



Rocky Mountain Fire Community Wildfire Protection Plan Executive Summary

The Rocky Mountain Fire Community Wildfire Protection Plan (RMF- CWPP) is a multi-year guiding document that will facilitate the implementation of future mitigation efforts.

In 2002, in response to ever-increasing levels of wildland fire threat, the Bush administration announced the Healthy Forest Restoration Act (HFRA), an initiative that enhanced measures to restore forest and rangeland health, and reduce the risk of catastrophic wildfires. In 2003, that act was signed into law. The general concepts of HFRA blended well with the established need for community wildfire protection in the study area. The spirit of the National Fire Plan and HFRA are reflected in the RMF CWPP.

This CWPP meets the requirements of HFRA by:

- 1. Identifying and prioritizing fuels reduction opportunities across the landscape**
See *Fuels Modification section* on pages 39-44 of the document.
- 2. Addressing structural ignitability**
See *Home Mitigation Guidelines* on pages 27-29 of the document.
- 3. Collaborating with stakeholders**
See Appendix E of the document

The RMF CWPP is the result of a district-wide fire protection planning effort that includes extensive field data, compilation of existing fire suppression documents, scientific analysis of the fire behavior potential of the study area (based on fuels, topography, and historical weather conditions), and collaboration with homeowners and officials from the Rocky Mountain Fire District and the Colorado State Forest Service.

This CWPP provides a comprehensive assessment of the wildfire hazards and risks in the study area. Its goal is to reduce hazards through increased education about wildfires, hazardous fuels reduction, and improved levels of fire suppression response. Detailed recommendations for specific actions are included herein. It is important to note that the RMF CWPP is a working document, and, as such, will need to be updated every three years, and/or after a major “event” such as wildfire, flood, insect infestation, or significant new home development.

Major conclusions:

- **Hazard Level,**
 - Of the eight communities analyzed, five were found to represent an extreme, very high, or high hazard.
- **Home Mitigation,**
 - Individual home assessments and mitigation recommendations will benefit all the communities.
- **Public Education,**
 - There is a need for a fire district-wide campaign to improve addressing markers.



- **Evacuation Routes and Fuels Reduction Projects**

- Eight projects are recommended and will enhance public and firefighter safety.

The CWPP provides an overview of the Values at Risk on which a significant wildfire would have an impact. These include: Life Safety and Homes, Commerce and Infrastructure, Recreation and Lifestyle, Habitat Effectiveness, and Environmental Resources.

The report's main recommendations are organized into sections that address five broad categories of fire mitigation: Mitigation Guidelines for Homes with detailed instructions for creating defensible space; Public Education recommendations, including recommendations for creating a standard for effective addressing; Local Preparedness and Firefighting Capability recommendations cover training, equipment, and communications; Fuels Modification recommendations with a list of Current and Proposed Cross-Boundary Fuels Reduction Projects; and Water Supply.

This report also contains eight detailed Community Descriptions and Recommendations for the following communities: Kneale Road, the Town of Eldorado Springs, Pine Needle, Lakeshore Park, Flagstaff Road, Superior/Rock Creek, Eldorado Springs Valley, and the Town of Marshall. In each case, a hazard rating is supplied, and recommendations intended for both homeowners and Rocky Mountain Fire are included. In addition the report also contains an "Areas of Special Interest" section, which analyzes and makes mitigation recommendations for Walker Ranch, Kossler Lake, Gross Reservoir, Eldorado Canyon State Park, the National Renewable Energy Laboratory, and Rocky Flats National Wildlife Refuge.

Because much of the information contained in the report is extensive and/or technical in nature, detailed discussions of certain elements are contained in appendices:

Appendix A: *Communities*

- Appendix A examines the communities in the study area in detail.

Appendix B: *Fire Behavior Potential Analysis Methodology*

- *Appendix B* describes the methodology used to evaluate the threat represented by physical hazards such as fuels, weather, and topography to Values at Risk in the study area, by modeling their effects on fire behavior potential. A detailed description of each standardized, nationally recognized fuel model found in the study area is included.

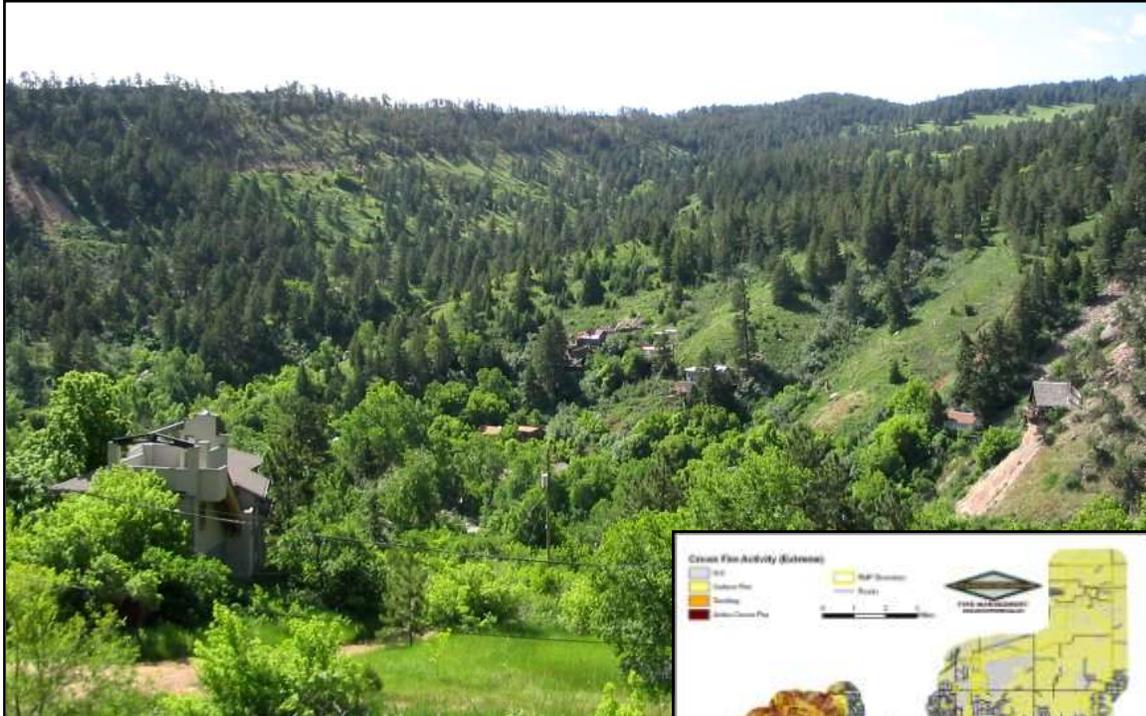
Appendix C: *Structural Triage and Preparation*

Appendix D: *Access and Water Supply Recommended Guidelines*

Appendix E: *Collaborative Effort*

ROCKY MOUNTAIN FIRE

WILDLAND-URBAN INTERFACE COMMUNITY WILDFIRE PROTECTION PLAN



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SUMMARY OF THIS DOCUMENT

This document incorporates new and existing information relating to wildfire for citizens, policy makers, and public agencies in the Rocky Mountain Fire (RMF) service area, Boulder, Colorado. Wildfire hazard data is derived from the community wildfire hazard rating analysis (WHR) and the analysis of fire behavior potential, which are extensive and/or technical in nature. As a result, our detailed findings and methodologies can be found in their entirety in the appendices rather than the main report text. This approach is designed to make the plan more readable while establishing a reference source for those interested in the technical elements of the RMF wildfire hazard and risk assessment.

