Pre Planning For Urban Interface Fires In The Perry Park Ranch Subdivision

Leading Community Risk Reduction

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Jimmy. C. Bumgarner Jr.

Larkspur Fire Protection District, Larkspur, Colorado

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Certification Statement

I herby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed _____

Abstract

Perry Park ranch currently lies within the boundaries established for Urban Interface fires. No comprehensive pre plan exists for Perry Park Ranch during an Urban Interface fire event therefore the lack of planning places the residents of Perry Park and responders arriving to mitigate the incident in danger.

The purpose of the research is to determine the components of a pre plan and recommend steps to improve the safety of residents and responders. By using descriptive research the answers to the following questions were determined.

- What elements make up a comprehensive preplan for urban interface incidents?
- What risk factors determine how susceptible a subdivision is during an urban interface fire?
- What risk factors are contained within Perry Park Ranch?
- What can we do to increase the safety of the residents and firefighters during Urban Interface fires in Perry Park ranch?

Using NFPA 1144, I determined that Perry Park ranch is in a high hazard category for wildfires, and contains all of the items that make subdivisions susceptible to wildfires. To increase safety during wildfire events we must increase pre planning efforts, and improving coordination between all agencies involved at the local, state, and federal level.

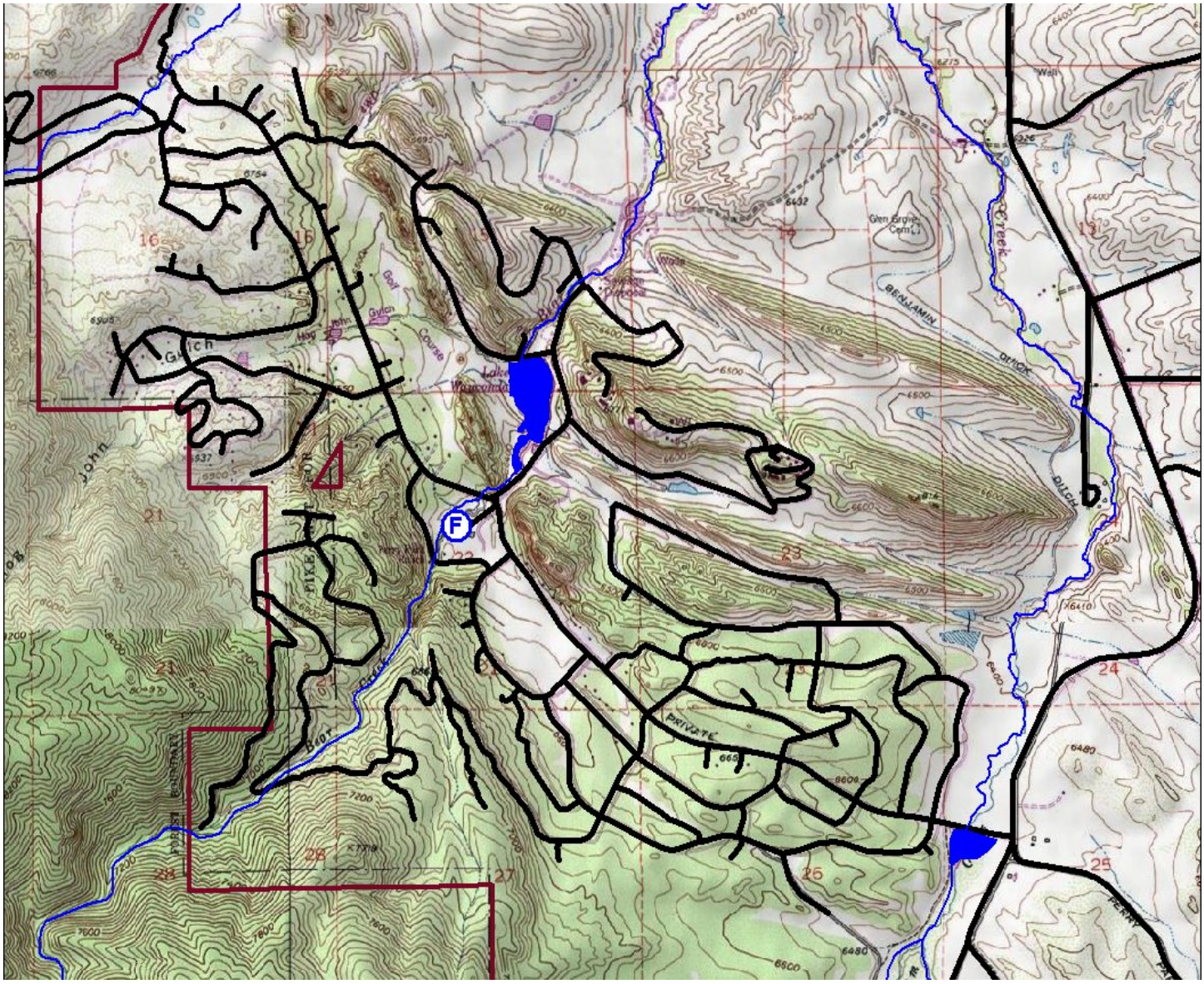

Figure 1

Map of the Perry Park Ranch Subdivision

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Introduction

The Urban Interface fire problem is not isolated to Larkspur, Colorado. The problem exists all across the United States, and for that matter the whole world. To truly understand the problem we need to define the term Urban Interface. According to National Fire Protection Association (NFPA) 1143, *Standard for Wildfire Management* (NFPA 1143) the Urban Interface is defined as "any area where wildland fuels threaten to ignite combustible homes and structures."

The Larkspur Fire Protection District has been aware for sometime about the Urban Interface fire problem within our district and particulalry in Perry Park. Beginning in the late 1990's our district began educating the citizens about living in the urban interface and how to prepare for the eventual fire that will occur. Many residents refuse to accept the fact that an Urban Interface fire will occur and threaten their homes and property, in fact there are groups of citizens that prefer to believe that it can't happen to me or it cannot happen here. Being the fire protection district it is our responsibility to prepare for the eventual fire and help our citizens prepare for their role in the fire event.

The problem is no pre fire plan exists today for the Perry Park Ranch subdivision during an Urban Interface fire. We at the Larkspur Fire Protection District are aware that we live in and serve an area that resides in the wildland urban interface zone. The purpose of the research is to determine what the components of a comprehensive pre fire plan are, make recommendations based upon my findings to correct inadequacies if they exist, and improve firefighter and citizen safety during an

urban interface fire event. By answering the following questions I was able to complete the research:

- What elements make up a comprehensive preplan for urban interface incidents?
- What are the risk factors that determine how susceptible a subdivision is during an urban interface fire?
- What risk factors are contained within the Perry Park Ranch subdivision?
- What can we do to increase the safety of the residents and firefighters during an Urban Interface fire in the Perry Park ranch subdivision?

Background and Significance

The Larkspur FPD covers 109 square miles of southern Douglas County in the state of Colorado. We are located along the Interstate 25 corridor between Denver to the north and Colorado Springs to the south. The topography of the district ranges from 6300 feet in elevation to 7000 feet in elevation. Most of the district is covered by grass, gamble oak brush, and Douglas fir. The district transitions quickly from rolling prairie to mountains in a span of approximately five miles. Over 70% of the district lies within the urban interface zone. We provide coverage to the district from three fire stations located across the 109 square miles.

