from ignition of the structure by firebrands and secondary ignitions. Firebrands are burning materials or embers that are lifted into the air by convective wind currents. Firebrands can be cast hundreds of feet in advance of the fire front.

Research and case studies in Australia have found that there is a 50% probability of loss of structures that are 100 – 200 feet from the fire front. This would seem to indicate that firebrands are a major contributing factor of structure loss.

In the U.S., studies indicate there is 90% probability that a structure with a non-flammable roof and that is at least 100 feet from the fuel bed will not be lost during a wildfire. However, this statistic may be misleading as the Cedar Fire (CA) in 2003 indicated that 60% -70% of the structures lost were ignited by firebrands. This would also infer that solely relying on 'defensible space' for structure protection may not be adequate.

In a professional paper by Scott (2005), the exposure of a structure to embers and firebrands is discussed. In an inference to fuel mitigation in the 'defensible space' zones, Scott states that "In no case is complete removal of the forest canopy required to mitigate crown fire potential near a structure." This infers that 'defensible space', while a good starting point, may not be the whole solution in preventing structure loss.

***Currently, fire-safe construction is the recommended protocol for fire brand risk reduction by the professional wildfire community.***

### ***Roads and Driveways***

Roads and driveways to individual lots should be constructed in accordance with NFPA 1141, *Fire Protection for Planned Building Groups*. Specifically, road widths should not be less than twenty-four feet to allow for simultaneous access of emergency equipment and evacuation of visitors.

Driveways should provide a minimum width of twelve feet and a minimum vertical clearance of fifteen feet. The grade of any driveway should not exceed 12%. The entrance to any driveway from public roads should not exceed a ninety-degree angle. A turnaround should be provided at all structure sites on driveways over three hundred feet in length. These turnarounds should be within fifty feet of any structure.

## ***Landscaping***

The vegetation that is used in the landscaping of the structure should be fire resistant. For example, ornamental junipers can be very flammable and easily ignited by aerial firebrands. Planting these shrubs near the exterior walls of any residential structures provide a readily available fuel source that could threaten the structure and divert suppression forces to protect the building instead of controlling the wildfire.

From the historical fire record of the region, the ignition of ornamental junipers around structures is a major contributor to damage and subsequent loss. **It is strongly recommended that the use of junipers and any other lowing growing ornamental conifer in the landscape be prohibited within thirty feet of a structure's foundation.**

It is assumed here that a native landscape is the preferred condition. Grass should be mowed on a regular basis where it is within proximity to any planned residential structure and outbuildings.

An alternative to irrigated green space would be to line the footprint of the foundation of the structure with rock. If rock is used, it should be placed at a minimum width of five feet from the foundation. This will prevent flame lengths from reaching the building.

There are many different sizes and types of rock available. It should be noted here that it would be necessary to remove leaves and other litter from within this rock fuel break on an annual basis.

Based upon the compressed forest litter present, it may only be necessary to remove this material each fall. Ponderosa pine naturally sheds its three (3) year old needles. This litter is more flammable as it is light fluffy and not compressed onto the forest floor.

## ***Construction Considerations***

Predictable sources of fuel that will burn and allow entry of wildfire into the structure will be debris that is trapped under or next to the building or accumulation in the roof gutters. Porch, foundation, roof and ventilation openings should be screened off or enclosed to keep debris from accumulating and burning underneath. This is particularly important where wooden decks are planned at ground level. This was a factor in the loss of structures in the Waldo Canyon Fire. These location concerns were also expressed in a joint publication by [Green Builder Media](#) and the NFPA. This recently released e-book, 'Design with Fire in Mind', can be downloaded using the link. Go to the Resources tab and click on e-books.

During the Waldo Canyon Fire, burning decks were removed to prevent the spread of the fire into the main residential structure. This was due to embers being blown underneath wooden decks. The flammable debris present under the deck ignited, resulting in the deck itself burning and subsequently damaging or destroying the main residential structure.

**It is strongly recommended that all decks that are planned at ground level be required to be sealed off and enclosed to prevent the accumulation of flammable debris underneath them.**

The National Institute of Standards and Technology published results from experiments that examined how fire spread toward a structure is affected by combustible fences and mulch under conditions that may be encountered in a wildland-urban interface fire.