The RMF Community Wildfire Protection Plan (CWPP) is the result of a community-wide fire protection planning effort that includes extensive field data gathering, compilation of existing fire suppression documents, a scientific analysis of the fire behavior potential of the study area, and collaboration with various participants: homeowners, RMF officials, and the Colorado State Forest Service (CSFS). This project meets the requirements of the federal Healthy Forests Restoration Act (HFRA) of 2003 for community fire planning.

This CWPP meets the requirements of HFRA by:

- 1. Identifying and prioritizing fuels reduction opportunities across the landscape**
Fuels modification recommendations can be found on pages 15-26 and 48-53 of this document.
- 2. Addressing structural ignitability**
See pages 27-29.
- 3. Collaborating with stakeholders**
See Appendix E

THE NATIONAL FIRE PLAN

In 2000, more than eight million acres burned across the United States, marking one of the most devastating wildfire seasons in American history. One high-profile incident, the Cerro Grande fire at Los Alamos, NM, destroyed more than 235 structures and threatened the Department of Energy's nuclear research facility.

Two reports addressing federal wildland fire management were initiated after the 2000 fire season. The first was a document prepared by a Federal Interagency Group titled, "Review and Update of the 1995 Federal Wildland Fire Management Policy" (2001), which concluded, among other points, that the condition of America's forests had continued to deteriorate.

The second report, issued by the Bureau of Land Management (BLM) and the United States Department of Agriculture Forest Service (USFS) and titled "Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of

2000”, would become known as the National Fire Plan (NFP). That report, and the ensuing congressional appropriations, ultimately required actions to:

1. Respond to severe fires
2. Reduce the impact of fire on rural communities and the environment
3. Ensure sufficient firefighting resources

Congress increased its specific appropriations to accomplish these goals. However, 2002 was another severe season, with more than 1,200 homes destroyed and seven million acres burned. In response to public pressure, Congress and the Bush administration continued to obligate funds for specific actionable items, such as preparedness and suppression. That same year, the Bush administration announced the HFRA initiative, which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic wildfires. In 2003, that act was signed into law.

Through these watershed pieces of legislation, Congress continues to appropriate specific funding to address five main sub-categories: preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters. The general concepts of the NFP blended well with the established need for community wildfire protection in the study area. The spirit of the National Fire Plan is reflected in the Rocky Mountain Fire CWPP.

PURPOSE

The purpose of the risk analysis, fire behavior analysis, community wildfire hazard rating (WHR) and the resulting CWPP is to provide a comprehensive, scientifically-based assessment of the wildfire hazards and risks within the RMF.

The assessment estimates the risks and hazards associated with wildland fire in proximity to communities. This information, in conjunction with Values at Risk, defines “areas of concern” for the community and allows for prioritization of mitigation efforts. From these analyses, solutions and mitigation recommendations are offered that will aid homeowners, land managers and other interested parties in developing short-term and long-term fuels and fire management plans.

For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the WHR ratings of the WUI communities and the analysis of fire behavior potential, as modeled from the fuels, weather and topography of the study area. Hazard attempts to quantify the severity of undesirable fire outcomes to the Values at Risk.

Values at Risk are the human and intrinsic values identified as important to the way of life of the study area by its inhabitants, such as life safety, property conservation, access to recreation and wildlife habitat. (See pages 5-8 for a comprehensive overview.)

GOALS AND OBJECTIVES

Goals for this project include the following:

1. Enhance life safety for residents and responders
2. Mitigate undesirable fire outcomes to property and infrastructure
3. Mitigate undesirable fire outcomes to the environment and quality of life

In order to accomplish these goals the following objectives have been identified:

1. Establish an approximate level of risk (the likelihood of a significant wildfire event for the study area)
2. Provide a scientific analysis of the fire behavior potential of the study area
3. Group Values at Risk into "communities" that represent relatively similar hazard factors
4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the Values at Risk (hazard levels)
5. Recommend specific actions that will reduce hazards to the Values at Risk

OTHER DESIRED OUTCOMES

1. Promote community awareness:

Quantification of the community's hazards and risk from wildfire will facilitate public awareness and assist in creating public action to mitigate the defined hazards.

2. Improve wildfire prevention through education:

Awareness, combined with education, will help to reduce the risk of unplanned human ignitions.

3. Facilitate and prioritize appropriate hazardous fuel reduction:

Organizing and prioritizing hazard mitigation actions into Fire Management Units (FMUs) can assist stakeholders in focusing future efforts from both a social and fire management perspective.

4. Promote improved levels of response:

The identification of areas of concern will improve the accuracy of pre-planning, and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

COLLABORATION: COMMUNITY/AGENCY/STAKEHOLDERS

Representatives involved in the development of the RMF CWPP are included in the following table. Their names, organization, and roles and responsibilities are indicated in Table 1. For more information on the collaborative process that led to the development of this CWPP, see Appendix E, RMF CWPP Collaborative Effort.

TABLE 1. CWPP Development Team

Name	Organization	Roles / Responsibilities
Mike Tombolato, Chief Don Whittemore, Assistant Chief	Rocky Mountain Fire	Local information and expertise, including community risk and value assessment, development of community protection priorities, and establishment of fuels treatment project areas and methods.
Allen Owen, District Forester	Colorado State Forest Service	Facilitation of planning process and approval of CWPP minimum standards.
Rodrigo Moraga, Managing Member, Fire Behavior Analyst Christopher White, CEO, Urban Interface Specialist Mark McLean, GIS Project Manager Marc McDonald, Project Manager Quinn MacLeod, WUI Project Specialist	Anchor Point Group LLC Consultants	Development of the CWPP, decision-making, community risk and value assessment, development of community protection priorities, establishment of fuels treatment project areas and methods.

STUDY AREA OVERVIEW

Rocky Mountain Fire (RMF) is located in Boulder County, Colorado. RMF covers an area of 78 square miles, and has approximately 35,000 residents. The district is bordered by various other suppression agencies including the City of Boulder Fire Department, Boulder Rural Fire Protection District, Mountain View Fire Protection District, Louisville Fire Department, North Metro Fire Rescue, Coal Creek Canyon Fire Department, High Country Fire Protection District, Sugarloaf Fire Protection District, and the Four Mile Fire Protection District.

FIGURE 1. Flagstaff area



For the purpose of this report, communities have been assessed for the hazards and risks that occur inside the district boundaries. Geographical Information Systems (GIS) work for this project has been extended to a project boundary beyond the district boundaries. Unless noted otherwise, rankings and descriptions of communities, as well as hazard and risk recommendations, pertain only to the portions of those areas that lie within the boundaries of Rocky Mountain Fire.