The current location of our stations places the main station (161) and our westernmost station (162) approximately 11 road miles from one another. Our southernmost station (164) is 14 road miles from our main station. Station 162 is

approximately 16.5 miles northwest from station 164. Currently we staff our stations by using both career and volunteer firefighters. Our main station 161 is staffed by 12 career firefighters and three permanent part-time firefighters deployed five on each shift. We also utilize volunteer and reserve firefighters to pull duty shifts to supplement the career staff. On average there are 6 firefighters on duty at station 161. Our administrative staff members are is also assigned to station 161, adding two chief officers and an additional firefighter during the weekday. The other two stations, 162 and 164, are staffed by volunteer firefighters however we are working to increase staffing at station 162.

Larkspur Fire also provides Emergency Medical Services at the Paramedic level, including ambulance transport service. Eighty percent of our responses are medical in nature, either medical conditions or trauma resulting from motor vehicle accidents. Usually, due to the staffing of our district, we respond from station 161 to all incidents within the district and arrive prior to any volunteer response from other stations.

The Larkspur FPD has attempted in the past to pre plan our subdivisions for urban interface fires however the pre plans are extremely simple and provide very little information in the event of a major fire. The safety of the citizens and responders to an urban interface fire event as always is our number one concern. In 2002 the Hayman fire burned to within five miles of the Perry Park subdivision, destroyed 138,000 acres, 133 homes, one commercial building, and 466 outbuildings (The Wilderness Society, 2003.) The residents briefly lent an ear to the fire district to discuss the issues surrounding their subdivision and the dangers a wildland urban interface fire event will pose. The firefighters however realized that another

devastating wildfire was always just around the corner and began attempting to plan for the next event. Due to the large size of the district, and the rural setting in which we live and serve we have to be proactive when preparing for urban interface fire events. Our partners that will assist us during an Interface fire will come from several miles away, therefore stopping or containing interface fires while they are small is critical. Examining the components of a pre plan will assist the future Incident commanders greatly by providing quick access to essential information prior to and during an interface fire event therefore increasing the safety of responders and citizens.

The mission of the Larkspur Fire District is “serving our community through quality services, compassion, and excellence” (“*Strategic Plan*”, 2004, pp. 18). By evaluating the essential components of a comprehensive pre plan and recommending alternative methods to protect our residents we will fulfill the mission of our organization. The Research project also fulfills a goal of the USFA by “responding appropriately in a timely manner to emerging issues” (Applied Research Guidelines, pp. II-2).

The second Executive Fire Officer class, Leading Community Risk Reduction, provides the student with the tools necessary to return to their organization and lead the risk reduction process for their local area. By evaluating the components that dispose a subdivision to danger during an interface fire event we will be able to reduce the risk to our citizens and emergency responders by mitigating as many factors as possible before the event occurs. Our district has already within the last 4 years experienced a near

devastating wildfire that in one day consumed over 17 miles of forest and roads (The Wilderness Society, 2003.) We must prepare today for the urban interface fire that will strike our district.

Literature Review

A literary review was conducted to obtain information from the existing body of knowledge in regards to urban interface fires. I evaluated numerous pieces of literature that discussed urban interface fires especially those that detailed how to plan, prepare, and respond / mitigate urban interface fire events.

Chief Michael Rhode from the Orange County, California fire department produced a thesis titled *Command Decisions during Catastrophic Urban Interface Wildfire: A case study of the 1993 Orange County, California, Laguna Fire*. (Rhodes, 1999). In the document Chief Rhodes interviews a former fire commander, retired Division Assistant Chief Gary Nelson, of the Los Angeles County Fire Department. Chief Nelson describes his participation during the 1993 Old Topanga Fire. The experience gained at the Old Topanga fire along with all of the other fire experiences during Chief Nelson career provided valuable insights that will help other fire officers attempting to preplan for and command an urban interface fire event. Chief Nelson describes the utter confusion that firefighters, fire officers, and citizens experienced during these fire events. The points listed below are from Chief Nelson's knowledge base. They will assist any prospective incident commander in handling and preplanning for urban interface fire events.

1. *Look for the big decisions.*
2. *Make a fire projection map.*

3. *Make life safety the highest priority.*
4. *Exercise opportunities to limit the size of the fire.*
5. *Request resources using a sequence, not all at once.*
6. *Plan and train on routine functions, in order to be able to use mental energy on the important issues.(Rhodes, 1999)*

Urban interface fire events also expand very rapidly both in acreage and complexity as it relates to the incident commander. Most all of the Urban Interface fires occur during extreme drought, low fuel moistures, and excessive winds. The Laguna fire like most all of the other major urban interface fires occurred under these extreme conditions. The Old Topanga fire grew from 2 acres to over 1000 acres in less than 45 minutes (Rhodes, 1999), and this appears to be a typical series of events for Urban Interface fires according to Rhodes, 1999. Completing the review of Chief Rhodes' thesis I found a paragraph from Chief Nelson's interview, detailing how he benchmarks success in wildland fire situations by preplanning desired outcomes for critical fire corridors. He considers fire history, critical fire weather patterns, resource deployment, concurrent offensive (perimeter control) and defensive (structure protection) operations, and related factors in developing best-possible-outcome expectations. He includes the development of an effective incident organization, using his "Blitz list", a one hour deployment model as a means for evaluation (Rhodes, 1999.) The overall theme gained from the Chief Rhodes' thesis suggests that preplanning produces likely outcomes, expectations, and opportunities. Many of the elements discussed must be addressed, identified, and planned for prior to seeing smoke rising up in the air.

To summarize all of the information contained within (Rhodes, 1999) I have identified several points that relate too many of the historical devastating wildfires. All of the significant fires in the report have many similarities that include:

- All began as a wildfire.
- Topography was mountainous producing extreme rates of spread, and all occurred fires occurred during high fire danger conditions.
- Significant structural loss occurred during the first operational period (12hrs).
- Required significant mutual aid response.
- Challenged significantly the local incident command systems initially established.
- Required a greater resource commitment during the first several than could be delivered.
- Large areas of populace and development where immediately adjacent to the point of origin.
- Civilian evacuations where a problem in all of the fires. Law enforcement officers were very limited and in many cases where unable to mount an effective evacuation. If they were able to initiate an evacuation serious traffic jams resulted from emergency vehicles encountering fleeing civilian vehicles.

Not all fires must reach the disastrous proportions as the ones examined by Chief Rhodes, not all of the recommendation made will be utilized on all fires but future Incident Commanders should add these tools to their toolbox especially to

facilitate the pre planning process. There is much to be said for learning from the past and furthermore I will utilize many of the recommendations discovered to improve our districts response to urban interface fires.