The study found that firebrands capable of igniting spot fires downwind were generated by nearly all combinations of fence and mulch tested. Mulch was placed under the fences to mimic debris that commonly accumulates under or around them. A target mulch bed at the base of a constructed structure tested the ability of firebrands produced by the burning fence and mulch (simulated debris) to ignite spot fires that threatened the structure.

The result was that all wood fences with mulch (simulated debris) at the base caused spot fires in the target mulch bed. In summary, fire spread is more likely with wood and wood-plastic composite fences than with fences made of vinyl or noncombustible materials such as stone, brick, or steel.

More details on this study can be found at [Wind-Driven Fire Spread to a Structure from Fences and Mulch \(nist.gov\)](#)

In a wildfire risk assessment in a local development, a significant entry point for fire into a house was through the eaves, overhangs or soffits. These locations can trap embers and combustible gas or heat, that can ignite the structure.

**Based upon recommendations from FEMA, overhangs, if used, should be enclosed with a flat, horizontal soffit with a one-hour fire resistance rating. The fascia should be constructed of non-combustible material.**

The combustibility of a roof is one of the most important factors in determining the risk of a structure to damage or loss from wildfire. The use of combustible materials such as wood shingles does not necessarily increase their susceptibility to fire. However, as a wood shingle roof ages and is influenced by the weather, individual shingles may start to warp, curl, and lose the tightness that was exhibited upon initial installation.

Siding materials, while not as critical as compared to roof, can help to lower the overall risk of a structure to damage from wildfire. Where a high wildfire risk exists, the wildfire intensity could ignite combustible siding material

**It is recommended that where slopes exceed 15% in areas where the wildfire hazard is considered high, non-combustible siding materials should be used in the construction of structures.**

Due to the increased loss of structures to wildfire events nationwide, there is growing emphasis on 'hardening the structure.' A recent report published by Headwaters Economics discusses the costs of added protection during construction of a residential structure. A copy of the full report can be downloaded at: [Construction Costs for a Wildfire Resistant Home, California Edition \(headwaterseconomics.org\)](https://www.headwaterseconomics.org/reports/construction-costs-for-a-wildfire-resistant-home-california-edition)

The report lists several construction improvements that are relatively inexpensive to install.

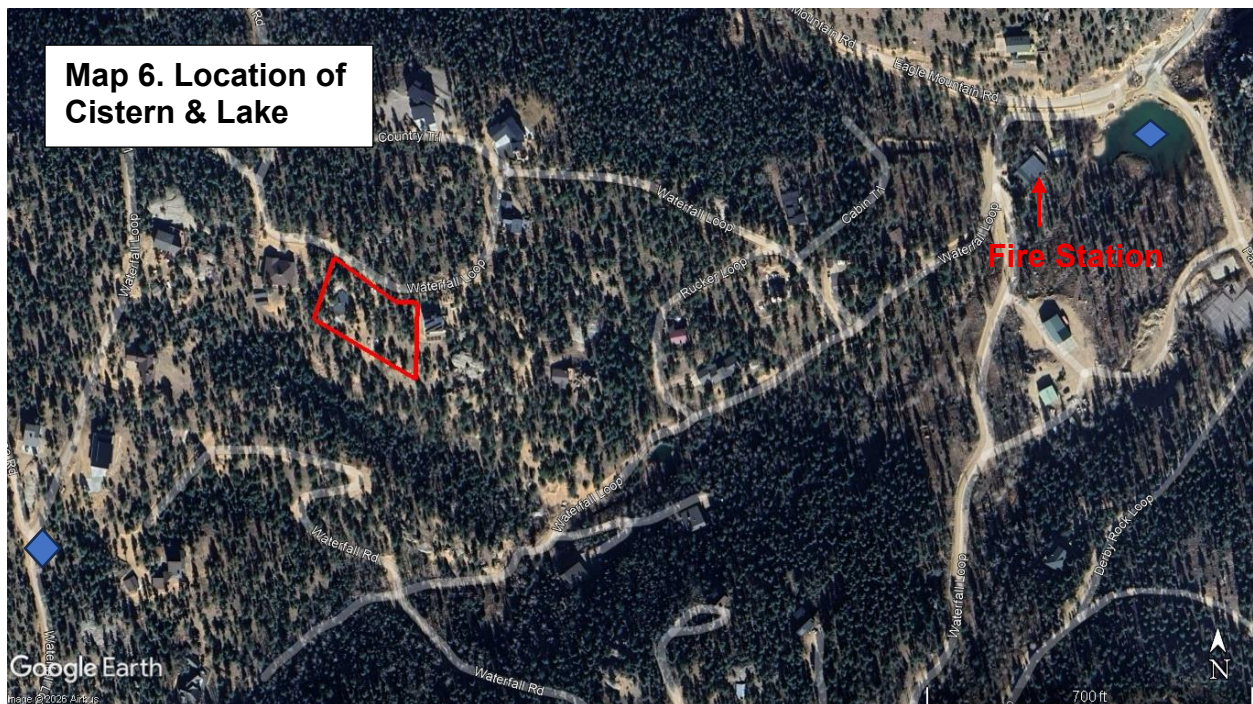
**It is strongly suggested that firewood storage be located at least fifteen (15) feet away from any structure and cleaned of fine flammable debris such as needles on a regular basis.**