The district has two distinct areas, the plains and the foothills. The Plains life zone, 3,500 to 5,500 feet, is where the majority of study area population resides. It is dominated by grasslands, tall grass prairie remnants and riparian vegetation (including cattails, cottonwoods and other riparian hardwoods and shrubs) growing along water courses and in drainages. The foothill area is considered to be in the Foothill/Montane life zone (6,000'-10,000') of the eastern slope of the Northern Colorado Front Range.¹ The dominant vegetation is ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*). The foothill area also contains dense stands of mixed conifers primarily on north facing slopes. Dense riparian shrub corridors and open canopy woodlands broken by large grass meadows also exist in this area.

VALUES AT RISK

LIFE SAFETY AND HOMES

There are approximately 35,000 citizens residing within the Rocky Mountain Fire Protection District. The Wildland-Urban Interface areas were divided into eight communities. Of those eight communities, five are located within the foothills. The areas within each community represent certain dominant hazards from a wildfire perspective. Fuels, topography, structural flammability, availability of water for fire suppression, egress and access difficulties, as well as other hazards both natural and manmade, are considered in the overall hazard ranking of these communities. The hazard assessment identified five of the eight communities in the study area to be extreme to high hazard areas. Under extreme burning conditions, there is a likelihood of rapid increases

¹ Elevation limits for life zones were based on life zone ranges from: Jack Carter, "Trees and Shrubs of Colorado" (Boulder, CO, Johnson Books, 1998).

in fire intensity and spread in these areas due to steep topography, fast burning or flashy fuel components, and other topographic features that contribute to channeling winds and promotion of extreme fire behavior. These areas may also represent a high threat to life safety due to poor egress, the likelihood of heavy smoke, heat, and/or long response times.

With tens of thousands of people moving to Colorado each year, building in the once inaccessible mountain areas has become a growing concern. Most of Boulder County is vulnerable to some form of natural disturbance. Recent national disaster events have focused increased attention at both local and state government levels on the need to mitigate such events where possible and to prepare to cope with them when unavoidable.²

Boulder County recognizes the Wildland-Urban Interface as an area particularly at risk to wildland fires. Fire should be recognized as a natural and/or human-caused occurrence with certain benefits to the ecosystem. The county should strive towards balancing the natural processes of the ecosystem with development concerns so that residents may co-exist in a fire-dependent ecosystem.³

The population of Boulder County is growing at an average rate of 3% per year, and has increased 29% between 1990 and 2000, with increased mountain development and recreational pressures following this increase in population. Over 154,000 people in the county live in wildfire hazard areas.⁴

Boulder County has a recorded history of forest fires dating back to June 29, 1916, when 1,000 acres burned around Bear Mountain (**See Current Risk Situation, page 8**).⁵

COMMERCE AND INFRASTRUCTURE

Commercial property and retail business are limited within the Wildland-Urban Interface portions of RMF, although some residents maintain home-based businesses. Agricultural properties and livestock-related businesses also exist in some portions of the study area.

A significant component in both the *Boulder County Comprehensive Plan* and a majority of the local municipal plans and programs is recognition of the importance of environmental factors, natural and cultural amenities, or "quality of life" issues to the health of the economy. The Boulder County economy has benefited from its legacy of careful land use decisions in its open space lands, which include national and state parks, national and state forests, and city and county open space and parks.⁶ The economy of the area is based largely on the quality of life that attracts professionals to establish residences. Wildfire, therefore, has the potential to cause significant damage to the local economy.

2 Boulder County Comprehensive Plan - Boulder County Land Use Department
(<http://www.co.boulder.co.us/lu/bcccp/introduction.htm>)

3 Ibid.

4 http://www.ncsu.edu/project/wildfire/Colorado/boulder/BoulderCaseStudy_final.pdf

5 <http://www.co.boulder.co.us/sheriff/fire/firehistory.htm>. referenced 5-25-07

6 Boulder County Comprehensive Plan – Boulder County Land Use Department
(<http://www.co.boulder.co.us/lu/bcccp/introduction.htm>)

RECREATION AND LIFESTYLE

The culture of Boulder County emphasizes environmental values and outdoor recreation. Boulder County has intermixed land ownership. Approximately 60% of the land is owned publicly with 40% owned privately. Public land is divided among a variety of local, state and federal managers including the United States Forest Service, Boulder County Parks and Open Space, City of Boulder Open Space and Mountain Parks, and Colorado State Parks.⁷

Eldorado Canyon State Park was voted one of the top ten state parks in the country.⁸ The park offers a multitude of recreational opportunities including rock climbing, hiking, mountain biking, and many other outdoor interests. During an average summer weekend the park is filled to capacity.

The idea of a county open space program was initiated in the mid-1960s by Boulder County citizens who were interested in parks and recreation needs of the unincorporated area and in "preserving open space land in the face of rapid county development." This was at a time when Boulder County's 750 square miles were home to a population of fewer than 130,000 people. The 1995 population was almost 260,000.⁹

In 1978, the *Boulder County Comprehensive Plan* was adopted. The plan included goals and policies for preserving open space, protecting environmental resources (including both natural and cultural resources), and developing a county-wide trail system. The implementation of the open space plan has been based both on private cooperation and on the county's financial ability to acquire an interest in these lands.

By early 1998, the county open space program comprised more than 52,000 acres of preserved land scattered throughout the county, along with 70 miles of trails. The majority of this land is open for public use. The remainder is under agricultural lease or conservation easements, which do not include public access. Most of the properties are well-suited to passive recreation (recreation development is limited to trails, parking areas/trailheads, picnic areas/shelters, outhouses, and simple boat docks or fishing piers where necessary).

Residents who live in the study area have a keen appreciation for their natural environment. Recreation and the natural beauty of the area, values which can be seriously damaged by wildfire, are frequently quoted as reasons local residents have chosen to live in the study area.

HABITAT EFFECTIVENESS & ENVIRONMENTAL RESOURCES

Residents are clear that the preservation of wildlife and the environment is important to the quality of life of the area. Habitat effectiveness is defined as the degree to which habitat is free of human disturbance and available for wildlife to use. Effective habitat is mostly undisturbed land area, which is buffered (at least 300 feet in essentially all situations) from regular motorized and non-motorized use of roads and trails (11 or more people or vehicle trips per week). The commonly held view is that habitat effectiveness should not fall below 50%, although the best

7 "Community Responses to Wildland Fire Threats in Colorado" – T. Steelman, D. Bell, Dept. of Forestry, NCSU (http://www.ncsu.edu/project/wildfire/Colorado/boulder/b_reduce.html)

8 <http://www.smartertravel.com/travel-advice/photos/ten-state-parks-you-cant-afford-to-miss.html>

9 Ibid.

wildlife habitats have a much higher percentage.¹⁰ Wildfire, specifically severe wildfire, can have significant adverse effects on habitat effectiveness.