In the technical report produced by FEMA, *East Bay Hills Fire* (FEMA, 1991), it details perhaps one of the most notorious wildland urban interface fire events. The East Bay Hills fire occurred in Oakland and Berkeley, California between October 19th and October 22nd 1991. The fire actually started on Saturday October 19th at 12:12 pm on the hillside above 7151 Buckingham Boulevard (FEMA, 1991). The fire was burning in vegetation that had not burned in many years resulting in a very heavy concentration of native vegetation that included the extremely flammable eucalyptus. Eucalyptus has a waxy coating and when heated turns into a substance very similar to petroleum or hydro carbons. They burn very hot, very quickly, and need very little external encouragement from items such as wind. The fire on Saturday October 19th was controlled within about one hour and a half, with the size determined to be about 2 acres. On the morning of October 20th several units from the Oakland fire department and the East Bay Hills regional parks department were on scene to complete mopping up the fire from the previous day. The morning of the 20th also brought the return of the Diablo winds, a local wind pattern named for Mount Diablo located in adjacent Contra Costa County about 15 miles inland. This wind pattern is similar to the Santa Ana winds in southern California where warm, dry air rushes from inland elevations down to sea level and dries everything living in its path. Often times these winds patterns do not cease for several days and certainly can and have created havoc for firefighters. Firefighters on scene were making good progress

continuing the mop up operation and between 10:40 and 10:50 the winds picked up and several other spot fires developed. Crews on scene attempted to extinguish the spot fires but by 10:57 the winds continued to increase and Oakland fire department E19 requested a full assignment to assist units on scene with the fires. By 11:02, E19 had requested a second alarm and law enforcement to assistance. Things at that point began to spiral out of control 14 minutes after requesting the second alarm E19 had already requested a fourth alarm assignment to assist with the rapidly spreading fire in all directions. The rest of the fire is detailed in many different publications but I wanted to extract the important points discussed in the technical report.

Fire was certainly no stranger to the East Bay hills that encompass the mountains surrounding the cities of Oakland and Berkeley. In 1982 a Blue Ribbon committee was formed to study the fire problem within the East Bay hills area. The study resulted in numerous recommendations that included creating fuel breaks and controlling fuel growth within certain designated areas. Some of the recommendations were actually completed but in 1991 a severe economic crisis halted much if not all of the work (FEMA, 1991).

After the 1991 East bay hills fire a Hazard Mitigation report was published subsequent to the disaster declaration by the President of the United States following the fire. The mitigation report recommended many areas that needed attention. Some of the requirements suggested that fuel management be addressed as well as fuel separation. Roofing materials, roadways, and water supplies were also recommended to be addressed as part of the report (FEMA, 1991). After the fire and the release of the report there were folks on both sides of the controversy arguing for and against the

change. Many residents that lost everything in the 1991 fire expressed the desire to rebuild exactly where their houses were before the fire and utilize the same construction methods and products. Many of the opponents against implementing the recommendations expressed the fear that widening the roads would only increase unwanted traffic.

At the height of the East Bay Hills fire one of the Oakland fire command officers is quoted as saying “It’s hard to get organized and run for your life at the same time!” (FEMA, 1991).The resources responding to mitigate the fire where completely overwhelmed for the first 6 hours. The radio traffic, CAD logs, and final reports show that all of the responding units usually had to take action without consulting the incident commander or the communications center (FEMA, 1991.) This type of action although necessary can be extremely dangerous for the responders and citizens attempting to evacuate the area. The technical report reinforces the need to preplan, and utilize proper tactics during both suppression and mop up operations. Evacuation of citizens was a major issue during the East Bay Hills fire and must be addressed during every urban interface fire event. The East Bay hills fire forced the evacuation of between 20,000 and 30,000 people and resulted in the need to shelter many of the citizens due to the destruction of over 3,000 dwellings (FEMA, 1991.) At the time of the report in early 1992 the East Bay hills fire was the most costly fire in history. Hundreds of lessoned can be learned from the East Bay hills and most are summed up into two particular areas Mitigation and Disaster Response. Below are the lessons learned as published in the report from FEMA.

Mitigation

- Use of drought tolerant and fire resistant landscaping.
- Brush clearance areas around structures and fuel breaks in strategic locations.
- Fire resistant roofing and exterior wall materials.
- Adequate access roadways for emergency vehicles and exit roadways for residents.

Disaster Response

- Urban conflagration resulting from a wildland interface fire is a situation that has not received enough planning attention.
- It is impossible to manage a large scale disaster with insufficient command personnel and inadequate command and control systems. Fire departments should always anticipate the worst case scenarios and develop plans and procedures to address those situations.
- Communications adequate during normal times maybe completely overwhelmed during a disaster situation.
- When forced to retreat it is difficult to regroup, reorganize, and return to effective action.
- Early notification and request of aerial resources could be effective at controlling fires earlier.(FEMA, 1991)

These items listed above are just some of the key points from the FEMA technical report on the East Bay Hills fire (FEMA, 1991.) The East Bay Hills fire

differed from most other urban interface fires in respect to its origin. The origin was located within an urban area and spread to the wildlands. This actual point of origin was within 15 feet of structures and had consumed several structures within the first 30 minutes of burning, even though firefighters were on scene when it started. Most all of the other major urban interface fires have started in the wildland areas and then spread to the urban areas. The key points identified within this technical report will provide valuable information towards improving the safety of all involved within the Larkspur Fire District.

Most of the previous pieces of literature discussed in great depth who, what, when, and where it happens during urban interface fire events. For the most part the discussions have centered on the destruction wildfires have caused, and how to prepare for them. One item missing from the piece of the puzzle during my literature review was how the structures ignited during an urban interface fire. For that information I reviewed several of Jack Cohen's papers on home ignitions. The Structure Ignition Assessment Model (SIAM) developed by the Rocky Mountain Research Station in Missoula, Montana (Cohen, 1994) and Examination of the Home Destruction in Los Alamos Associated with the Cerro Grande fire July 10, 2000 (Cohen. 2000.)

Dr. Cohen describes in great detail that most structures that burn during urban interface fire events do so because of ground cover fires not the crown fires normally associated with major fires (Cohen, 2000.) A crown fire is described as fire that moves up into the crowns of the fuel, and burns rapidly and with considerable intensity (Tie, pp 207, 1991.) Most crown fires are also associated with strong winds

that push the fire through the tree tops. When a crown fire encounters an area where tree crowns are not tightly spaced the crown fire will most of the time drop to the ground cover. These ground cover fires burn the fuels such as grass, needle liter under conifer trees, and the leaf duff that lie on top of the ground. Ground cover fires also burn up next to improvements made on lots or land such as landscaping timbers, porch railings, and even decks with grass growing underneath. Most of the research to determine why structures ignite is based upon actual fire site visits. The most notable fire sites visited were the Rodeo Chediski fire in Arizona, and the Hayman fire in Colorado. These site visits showed that many trees around the destroyed structures survived the fire and in many places did not burn at all. The ground fuels however did in fact burn and in most all of the cases the paths led right up to the destroyed structures providing and ignition source as describe in Cohen, 2000. Many tests were preformed to determine how and why structures ignite. Test were performed to determine how much heat is required to break windows and also how much heat is required to ignite wall materials. After reviewing the SIAM (Cohen, 1994) it was determined to be more of an assessment tool to evaluate the potential for structure ignition rather than predict ignitions however Cohen, 2000 provides insight as to how small fires ignited homes and methods to prevent this in the future. These recommendations will be relayed to our homeowners to provide a mechanism for increasing the survivability of their home and also provide our firefighters space to defend homes.