## Water Supply

The property is within unincorporated land of El Paso County, and fire protection is provided by the Crystal Park Metro District. The initial response to a wildfire event would be provided by the Crystal Park Volunteer Fire Department located at 496 Palmer Trail (see Map 6)..

The department has the availability of 1 engine, 1 brush truck and 2 water tenders at any given time. The water tenders have a combined capacity of 3,800 gallons. There are no full-time employees assigned to the fire station. It is assumed that maintenance personnel are cross trained on fire equipment and may be first responders until volunteers arrive.

In the event of extended attack on a wildfire, the Manitou Springs Fire Department would respond. This department automatically dispatches resources to any report of a fire in the subdivision.



The blue diamonds show the location of a cistern and lake for water supply.

The cistern #319 along Waterfall Loop and Spruce Road is listed as having a 1,500-gallon capacity (see Map 6). It is 0.29 away from the subject property. The recreational lake is slightly further away from the property. Both locations should be capable of refilling the Crystal Park fire department tankers.

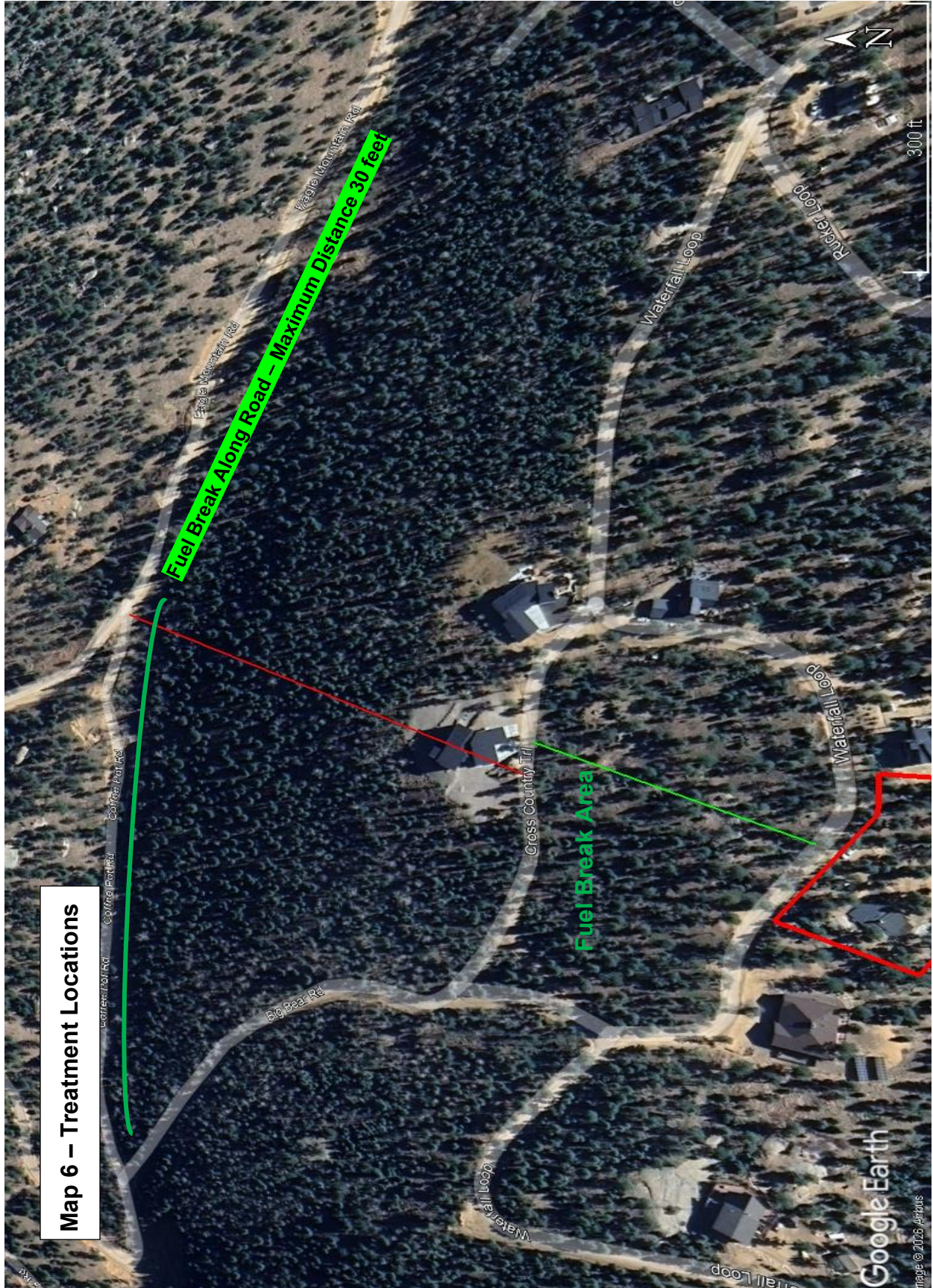
## ***Forest Management***

There is no forest management required. The trees on the property have been thinned and the ladder fuels removed. At present there are no infections of dwarf mistletoe and no infestations of mountain pine in the immediate area. No further maintenance is needed.

The slope below the property could be thinned and downed trees removed. However, due to the steep slope mentioned previously this may be impractical. An alternative would be to create a fuel break along Coffee Pot/Eagle Mtn Roads.