The environmental character of Boulder County is due in large measure to the abrupt altitudinal variation within a 20-mile east-west gradient. The dramatic landform changes sharply define the native ecosystems and their associations of plant and animal species.

The county's environmental heritage includes non-renewable resources such as natural areas, historic/archaeological sites, and natural landmarks. As irreplaceable resources, they warrant preservation from destruction or harmful alteration. Wetlands are critical environmental resources that function variously as wildlife habitat, aquifer recharge areas, and linkages in the overall county wildlife system, and aids for smog control.

The goal of the [Boulder County Comprehensive Plan](#) is to maintain and monitor the forests on open space in accordance with ways that benefits the ecosystem and the public by:

- Assessing overall forest conditions through forest inventories and surveys
- Implementing prescriptions based on the results of these inventories and surveys
- Taking action to change or increase the individual tree's health and vigor
- Reducing fire danger
- Improving or maintaining wildlife habitat
- Maintaining and preserving the aesthetic and ecological value of the forest

The RMF CWPP process is in concert with these guiding comprehensive plan principles. Through public involvement, local support and a regional perspective, the fuels reduction elements described in this document can and should enhance and protect the values of the study area.

CURRENT RISK SITUATION

For the purpose of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the wildfire hazard ratings of the Wildland-Urban Interface (WUI) communities and fire behavior potential, as modeled from the fuels, weather, and topography of the study area.

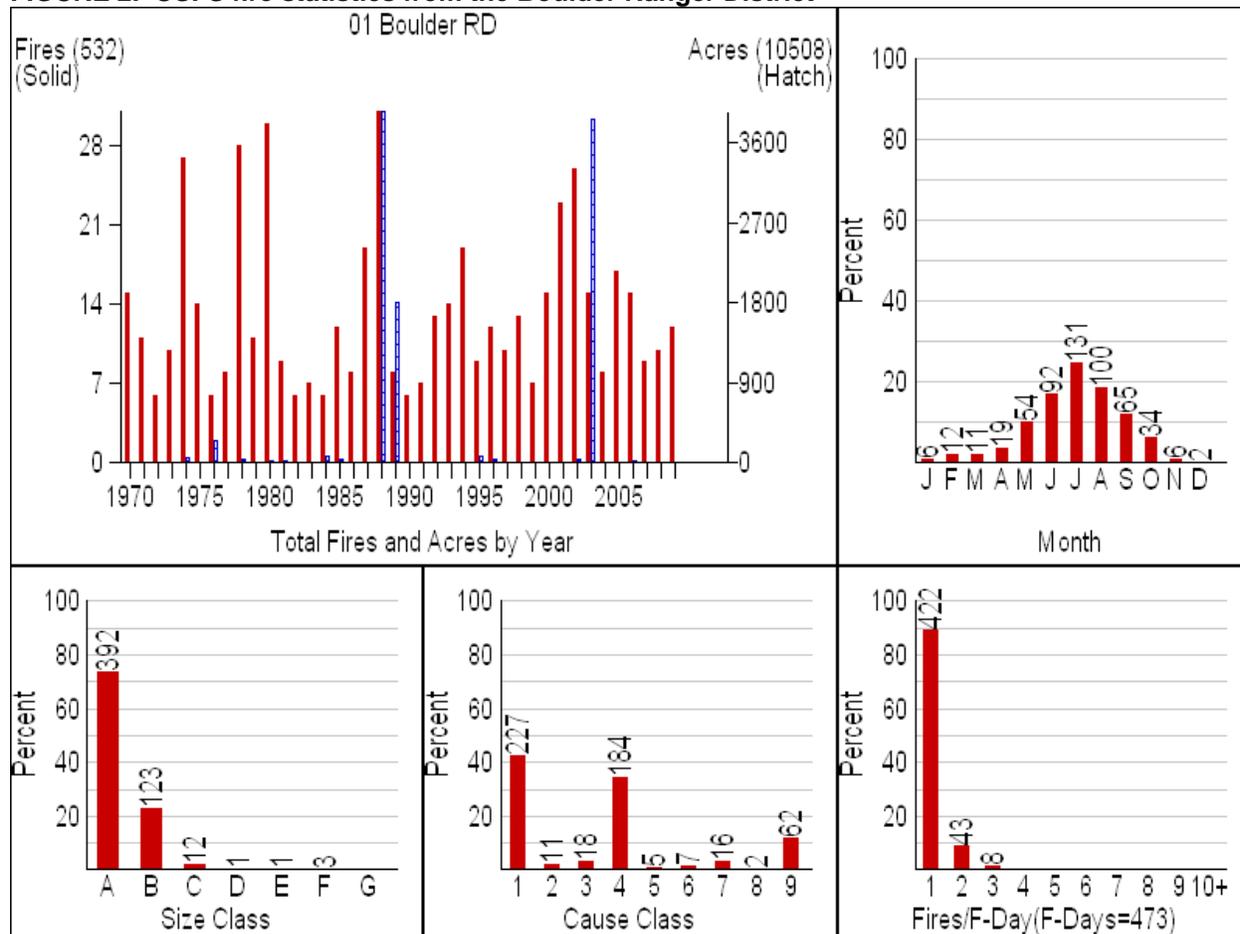
The majority of the district is at a high risk for wildland fires. This assessment is based on the analysis of the following factors:

1. The city of Boulder is listed in the Federal Register as a community at high risk from wildfire (<http://www.fireplan.gov/reports/351-358-en.pdf>).

¹⁰ Peak to Peak Community Indicators Project 2003 Presented by Peak to Peak Healthy Communities Project ©Copyright 2003 Peak to Peak Healthy Communities Project

2. The area is shown in the Colorado State Forest Service WUI Hazard Assessment map to be an area of high Hazard Value (an aggregate of Hazard, Risk and Values Layers).
3. Rocky Mountain Fire responded to a total of 169 wildland incidents in the years from 2001 through 2009. In 2006 alone RMF responded to 34 wildland fires. No major fires (fires greater than 100 acres) have burned in the district since 2000 (the Walker Ranch Fire), but major fires have recently occurred near the district, including a number of large (500+ acres) grass fires in the winter of 2006. Of particular mention was the April of 2006 wildfire at Rocky Flats National Wildlife Refuge. This area contracts with RMF for emergency services. It is important to note there are over 20 fire departments in Boulder County, and many mutual aid agreements are in place. The Boulder area has a large number of well-trained resources. Ignitions in this area attract a rapid, professional response and are generally extinguished quickly.
4. Boulder County experiences an average of 100 fire starts per year. Over the past 20 years the county has seen a number of major wildland fires, and until 2001, held the Colorado record for structural losses from wildland fires. This was due largely to the 1989 Black Tiger fire, which claimed 44 homes. The Walker Ranch fire which started on September 15, 2000 was the first major fire since the Old Stage Fire in 1990. The fire burned approximately 1,100 acres. Although there were over 250 homes in the area, no structures were lost.
5. Fire history statistics from the Colorado State Forest Service (CSFS) and its cooperator fire departments reflect an active fire history for the years available. CSFS reports 100 fires in 1990, 104 in 1991, 126 in 1992, and 98 in 1993, for a total of 428 in Boulder County during the four-year period.
6. The USDA Forest Service fire regime and condition class evaluation of forest stands in the study area shows that historic fire regimes have been moderately altered. Please see the *Fire Regime and Condition Class* section of this report for details.
7. The surrounding federal lands report an active, but far from extreme, fire history. Fire occurrences for the Boulder Ranger District of the Arapahoe-Roosevelt National Forest (see **Figure 2**, page 10) were calculated from the USDA Forest Service Personal Computer Historical Archive for the thirty-nine year period from 1970-2009. These areas represent federal lands adjacent to the study area, but do not include any data from state, county, or private lands. The data have been processed and graphed using the Fire Family Plus software program and are summarized below.