The SIAM (Cohen, 1994) will certainly have its place within the fire community to assist firefighters with how to determine the susceptibility of a structure to an

Urban Interface fire event. If we can determine how susceptible structures are, we can then take steps to mitigate the hazards and therefore help many other structures survive during an urban interface fire.

One of the previous EFO paper's written by Keith Brown titled *Structure Triage during Wildland/Urban Interface/ Intermix Fires* (Brown, 1984), describes discovering four main areas that can predict structure survivability during interface fire events. Accessibility to the property and structures, roof construction, defensible space, and slope of adjoining terrain assist with determining the survivability of structures. We are also introduced to the structural triage system known as the WURST system (Brown, 1984). WURST stands for Wildland/Urban/Rural Structure Triage system. The WURST system uses all of the previously identified areas of concern for firefighters and homeowner's to prevent structural ignition. The one stand out from the WRUST system is that it incorporates setup time for units preparing to defend a structure or structures. It does not however take into account firefighter safety items such as Lookout, Communications, Escape Routes, Safety zones, and accessibility to the property. After reading the paper Brown, 1984 many items identified have helped pave the way for programs that are available to our district within the state of Colorado today.

Another item discussed in previous pieces of literature has suggested that evacuation was a necessary component of any wildfire response plan. To fully understand the evacuation process one must evaluate the entire evacuation process. After searching the internet I found several pieces of literature that relate to evacuations in general and several that pertain to urban interface fire events.

Thomas J. Cova, a professor from the University of Utah, authored a document titled *Public Safety in the Urban-Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy* (Cova, 2005.) Cova describes the methodology behind using the building egress code to determine the number and spacing of exits required for urban interface fire prone subdivisions. The term community exit is introduced in the paper. We are also introduced to the emergency planning zone (EPZ) Cova, 2005. An emergency planning zone is an area centered on a stationary known hazard. Examples of a traditional EPZ are nuclear power plants or chemical plants (Cova, 2005.) An urban interface community is not unlike a traditional EPZ mainly due to the fact that urban interface fires are very dynamic and spread in many directions. It is essential that pre identification of escape routes be conducted prior to smoke being in the air. When evaluating evacuation routes you have to look for the most constricting area. This area is where traffic will bottleneck and therefore reduce the speed or halt the evacuation all together. It is preferable that subdivision's have more than one exit but that in itself will not guarantee a timely evacuation. I used findings from Cova, 2005 and determined how Perry Park ranch shaped up using the standard established for exits from the community. This information will be useful as we recommend improvements to the community.

In a recent Fire Chief Magazine from April 2006, *Interface Mitigation* (Keller, 2006) relates many other elements to be considered for urban interface subdivision. These elements are broken down into four major categories that include Engineering, Enforcement, Education, and Ecosystem Management.

Engineering encompasses all of the traditional items but it also includes the use of technology to assist with the problem of unwanted fires. Two basic groups derived from the use of technology are limiting unwanted ignitions, and limit the damage from unwanted ignitions (Keller, 2006). Urban Interface fires all involve property and wildland fuels so by eliminating or limiting unwanted ignitions and developing building materials that will limit the damage caused by unwanted fires we can at least begin to tackle a portion of the urban interface fire problem.

Education is a very critical component as it relates to pre planning of urban interface fire events (Keller, 2006). The community and its citizens must be aware that they do live in a fire prone environment and how to properly prepare for the fire event. Citizens should take appropriate steps to minimize damage to their property by using fire resistive building materials and landscaping techniques, providing defensible space around the structures, maintaining access for fire apparatus to their property, and knowing proper procedures to use during an evacuation for an urban interface fire event. Most of the education efforts around the country focus on the Smokey Bear icon and preventing fires from starting (Keller, 2006). Fire is a healthy part of the landscape and only becomes a problem when humans and property become an issue. Citizens do need to be cautious when using fire outdoors but they also should understand that fire is a healthy tool for the forest. Engineering, Enforcement, Education, and Ecosystem Management will be utilized to establish standards to improve safety of all during urban interface fire events.

NFPA 1143, *Standard for Wildfire Management* (NFPA 1143, 2003) details the process that managers should use when their agencies develop and updates policies

and procedures as they pertain to wildfire management programs. The document list items to be considered for wildfire management to include values at risk, risk assessment, hazard assessment, and mitigation plans. The mitigation plan is extremely detailed to include ignitions, fuels treatment, public education, building site design and construction, firefighting capabilities, and infrastructure. NFPA 1143 is written for the agencies providing firefighting services to their communities including local, state, and federal departments.

NFPA 1144 *Standard for Protection of Life and Property from Wildfire* (NFPA 1144, 2002) provides planning, construction, maintenance, education, and elements for the protection of life, property, and other values that are or could be threatened by wildfire. Like its sister document NFPA 1143, NFPA 1144 also provides an extensive list of items to be considered as they relate to wildfire. The document also goes into great detail about access and egress issues as they relate to urban interface subdivisions. Perhaps the most significant item provided by NFPA 1144 is the Wildfire Risk and Hazard Severity Assessment Form (NFPA 1144) contained in appendix A. The form takes most all of the items discussed in great detail and simplifies them into a two page user friendly checklist. The checklist allows the user to carry the form into the field and evaluate the danger posed by wildfire to entire subdivisions or portions of subdivisions. The form was a large part of determining the answers to the research and in fact I used the same form and determined the numerical rating for Perry Park ranch. The questions are given a numerical rating as they rank in importance, and the sum is taken at the end to give the subdivision a numerical rating for susceptibility to wildfire.

In summary the literature review provided very valuable information for the project and most importantly it will provide steps to assist with the recommendations to the fire district and homeowners for the eventual urban interface fire. It also provided a solid base for development of a comprehensive pre plan for Perry Park ranch at a later date to assist with mitigating an urban interface fire event.

Procedures

Many different ideas and literature were evaluated and weighed to determine the best course of action for my research. By using descriptive research the author was able to determine what is currently going on with preplanning for urban interface fires across the nation and also report the present status to the readers of planning for Perry Park ranch. While an abundance of information is available through literature both printed and web based, I used two NFPA documents, NFPA 1143, *Standard for Wildfire Management* (NFPA 1143, 2003), and NFPA 1144 *Standard for Protection of Life and Property from Wildfire* (NFPA 1144, 2002) to determine the susceptibility of Perry Park Ranch during an Urban Interface fire event.

In the first step of the process it was necessary to determine what components must be present or included in pre plans for urban interface subdivision. By using NFPA 1143 and NFPA 1144 the author was able to identify what items should be included in a pre plan for subdivisions in the urban interface.