This would require cooperation from the HOA and local lot owners. It is suggested here to limit the width of the fuel break to a maximum of thirty feet due to the steep slope. The intent is to give the local volunteer fire department members a chance to respond successfully.

Another approach would be to bolster the ponderosa pine along Waterfall Loop and attempt to reach downhill towards Coffee Pot/Eagle Mountain Roads (see Map 6). Again, the limit of width downhill may only reach thirty (30) feet. The Waterfall Loop portion should have an aggressive approach to removing ladder fuel and dead ground fuel. Live green trees should be spaced so that the live green crowns do not touch.



# **Appendix A**

## **Fuel Model Descriptions**

### **Fuel Model 9 Summary Page**

Source: Anderson, Hal E. Aids to Determining Fuel Models for Estimating Fire Behavior, National Wildfire Coordinating Group, General Technical Report INT-122, April 1982.

“This report presents photographic examples, tabulations, and a similarity chart to assist fire behavior officers, fuel management specialists, and other field personnel in selecting a fuel model appropriate for a specific field situation. Proper selection of a fuel model is a critical step in mathematical modeling of fire behavior and fire danger rating.

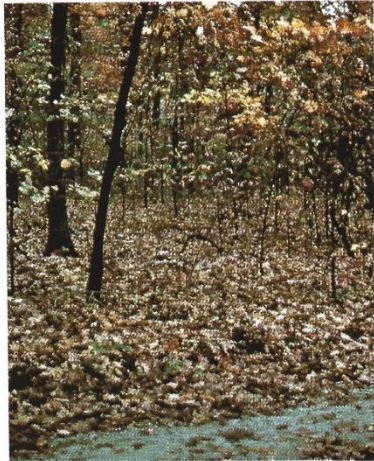
### **Very High Load, Dry Climate Shrub (SH7) Summary Page** **Low Load Compact Conifer Litter (TL1) Summary Page**

Source: Scott, Joe H. & Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel’s (1972) surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

“This report describes a new set of standard fire behavior fuel models for use with Rothermel’s surface fire spread model and the relationship of the new set to the original 13 fire behavior fuel models.”