FIGURE 2. USFS fire statistics from the Boulder Ranger District



Size Class (in acres)	A	B	C	D	E	F	G		
	< ¼	¼ - 9	10 - 99	100-299	300-999	1000 - 4999	5000 +		
	1	2	3	4	5	6	7	8	9
Causes	Lightning	Equipment	Smoking	Campfire	Debris Burning	Railroad	Arson	Children	Misc.

Figure 2a shows the number of fires (red bars) and the total acres burned (blue hatched bars) in the Boulder Ranger District for each year. While the number of annual fires ranges from approximately 5 to over 30 fires per year, there is little year-to-year pattern to the variation. The single largest fire for acreage burned was the Overland Fire in 2003. Of the 10,508 acres reported burned in the ranger district between 1970 and 2009, 3,869 were burned by the Overland fire. The total number of acres burned was the greatest in 1988, when two large fires accounted for 3,922 acres burned and the Boulder Ranger District had the highest number of fires during the study period. A portion of the Black Tiger Fire also burned 1,804 acres in the Boulder Ranger District in 1989.

Figure 2b shows the percentage and number of fires occurring in each month of the year. July had the greatest number of fires, followed by June and August. The fewest fires occurred between the months of November and April, a fact which reflects the climate conditions for the area.

Figure 2c shows the size class distribution of fires. Approximately 98% of the reported fires (392 of 532) were less than 10 acres in size. These statistics reflect the widely held opinion that, throughout the western US, the vast majority of fires are controlled during initial attack.

Figure 2d shows the number of fires caused by each factor. As shown in this graph, the most common cause of ignitions is lightning (50%). However, the next most common cause is campfires (30%). If we remove the miscellaneous cause category, natural causes still represent the majority of ignitions (56% natural and 44% human-caused), but it should be noted that these numbers are for national forest areas which lack the concentrated development and many other risk factors present in the portions of the study area where private land is dominant.

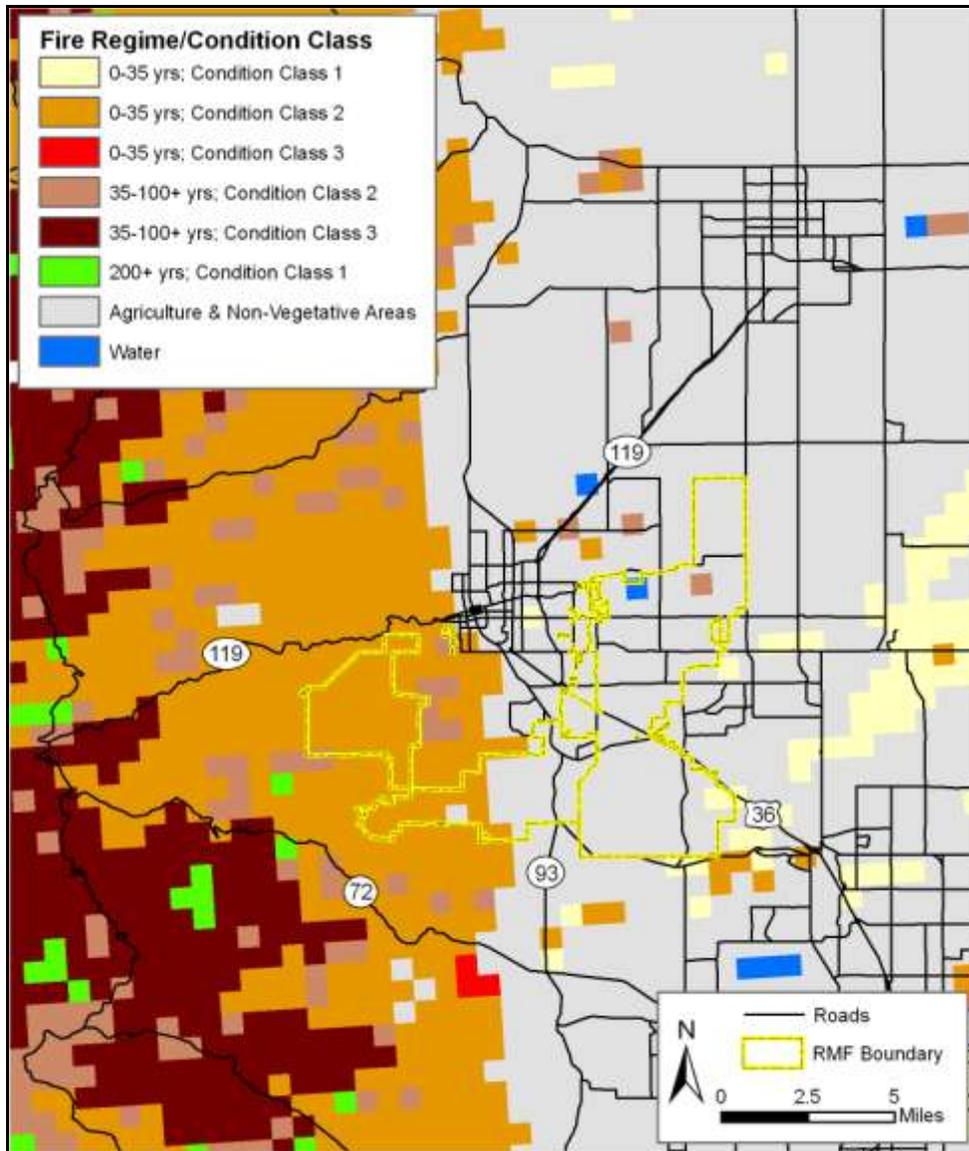
Figure 2e shows the number of fire starts for each day that a fire start was recorded. Most fires (422) occurred on days that only had one fire start. Approximately 9% (43) of fire days had two fire starts recorded, and days with three or more fire starts represent less than 2% of all fire start days. The statistics suggest that multiple start days are a rare occurrence compared to fire days with a single ignition.