The second step was to determine what risk factors determine how susceptible a subdivision is during and interface fire event. Risk factors used where based on findings contained within NFPA 1144. During the process of determining the risk

factors there was also a significant learning process about how the identified risk factors effect individual homes and cause their ignition. It was determined that excellent research had been performed by Dr. Jack Cohen on structure ignition assessment model (Cohen, 1994) and Cohen, 2000. This model assisted the author with understanding how and why structures ignite during urban interface fire events and answering the questions posed in NFPA 1144, as they relate to Perry Park.

The third step in the research process I removed the Wildfire Risk and Hazard Severity Assessment Form (NFPA 1144, 2002) and preformed a site visit to determine the risk factors identified in research question two and how many where present in the Perry Park ranch subdivision. A copy of the Wildfire Risk and Hazard Severity Assessment Form (NFPA 1144, 2002) is located in Appendix A. The author also consulted the *Community Wildfire Protection Plan* (LFPD, 2006) that the fire district assisted in authoring to confirm the presence of the risk factors and the severity of each area identified in NFPA 1144.

In the fourth step I complied all of the material and determined what recommendations were needed to assist with the development of a pre fire plan for an Urban Interface fire event in the Perry Park ranch subdivision.

Definition of Terms:

- Wildland/Urban Interface: any area where wildland fuels threaten to ignite combustible homes and structures.(NFPA, 1143, 2003)

- Wildland/Urban Intermix: An area where improved property and wildland fuels meet with no clearly defined boundary.(NFPA 1143, 2003)
- Mitigation: Action that moderates the severity of a fire hazard or risk. (NFPA 1144, 2002)
- Fuel Modification: Any manipulation or removal of fuels to reduce the likelihood of ignition or resistance to fire control. (NFPA 1144, 2002)
- Ground Cover Fuels/ Fires: All combustible materials such as grass, duff, loose surface litter, tree or shrub roots, rotting wood, leaves, peat, or sawdust that typically support combustion. (NFPA 1144, 2002)
- Turnaround: A portion of the roadway, unobstructed by parking, that allows for a safe reversal of direction for emergency equipment. (NFPA 1144, 2002)
- Community exit: The discharge that leads residents to safety outside of the subdivision (Cova, 2005).
- Crown Fire or Crowning Fire: when the fire moves up into the tops of the fuel, and burns rapidly and with considerate intensity, *Fire Officers Handbook on Wildland Firefighting*, (Tie, 1997.)

Results

The results listed below were obtained using descriptive research.

Question #1. What elements make up a comprehensive preplan for urban interface incidents? Pre Plans for urban interface subdivisions contain many different elements.

They all should at the very minimum include the following recommendations from NFPA 1144 (NFPA 1144, 2002). Operational plans, Command elements, training elements, community notification and involvement elements, public fire safety information and education, public safety and evacuation elements, and a mutual aid assistance element.

Question #2 What are the risk factors that determine how susceptible a subdivision during an urban interface fire event? There are many risk factors that make a subdivision susceptible to urban interface fires. According to NFPA 1144 (NFPA 1144, 2002), there are eight hazards to consider when determining how susceptible a subdivision is to wildfire. The eight hazards are means of access, vegetation, topography within 300 feet of the structures, additional rating factors, roofing assembly, building construction, available fire protection, and placement of gas and electric utilities. In addition to the eight hazards I believe that we also should consider the five risk that include natural occurrences (e.g. lightning), utility transportation, industry, recreation, and arson (NFPA 1143, 2003).

By considering all of the items listed above you will identify potential sources of ignition and also items that will readily contribute the spread of a devastating urban interface fire.

Question #3 What risk factors are contained within Perry Park Ranch? Perry Park ranch contains all eight of the hazards identified in research question two. I completed the Wildfire Risk and Hazard Severity Assessment Form (NFPA 1144, 2002), and

determined the numerical rating for each category. The results are listed at the end of each section and a copy of the completed form can be found in Appendix B.

- Means of Access

Access to Perry Park ranch is achieved by one main road running mostly east and west within the subdivision. Red Rock drive is the main access road from Colorado Highway 105. Using the hazard assessment form from NFPA 1144 the numerical rating for this subdivision under access is 14.

- Vegetation

The vegetation component within Perry Park is dense stands of ponderosa pine with gamble oak under story along with Douglas fir and mountain juniper bushes. The vegetation within Perry Park would not generally produce large devastating fires however during periods of drought accompanied by high or gusty winds have and will produce extreme damaging fires. The Hayman fire of 2002 occurred under these conditions and on "June 9th the National Interagency Fire Center had issued a Red Flag Warning in Colorado for winds at 25-35 mph, very warm weather and extremely low relative humidity. Gusts of up to 60 mph were reported from various weather stations that day. On this Red Flag day, the Hayman fire ran for 17 miles, burned through a series of small fuel reduction projects, at least one clear-cut, and across many roads including a 3-lane highway. Indicative of the extreme conditions, one section of the fire spread ½ mile in just four minutes" (The Wilderness Society, 2003.)

Numerical rating for the vegetation element is 30.

- Topography

Topographical features within the subdivision include gentle or zero to fifteen percent slopes on the southern and eastern boundaries, transitioning to extreme slopes or thirty to one hundred percent slopes along the western boundaries. Numerical rating for this element is 7.

- Additional Rating Factors

Additional rating factors address the topographical features that effect wildfire behaviour, significant or frequent fire events, weather patterns that increase fire intensity, and separation of structures that could contribute to fire spread.

Very few fires have occurred within in the boundaries of the subdivision but in the forest immediately adjacent there have been at least two significant fires within the last four years. The Border fire started on July 3, 2001 and was the result of natural causes or lightning. The Hayman Fire started on June 8, 2002 and was human caused. The Border fire burned eight acres immediately adjacent to Perry Park and the Hayman fire burned 138,000 acres stopping about five miles west of the subdivision (The Wilderness Society, 2003.) Both of these fires started during extreme weather patterns accompanied by prolonged drought. The Border fire one was of four starts occurring within the Larkspur FPD from the afternoon of July 3rd to the morning of July 4th (personal observation 2006.) When the Hayman fire started the state of Colorado was experiencing severe to extreme drought with the snow melt occurring 6 weeks earlier than normal (The Wilderness Society, 2003.) The forest around Perry Park does however seem to experience a high number of lightning strikes starting several small fires most are less than ¼ acre each year. The numerical rating for this element is 14.

- Roofing Assembly

Roofing assemblies identify roofing materials and how susceptible they may be to fire and how many fire brands they may produce once ignited. The numerical rating for this element is 3.

- Building Construction

Materials used during construction and methods used are evaluated under this element. The numerical rating for this element is 15.

- Available Fire Protection

Evaluated in this element are water supplies, organized response resources, and fixed fire protection systems. Water is supplied by a pressurized water system of hydrants located generally within less than 1000 feet of a structure and gallons per minute (gpm) flows of greater than 500 gpm. Fire protection is provided by the Larkspur FPD. Our district has extensive mutual aid agreements with all of the Douglas County fire districts including the National Forest and neighboring El Paso County. We have an annual operating plan (AOP) for wildland fire within Douglas County and the signatures to that are the Douglas County Sheriffs office, Colorado State Forest Service, US Forest service, as well as all of the county fire districts. The AOP describes the firefighting responsibilities and more importantly to an operations person the process to request assistance from outside the county at the federal level. Items that would be request from this level would be hand crews, aviation resources, and overhead personnel.