### Fire Behavior Fuel Model 9

Fires run through the surface litter faster than model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red pines, or southern pine plantations are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.



*Photo 25. Western Oregon white oak fall litter; wind tumbled leaves may cause short-range spotting that may increase ROS above the predicted value.*



*Photo 26. Loose hardwood litter under stands of oak, hickory, maple and other hardwood species of the East.*



*Photo 27. Long-needle forest floor litter in ponderosa pine stand near Alberton, Mont.*

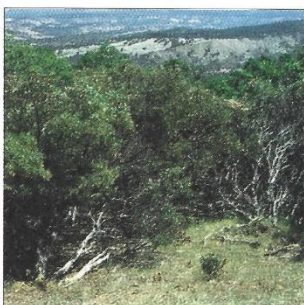
NFDRS fuel models E, P, and U are represented by this model. It is also a second choice for models C and S. Some of the possible field situations fitting this model are shown in photographs 25, 26, and 27.

### Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, 1/4-inch, tons/acre	2.9
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

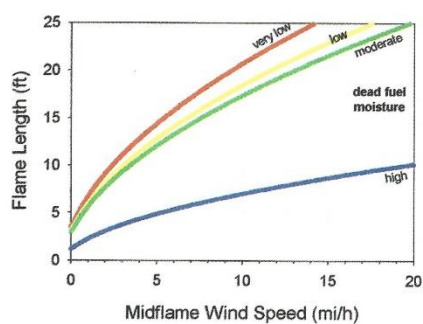
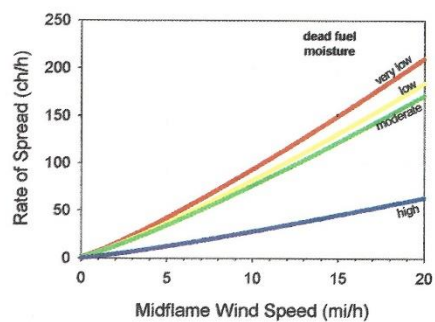
## SH7 (147)

### Very High Load, Dry Climate Shrub



**Description:** The primary carrier of fire in SH7 is woody shrubs and shrub litter. Very heavy shrub load, depth 4 to 6 feet. Spread rate lower than SH7, but flame length similar. Spread rate is high; flame length very high.

Fine fuel load (t/ac)	6.9
Characteristic SAV (ft-1)	1233
Packing ratio (dimensionless)	0.00344
Extinction moisture content (percent)	15



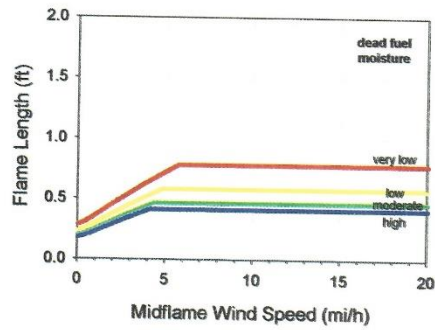
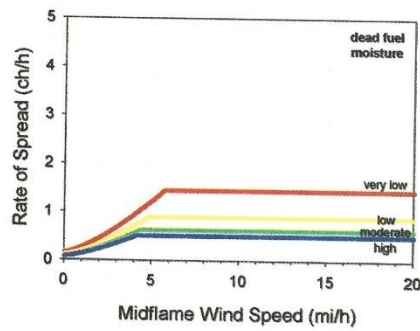
TL1 (181)

Low Load Compact Conifer Litter



**Description:** The primary carrier of fire in TL1 is compact forest litter. Light to moderate load, fuels 1 to 2 inches deep. May be used to represent a recently burned forest. Spread rate is very low; flame length very low.

Fine fuel load (t/ac)	1.0
Characteristic SAV (ft-1)	1716
Packing ratio (dimensionless)	0.04878
Extinction moisture content (percent)	30



# Appendix B

## CO-Wrap Assessment

Attached under a separate copy

**Note:** Wildfire maps are obtained through the Colorado Wildfire Assessment Portal and subsequent assessment report.