FIRE REGIME CONDITION CLASS

The Fire Regime Condition Class (FRCC) is a landscape evaluation of expected fire behavior as it relates to the departure from historic norms. The data used for this study is from a national level map. The minimum mapping unit for this data is one square kilometer. FRCC is not to be confused with BEHAVE or FlamMap fire behavior models (detailed in the fire behavior section), which provide the fire behavior potential analysis for expected flame length, rate of spread, and crown fire development.

The FRCC is an expression current condition's departure from the historical fire regime. It is used as a proxy for the probability of severe fire effects (the loss of key ecosystem components such as soil, vegetation structure, species; or alteration of key ecosystem processes, such as nutrient cycles, hydrologic regimes). Consequently, FRCC is an index of hazards to the status of many components (e.g., water quality, fish status, wildlife habitats, etc.). **Figure 3** (page 12), graphically displays the return interval and condition class of the study area.

FIGURE 3. Fire Regime/Condition Class

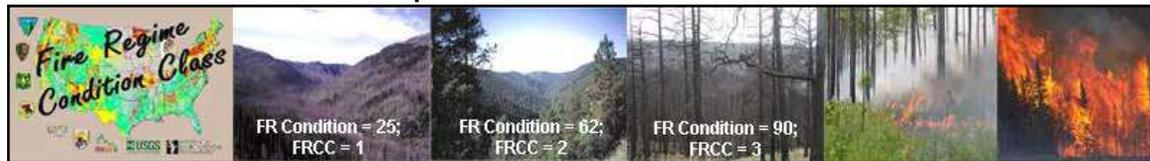


Deriving FRCC is accomplished by comparing current conditions to an estimate of the historical range that existed prior to substantial settlement by Euro-Americans. The departure of the current condition from the historical baseline serves as a proxy to likely ecosystem effects. In applying the condition class concept, it is assumed that historical fire regimes represent the conditions under which the ecosystem components within fire-adapted ecosystems evolved and have been maintained over time. Thus, if it is projected that fire intervals and/or fire severity have changed from the historical conditions, then it would be expected that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, if it is assumed that these basic fire characteristics have changed, then it is likely that there would be subsequent effects to those ecosystem components that had adapted to the historical fire regimes. As used here, the potential of ecosystem effects reflect the probability that key ecosystem components would be lost if a fire were to occur within the Foothills communities of RMF. It should be noted that a key ecosystem component can represent virtually any attribute of

an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).

The following categories of condition class are used to qualitatively rank the potential of effects to key ecosystem components:

Table 2. Condition Class Description¹¹



Condition Class	Condition Class Description
1	Fire regimes are within their historical range. The risk of losing key ecosystem components as a result of wildfire is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. Fire effects would be similar to those expected under historic fire regimes.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components as a result of wildfire is moderate. Fire frequencies have changed by one or more fire-return intervals (either increased or decreased). Vegetation attributes have been moderately altered from their historical range. Consequently, wildfires would likely be larger, more intense, more severe, and have altered burn patterns, as compared with those expected under historic fire regimes.
3	Fire regimes have changed substantially from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have changed by two or more fire-return intervals. Vegetation attributes have been significantly altered from their historical range. Consequently, wildfires would likely be larger, more intense, and have altered burn patterns, as compared with those expected under historic fire regimes.

The foothill communities of the study area are primarily classified under Condition Class 2. By definition, historic fire regimes have been moderately altered. As a consequence, wildfires are likely to be larger, more severe, and have altered burn patterns, as compared with those expected under historic fire regimes.

¹¹ Fire Regime Condition Class, website, <http://www.frcc.gov/>, July 2005.

COMMUNITY RECOMMENDATIONS

FIGURE 4. Rocky Mountain Fire Community Hazard Rating Map

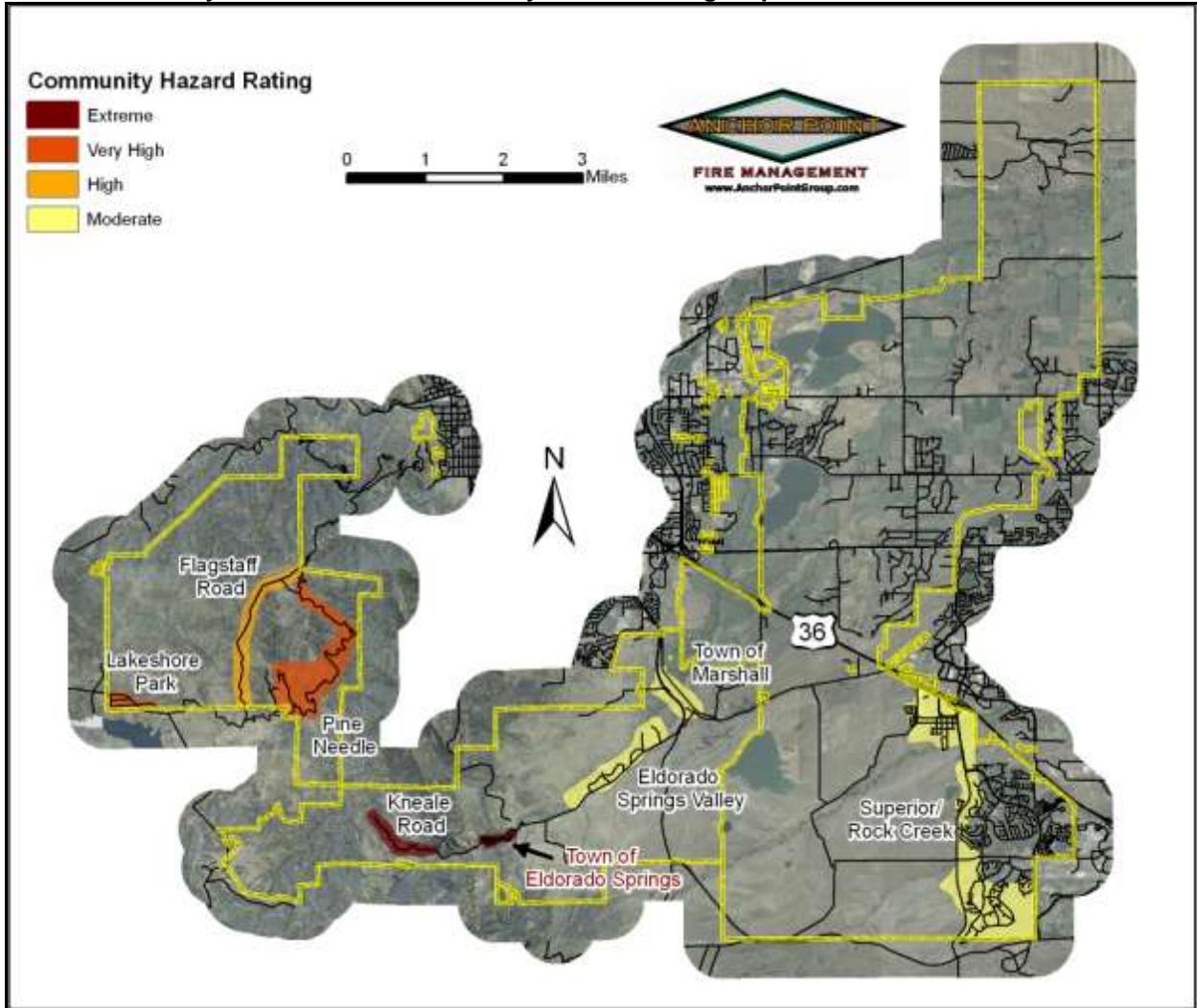


TABLE 3. Study area communities

1. Kneale Road	5. Flagstaff Road
2. Town of Eldorado Springs	6. Superior / Rock Creek
3. Pine Needle	7. Eldorado Springs Valley
4. Lakeshore park	8. Town of Marshall

1. KNEALE ROAD (Extreme Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is **strongly advised** for all homes in the Kneale Road community. For details on defensible space, please refer to the **Home Mitigation** section, page 27.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” in the **Fuels Modification Projects** section, page 39.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. An improved turnaround should be constructed at the point where Kneale Road leaves South Boulder Creek. For details, please refer to **Appendix D**.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- A large-animal evacuation plan should be developed if applicable.