Larkspur FPD personnel are all certified to meet National Wildfire Coordinating Group standards for basic wildland firefighter and many of the firefighters are

qualified to function at levels such as Engine Boss, Strike Team Leader, and Incident Commander Type 4. The district maintains a fleet of twenty vehicles for many types of fires. All of our apparatus are equipped to fight wildland fires in addition to the other types of fires we respond to.

Also evaluated under available fire protection systems are fixed systems such as residential sprinklers and other types of fixed suppression systems. There are no fixed suppression systems currently in place within Perry Park.

The numerical rating for this element is 6.

- Utilities

The placement of utilities is evaluated as to their placement. Utilities within in Perry Park are mostly underground however a significant portion of the older part of the subdivision has above ground or elevated power lines. The numerical rating for utilities is 3.

After completing all of the sections using the Wildland Fire Risk and Hazard Severity Assessment form (NFPA 1144, 2002,) included in NFPA 1144 the numerical rating for the entire Perry Park Ranch subdivision is 92. That places the subdivision at a high hazard risk to/ for wildfires.

Question #4: What can we do to increase the safety of the residents and firefighters during an urban interface fire in the Perry Park Ranch subdivision? The questions above have identified that we do have a fire problem within the Perry Park Ranch subdivision. We do need to take action or steps to ensure citizen and firefighter safety

during an Urban Interface Fire in the subdivision. Below I have broken the items needing attention into two different broad categories.

- Citizens Safety

Education, Engineering, Enforcement, and Eco system management. (Keller, 2006)

- Firefighter Safety

Training, Operational Planning, and Route Planning

It must be noted that there certain limitations with the research. If someone else attempts to conduct research for the same subdivision there will very likely be different results. Many of the answers will be affected by opinion of circumstances and the lack of personal knowledge of the history will be missing however most of the research will remain the same due to the NFPA standards being utilized

Discussion

The purpose of the paper was to evaluate what items make up a pre fire plan, the risk factors that make a subdivision susceptible during an urban interface fire, what risk factors are contained within the Perry Park Ranch subdivision, and things we can do to increase citizen and firefighters safety when an urban interface fire event strikes Perry Park.

Completely selfish on my part was the research to complete the paper. The homeowners of Perry Park, Douglas County roads and planning department, and the Douglas County Commissioners have been in the process or are in the middle of a process to identify a secondary access route for the subdivision. Perry Park ranch was developed in the 60’s and had plans for multiple access routes. In the late 70’s the

developer went bankrupt and abandoned the project (LFPD, 2006.) The residents of the subdivision then formed a metropolitan district to help complete the process or ensure the completion of the process as best as they could. Of the many items that could not be completed or where lost was the construction of several more access routes in and out of the subdivision. Today the subdivision has ONE access route for all traffic. "One exit does not ensure that an egress system is sufficient. It depends on the number of occupants, the arrangement and capacity of the exits and the concentration of travel demand in space and time" (Cova, 2005.) According to Cova, 2005 the actual recommended number of exits for a subdivision with 800 homes is four. You also must evaluate the access routes to determine how many cars can pass through the narrowest point in one hour. The narrowest point on most roads will be at an intersection where two or more roads meet (Cova, 2005). For Perry Park the narrowest point is the main entrance at Red Rock Drive and Highway 105 as shown on figure2 below.

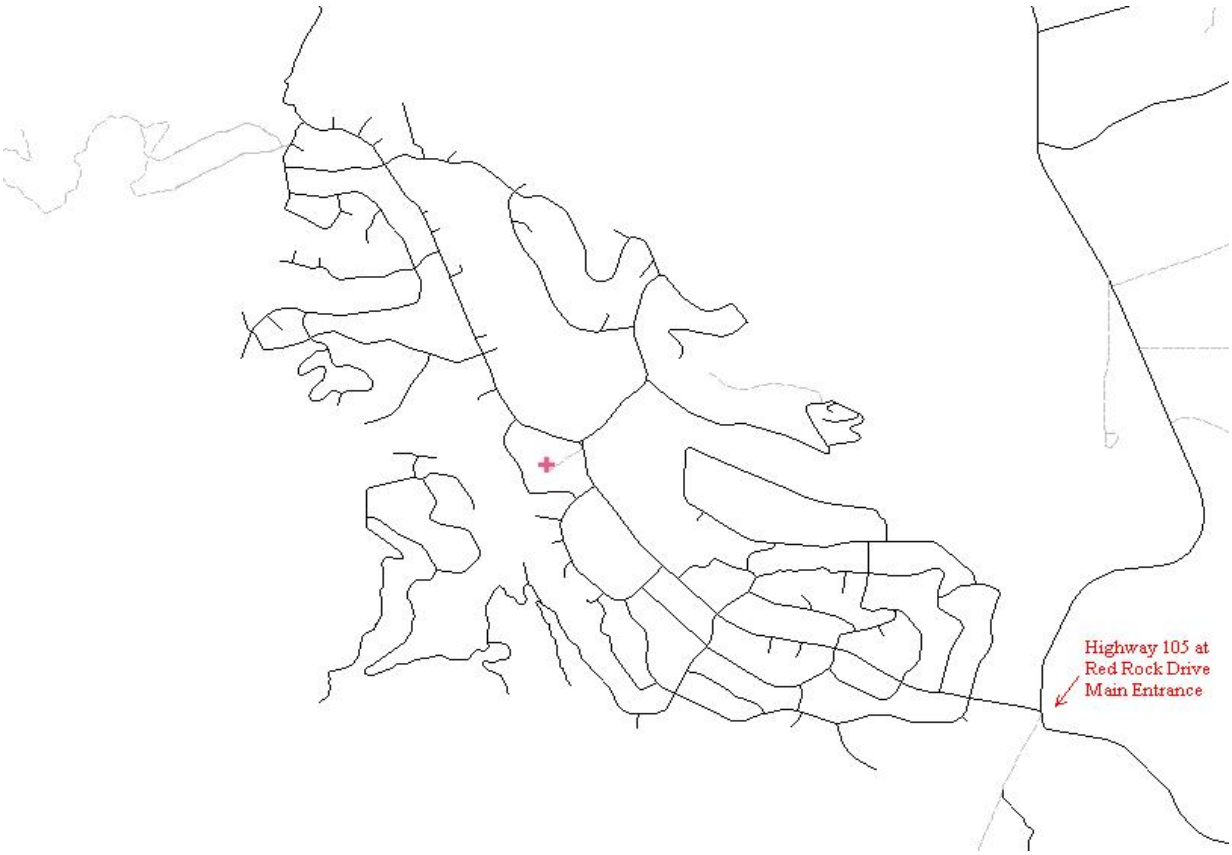

Figure 2.
Perry Park Subdivision Map showing Narrowest Point

While researching the paper and answering the questions I gained valuable knowledge to assist with pre planning and commanding an urban interface fire event. It should be noted that many residents within Perry Park believe that a wildfire will not happen to them and in fact publicly criticize the fire district for recommending a second access route and other efforts to reduce the threat posed by wildfire. The numerical rating of 92, determined in research question three, proved that using a nationally recognized standard the subdivision is exposed and suspectable to wildfires. Insight as to how the response or operational phase of an urban interface fire will go and what items should be planned for well in advance of smoke rising in the air where identified in research questions two. NFPA 1144 has an entire list that explains each area in great detail as t

why it is important and how it will affect the planning process as well as the response. Rhodes, 1994 sums it up well with an interview from Chief Gary Nelson saying it is essential that firefighters plan for urban interface fires in critical corridors for the district (Rhodes, 1994.) These fires normally happen under extreme weather condition and therefore extreme fire behaviour and rates of spread should be anticipated. Perry Park is exposed to extreme weather patterns as detailed during the Hayman fire 2002 (The Wilderness Society, 2003.) Chief Rhodes also emphasis that management teams must be established early due to the significant resources required to mitigate the event as well as the public evacuation, information, and sheltering that will be required during every urban interface fire event.