Kneale Road Recommendations – Rocky Mountain Fire

- A parcel-level analysis is recommended as soon as possible.** Re-evaluation if data is older than five years.
- Investigate and verify firefighter safety zone.**
 - 0.3 mile up the canyon from the Community Entrance Security Gate (near the Eldorado Canyon State Park visitor’s center)
- Evacuation and Access.**
 - **Evacuation Route, Kneale Road to Bison Drive via the “gas line road.” Priority Level High.** This project focuses on opening up the gas line road for emergency usage from Kneale Road where it leaves the South Boulder Creek northward to the Ethel Harrold Trailhead via Martin Gulch. Emergency use would be for both citizens and emergency responders. The road surface should be evaluated to determine the feasibility of allowing non-four wheel drive vehicles in and out of the area. Road pullouts also need to be constructed. See **Appendix D** for details. Fuels mitigation, consisting of limbing and thinning to create a safe and effective escape route, is also recommended (see the “Access Route Fuels Modification Projects” section of this report). This project will require a cooperative effort between RMF and Boulder County Open Space. It is recommended that the route be well marked. The metal pipe boundary fence at the junction with Eldorado Canyon trail should be replaced with a locked emergency gate.
 - Ensure that all Open Space access points are known to all responding agencies.

- **Fuel Reduction Project.**
 - **Kneale Road Evacuation Route Treatment (Approximately 81 acres). Priority Level High.** This project focuses on opening up the “gas line road” for emergency usage from Kneale Road where it leaves the South Boulder Creek northward to the Ethel Harrold Open Space Trailhead via Martin Gulch, through limbing and thinning. Emergency use would be for both citizens and emergency responders. Thinning should be conducted to conform to the shaded fuel break guidelines described in the “Access Route Fuels Modification Recommendations” section. If combined with extended defensible space for the few homes in the area, this project will help protect an important escape route, as well as providing a fuel break. This project will require a cooperative effort between RMF and Boulder County Open Space.

- **Water Supply**
 - **Priority Level High.** A medium sized (10,000 gal.) cistern is recommended for the Kneale Road community. This should be situated on a hillside where it could gravity-feed down to a valved outlet, yielding a more reliable fill rate over conventional drafting.
 - Make certain all water sources are adequately signed.

- **Areas of Special Interest.** City Open Space, County Open Space, and Eldorado State Park border the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be contacted and given these recommendations.

2. TOWN OF ELDORADO SPRINGS (Extreme Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section on page 27.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. Please refer to the “Access Route Fuels Modification Recommendations,” in the **Fuels Modification Projects** section, page 39.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Where slopes rise steeply, consider creating barriers such as rock walls to protect areas from burning rolling material.
- Ensure that all road signs are made of non-combustible materials.
- Add reflective, non-combustible addressing to all driveways and homes.

Town of Eldorado Springs Recommendations – Rocky Mountain Fire

- A parcel-level analysis is recommended as soon as possible.**
- Fuel Reduction Project.**
 - **Town of Eldorado Aqueduct Fuelbreak (Approximately 11 acres). Priority Level High (see Figure 10).** A fuelbreak needs to be created along the aqueduct on the south side of town. It will anchor into the road on the west end and extend on the uphill side of the aqueduct to the east side of the town, then extend uphill to join into the Boulder OSMP Lindsay Property project. Existing defensible space should be incorporated and extended to help create this fuelbreak (which will include the few homes that sit above the aqueduct). Thinning to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for at least 100 feet upslope. Where the fuelbreak leaves the aqueduct and turns upslope to tie in with the OSMP fuel break, it is recommended to thin back 100 feet on both sides.

- **Access**
 - Ensure that all Open Space access points are known to all responding agencies.

- **Improve all roads within the town limits.**

- **Post weight restrictions on bridges.** Consult with Boulder County.

- **Water Supply**
 - **Priority Level High.** The town of Eldorado Springs needs a larger capacity, reliable water supply for fire fighting. An in-depth study will determine the best course of action.
****In the entire study area, this is the most critical need.**

- **Make certain all water sources are adequately signed.**

- **Areas of Special Interest.** City Open Space and Eldorado State Park border the community. (See **Other Areas of Special Interest**, pages 48-53.) A responsible manager should be given these recommendations.

3. PINE NEEDLE (Very High Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section on page 27.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. Please refer to the “Access Route Fuels Modification Recommendations,” in the **Fuels Modification Projects** section on page 39.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Add reflective, non-combustible addressing to all driveways and homes.
- Ensure that all road signs are made of non-combustible materials.
- A large-animal evacuation plan should be developed where applicable.

Pine Needle Recommendations – Rocky Mountain Fire

- A parcel-level analysis is recommended.** Re-evaluation if data is older than five years.
- Investigate and verify firefighter safety zones.**
 - Flagstaff Road between Bison Drive and Kossler Lake
 - Flagstaff Road at the Walker Ranch Trailhead Road
- Evacuation and Access.**
 - **Evacuation Route, Kneale Road to Bison Drive via the “gas line road.” Priority Level High.** This project focuses on opening up the gas line road for emergency usage from Kneale Road where it leaves the South Boulder Creek northward to the Ethel Harrold Trailhead via Martin Gulch. Emergency use would be for both citizens and emergency responders. The road surface should be evaluated to determine the feasibility of allowing non-four wheel drive vehicles in and out of the area. Road pullouts will also need to be constructed. Please see **Appendix D** for details. Fuels mitigation, consisting of limbing and thinning to create a safe effective escape route, is also recommended (see the “Access Route Fuels Modification Projects” section of this report). This project will require a cooperative effort between RMF and Boulder County

Open Space. It is recommended that the route be well marked. The metal pipe boundary fence at the junction with Eldorado Canyon trail should be replaced with a locked emergency gate.

- **Evacuation Route; Bison Drive to Flagstaff Road. Priority Level High.** This project focuses on educating the homeowners in the area about the importance of allowing this road to be used as an emergency evacuation route. It is recommended that the current “private road” signs be replaced with signs that read “Emergency Evacuation Route Only” or similar wording.
- Ensure that all Open Space access points are known to all responding agencies.