Brown, 1994 provided four main areas to consider during structural triage and they are accessibility to the property and structures, roof construction, defensible space, and slope of adjoining terrain. By evaluating these items firefighters will be able to determine how susceptible a structure is, and what are the chances the structure will survive during an urban interface fire.

Based upon the literature review many of the recommendations from the printed media reviewed are pertinent to Perry Park ranch in order to pre plan for an Urban Interface fire. Rhodes, 1994 details the rapid rates of spread under extreme fire weather conditions and yes in fact those weather conditions have occurred within Perry Park when fires burned to within 5 miles during the Hayman fire in 2002. In fact the technical report published by FEMA, 1991 after the East Bay Hills fire, details many recommendations that if followed to day would or could prevent damage from urban interface fire events. Many of the recommendations from FEMA’s 1991 technical

report are present within Perry Park ranch and are so noted during the research for the paper. It is with a certain amount of amazement that I research these items understand that they exist today and still see homeowners with the opinion that it want or can't happen to me. The Hayman fire of 2002 forced the entire subdivision of Perry Park to evacuate over a 72 hour period. The first 48 hours were voluntary and the remaining 24 hours where mandatory. If your home was threatened by a fire that ran 17 miles in one day (The Wilderness Society, 2003), and there was only one way in and out of the subdivision would it not concern you for your safety and the safety of your family? Then we take no steps to help the survivability of our home once we have evacuated or if we can evacuate due to only having one means of egress. If evacuation is not possible then we must turn to shelter in place. "A key hurdle in advising people to shelter in place in their homes is that not all structures are defensible" (Cova, 2005.) People must understand that if you live in the western United States and own a home in the mountains or near the forest, fire is a healthy part of the relationship you choose live with. We must reach these citizens and begin the process of working together to mitigate the home ignition zone or the area immediately surrounding a structure where ignition is feasible (Cova, 2005.) Many dollars are invested in mitigating the national forest surrounding urban interface subdivisions but my belief is that those dollars should be spent mitigating the properties adjacent to the forest. The forest will burn the question is will we be ready for the fire when it reaches our subdivision. If we cannot evacuate then we must properly mitigate residential properties to allow for sheltering in place.

Engineering, Education, Enforcement, and Ecosystem Management were several items discussed in Keller, 2006 that will assist us in preparing for the eventual fire. These four words will be the base for which many of the items that need to be addressed in order to protect our citizens, property, and our responders to include firefighters during the devastating urban interface fire events. If we perform the four words to the fullest extent possible we can certainly begin to understand and make a difference in the urban Interface fire problem facing our country and the world.

As I stated in the beginning the Urban Interface fire problem is not only a national problem but a worldly problem. Urban Interface fires have occurred in nearly every continent and especially Australia, Spain, and Russia. Citizens and even fire chiefs, firefighters, and fire management officer often still place their heads in the sand and take the attitude that it can't and won't happen here. Well it does and it will and if we completely disregard that fact and refuse to plan for the urban interface fire, that will happen, then SHAME ON YOU.

Recommendations

We in the fire service must become instrumental at educating, enforcement, engineering, and eco-system management in order to reduce the threat and damage caused by urban interface fires. After completing the research for this paper and attending Leading Community Risk Reduction class, I have learned a tremendous amount of information on how to reduce risk and respond to urban interface fires. We cannot change the rating of 92 for Perry Park significantly; however we can take steps to minimize the effects wildfires will have on our community, and most importantly

provide a means to evacuate or at provide shelter in their homes until the fire has passed.

As the fire chief I make the following recommendations to the district, the resident of Larkspur FPD, and the Perry Park ranch subdivision. We must do the following to better prepare for Urban Interface fires events that will eventually strike our community.

Mitigation

- Continue to utilize, and enforce the current edition of NFPA 1144, *Standard for Protection of Life and Property from Wildfire. (NFPA 2002)* particularly Chapters four through ten.

Preparedness Planning

1. Identify specific wildland fire hazards and risk and hazard areas within the district and other hazards that negatively affect wildland fire control efforts.
2. Identification of fire protection features such as lakes, rivers, water points, natural firebreaks, and other areas or features that are beneficial to wildland fire control efforts.
3. A list of resources, including personnel, apparatus, and equipment.
4. A list of all cooperating agencies and other mutual aid resources and the procedures for requesting assistance from those agencies and resources.
5. A reference to any and all existing mutual aid agreements, contracts, and other protection agreements applicable to wildland fire control efforts.

6. A list of specific objectives relating to training, safety, response times, and staffing.
7. Continue to support the development and training of the Douglas County Incident Management team.
8. Plan for communications alternatives during Urban Interface fire events and publish an alternate communications plan for the district to use during an urban interface fire.
9. Prepare firefighters to retreat when forced to and develop plans to regroup, reorganize, and return to effective action.
10. Prepare a Blitz list of resources to order in the first hour and request aerial resources early to assist with controlling the fire.

There is additional research needed as it relates to evacuation of subdivisions and on a much larger scale evacuation of entire communities, town, and cities. In the wake of Hurricane Katrina and the devastation it caused we as a nation must commit more resources, time, and planning toward determining the best and most efficient evacuation procedures for all the communities we protect. I also believe that code adoption and enforcement will be required to ensure that communities are developed and built according to safe access and egress requirements.

Pre-Planning is an essential part of any response to emergencies and or to minimize the damage caused by an incident before it begins. A previous instructor of mine once coined the phrase that you must have a plan before the smoke is rising up in the air. Having worked in the western United States and responded to several wildfires

that have threatened structures, I learned very quickly that trying to develop a plan after the fire has started is practically useless until an incident management team arrives to assist. The initial incident commander is overwhelmed with ordering and assigning resources therefore it is essential that we have plans developed before the fire starts so all personnel and agencies, both citizens and firefighters, know exactly who, what, where, when, and how!

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Sample WFRHSA Form

Appendix A.

WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM

Assign a value to the most appropriate element in each category and place the number of points in the column on the right

Element	Points	Score
A. Means of Egress		
1. Ingress and Egress		
a. Two or more roads in/out	0	
b. one road in/out	7	
2. Road Widths		
a.> or = to 24ft	0	
b.> or = to 20ft and < 24ft	2	
c.< 20ft	4	
3. All season road condition		
a. Surfaced Road grade < 5%	0	
b. Surfaced road, grade > 5%	2	
c. Non-surfaced road, grade < 5%	2	
d. Non-surfaced road, grade > 5%	5	
e. Other than all season	7	
4. Fire Service Access		
a. < or = 300 ft with turnaround	0	
b. > 300 ft with turnaround	2	
c. < or = 300 ft with no turnaround	4	
d. > or = 300 ft with no turnaround	5	
5. Street Signs		
a. Present 4 inches in size and reflective	0	
b. Not Present	5	

B. Vegetation (Fuel Models)		
1. Characteristics of vegetation within 300 ft		
a. Light (grass, forbs, sawgrass, and tundra) Fuel Models A,C,L,N,S, and T	5	
b. Medium (light brush and small trees) Fuel Models D,E,F,H,P,Q, and U	10	
c. Heavy (dense brush, timber, and hardwoods) Fuel Models B,G, and O	20	
d. Slash (timber harvesting residue) Fuel Models J,K, and L	25	
2. Defensible Space		
a. More than 100 ft of treatment from structure	1	
b. 71ft to 100 ft of treatment from structure	3	
c. 30 ft to 70 ft of treatment from structure	10	
d. 30 ft of treatment from structure	25	

C. Topography with 300 ft of the structure		
1. Slope < 9%	1	

2. Slope 10% to 20%	4	
3. Slope 21% to 30%	7	
4. Slope 31% to 40%	8	
5. Slope > 41%	10	

D. Additional Rating Factors (rate all that apply)			
	1. Topographical features that adversely effect wildland fire behavior	0 - 5	
	2. Area with a history of higher fire occurrence	0 - 5	
	3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	0 - 5	
	4. Separation of adjacent structures that can contribute to fire spread	0 - 5	
E Roofing Assembly			
	1. Class A roof	0	
	2. Class B roof	3	
	3. Class C roof	15	
	4. Non-rated	25	
F. Building Construction			
	1. Materials		
	a. Non-combustible/ fire resistive siding, eaves, and decks	0	
	b. Non-combustible/ fire resistive siding, and combustible decks	5	
	c. combustible siding and deck	10	
	2.Building setbacks relative to slope of 30% <		
	a.> or = 30 ft to slope	1	
	b. < 30 ft to slope	5	
G. Available Fire Protection			
	1. Water Source availability		
	a. Pressurized water source availability		
	500 gpm hydrants < or = 1000 feet apart	0	
	250 gpm hydrants < or = 1000 feet apart	1	
	b. Non Pressurized water source availability		
	> or = 250 gpm continuous for 2 hours	3	
	< 250 gpm continuous for 2 hours	5	
	c. Water unavailable	10	
	2. Organized response resources		
	a. Station < or = 5 miles from structure	1	
	b. Station > 5 miles from structure	3	
	3. Fixed Fire Protection		
	a. NFPA 13, 13R, 13D sprinkle system	0	
	b. none	5	
H. Placement of Utility Lines			
	1. Both Underground	0	

2. One underground , one aboveground	3	
3. Both aboveground	5	

Total Points for Subdivision	

Low Hazard	< 40
Moderate Hazard	40 - 69
High Hazard	70 - 112
Extreme Hazard	>112

Information for this was taken from (NFPA 1144, 2003.)

Completed WFRHSA Form for the Perry Park Ranch Subdivision

Appendix B.

WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM (PERRY PARK)

Assign a value to the most appropriate element in each category and place the number of points in the column on the right

Element	Points	Score
A. Means of Egress		
1. Ingress and Egress		
a. Two or more roads in/out	0	
b. one road in/out	7	7
2. Road Widths		
a.> or = to 24ft	0	
b.> or = to 20ft and < 24ft	2	3
c.< 20ft	4	
3. All season road condition		
a. Surfaced Road grade < 5%	0	
b. Surfaced road, grade > 5%	2	2
c. Non-surfaced road, grade < 5%	2	
d. Non-surfaced road, grade > 5%	5	
e. Other than all season	7	
4. Fire Service Access		
a. < or = 300 ft with turnaround	0	
b. > 300 ft with turnaround	2	2
c. < or = 300 ft with no turnaround	4	
d. > or = 300 ft with no turnaround	5	
5. Street Signs		
a. Present 4 inches in size and reflective	0	0
b. Not Present	5	

B. Vegetation (Fuel Models)		
1. Characteristics of vegetation within 300 ft		
a. Light (grass, forbs, sawgrass, and tundra) Fuel Models A,C,L,N,S, and T	5	
b. Medium (light brush and small trees) Fuel Models D,E,F,H,P,Q, and U	10	
c. Heavy (dense brush, timber, and hardwoods) Fuel Models B,G, and O	20	20
d. Slash (timber harvesting residue) Fuel Models J,K, and L	25	
2. Defensible Space		
a. More than 100 ft of treatment from structure	1	
b. 71ft to 100 ft of treatment from structure	3	
c. 30 ft to 70 ft of treatment from structure	10	10
d. 30 ft of treatment from structure	25	

C. Topography with 300 ft of the structure		
1. Slope < 9%	1	

2. Slope 10% to 20%	4	
3. Slope 21% to 30%	7	7
4. Slope 31% to 40%	8	
5. Slope > 41%	10	

D. Additional Rating Factors (rate all that apply)		
1. Topographical features that adversely effect wildland fire behavior	0 - 5	5
2. Area with a history of higher fire occurrence	0 - 5	3
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	0 - 5	4
4. Separation of adjacent structures that can contribute to fire spread	0 - 5	2
E Roofing Assembly		
1. Class A roof	0	
2. Class B roof	3	3
3. Class C roof	15	
4. Non-rated	25	
F. Building Construction		
1. Materials		
a. Non-combustible/ fire resistive siding, eaves, and decks	0	
b. Non-combustible/ fire resistive siding, and combustible decks	5	
c. combustible siding and deck	10	10
2.Building setbacks relative to slope of 30% <		
a.> or = 30 ft to slope	1	
b. < 30 ft to slope	5	5
G. Available Fire Protection		
1. Water Source availability		
a. Pressurized water source availability		
500 gpm hydrants < or = 1000 feet apart	0	0
250 gpm hydrants < or = 1000 feet apart	1	
b. Non Pressurized water source availability		
> or = 250 gpm continuous for 2 hours	3	
< 250 gpm continuous for 2 hours	5	
c. Water unavailable	10	
2. Organized response resources		
a. Station < or = 5 miles from structure	1	1
b. Station > 5 miles from structure	3	
3. Fixed Fire Protection		
a. NFPA 13, 13R, 13D sprinkle system	0	
b. none	5	5
H. Placement of Utility Lines		
1. Both Underground	0	

2. One underground , one aboveground	3	3
3. Both aboveground	5	

Total Points for Subdivision	92

Low Hazard	< 40
Moderate Hazard	40 - 69
High Hazard	70 - 112
Extreme Hazard	>112

Information for this was taken from (NFPA 1144, 2003.)