□ **Fuel Reduction Projects**

- **Pika Road Treatment (Approximately 28 acres). Priority Level High (see Figure 10).** This project begins at Flagstaff Road and extends to the Ethel Harrold Open Space Trailhead along Pika Road. This project is designed to provide a fuel break along Pika Road, while protecting the egress route from this area. This will also help to protect the homes along Cougar Drive. Thinning should be conducted to conform to the shaded fuel break guidelines in the “Access Route Fuels Modification Recommendations” section.
- **Kneale Road Evacuation Route Treatment (Approximately 81 acres). Priority Level High (see Figure 10).** This project focuses on opening up the “gas line road” for emergency usage from Kneale Road where it leaves the South Boulder Creek northward to the Ethel Harrold Open Space Trailhead via Martin Gulch, through limbing and thinning. Emergency use would be for both citizens and emergency responders. Thinning should be conducted to conform to the shaded fuel break guidelines described in the “Access Route Fuels Modification Recommendations” section. If combined with extended defensible space for the few homes in the area, this project will help protect an important escape route, and provide a fuel break. This project will require a cooperative effort between RMF and Boulder County Open Space.

□ **Water Supply**

- **Priority Level High.** A medium-sized (10,000 gal.) cistern is recommended for the Bison Drive area within the Pine Needle community. This should be situated on a hillside where it could gravity-feed down to a valved outlet. This will yield a more reliable fill rate over conventional drafting, and will help to maintain an adequate spacing of water sources within the study area.

□ **Investigate the capabilities of the private pond located at 1564 Bison Drive.** What steps would be necessary to make this an emergency water source?

□ **Areas of Special Interest.** City Open Space and County Open Space border the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be contacted and distributed those recommendations.

4. LAKESHORE PARK (Very High Hazard Rating)

Lakeshore Park Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section on page 27.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” in the **Fuels Modification Projects** section on page 39.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Add reflective, non-combustible addressing to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- A large-animal evacuation plan should be developed where applicable.

Lakeshore Park Recommendations – Rocky Mountain Fire

- A parcel-level analysis is recommended.** Re-evaluation if data is older than five years.
- Investigate and verify firefighter safety zone.**
 - Lakeshore Drive and Gross Dam Road, southeast of the intersection (Walker Ranch burn area).
- Fuel Reduction Projects.**
 - Flagstaff Road Treatment (Approximately 115 acres). Priority level High (see Figure 10).** This project focuses on limbing and thinning along Flagstaff Road from Bison Drive to the west end of the Lakeshore Park community via Lakeshore Park Road. (This project will eventually tie into the efforts of the Boulder OSMP Flagstaff Road project. See **Figure 10**.) Thinning should be conducted to conform to the shaded fuelbreak guidelines described in the “Access Route Fuels Modification Recommendations” section. Extra depth should be considered below the road in the drainages (200 to 300 feet). If combined with defensible space for all homes, this project will help protect a critical access route and will interrupt the continuity of fuels near the road. This treatment will also help to protect the individual homes north-northeast of the Lakeshore Park community. Special consideration should be given to the homes along

the south side of Lakeshore Park Road. Linked defensible space would help to protect this area from an ignition along the shore of Gross Reservoir.

- **Lakeshore Drive Treatment (Approximately 9 acres). Priority Level High (see Figure 10).** This project focuses on providing a fuel break by linking together extended defensible space between all the homes along Lakeshore Drive. This project builds upon the Flagstaff Road/Lakeshore Park Road project (**Recommendation A**). Thinning should be conducted to conform to the shaded fuel break guidelines described in the “Access Route Fuels Modification Recommendations” section. This treatment will also help to protect the individual homes north-northeast of the Lakeshore Park community.

- **Water Supply**
 - **Priority Level High.** A few private cisterns were noted within the Lakeshore Park community (see **Figure 10**). One appeared to be very new and has a large diameter fitting (storz) attached to it. These cisterns should be investigated and deemed useable or not. Be sure to label to indicate their capabilities/capacities.
 - Make certain all water sources are adequately signed.

- **Areas of Special Interest.** City Open Space, County Open Space, and Gross Reservoir border the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be contacted and given these recommendations.

5. FLAGSTAFF ROAD (High Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section on page 27.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” in the **Fuels Modification Projects** section on page 39.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- A large-animal evacuation plan should be developed where applicable.

Flagstaff Road Recommendations – Rocky Mountain Fire

- A parcel-level analysis is recommended.** Re-evaluate if data is older than 5 years.
- Investigate and verify firefighter safety zone.**
 - Flagstaff Road between Bison Drive and Kossler Lake
 - East side of Flagstaff Road, 0.75 mile north of the Pika Road / Flagstaff Road intersection. 6941 Flagstaff Road or GPS coordinates 39° 5755.20' N, 105° 2014.21' W
 - Flagstaff Road at the Walker Ranch Trailhead Road
- Evacuation and Access.**
 - **Access Route; Chapman Drive to Boulder Canyon Drive. Priority Level High.** This project is meant to enhance fire district access to the area between Flagstaff Road and Boulder Canyon via Chapman Drive. It is recommended that the road surface be improved and the adjacent fuels brushed back to allow larger all-wheel drive fire apparatus. This project will also be recommended in the Boulder Fire Department CWPP. It is suggested that a joint effort be made to implement and complete this project between the agencies involved.
 - Ensure that all Open Space access points are known to all responding agencies.
- Fuel Reduction Projects.**
 - **Flagstaff Road Treatment (Approximately 115 acres). Priority level High (see Figure 10).** This project focuses on limbing and thinning along Flagstaff Road from Bison Drive to the west end of the Lakeshore Park community via Lakeshore Park Road. (This project will eventually tie into the efforts of the Boulder OSMP Flagstaff Road project. See **Figure 10**.) Thinning should be conducted to conform to the shaded fuelbreak guidelines described in the “Access Route Fuels Modification

Recommendations” section. Extra depth should be considered below the road in the drainages (200 to 300 feet). If combined with defensible space for all homes, this project will help protect a critical access route and will interrupt the continuity of fuels near the road. This treatment will also help to protect the individual homes north-northeast of the Lakeshore Park community. Special consideration should be given to the homes along the south side of Lakeshore Park Road. Linked defensible space would help to protect this area from an ignition along the shore of Gross Reservoir.

- **Water Supply**
 - Make certain all water sources are adequately signed.

- **Areas of Special Interest.** City Open Space and County Open Space border the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be contacted and given these recommendations.

6. SUPERIOR / ROCK CREEK (Moderate Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes, especially those located on the perimeter. For details, please refer to the **Home Mitigation** section on page 27.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that greenbelts remain irrigated.

Superior / Rock Creek Recommendations – Rocky Mountain Fire

- Access:** Ensure that Open Space access points are known to all responding agencies.
- Areas of Special Interest.** City Open Space, County Open Space, National Renewable Energy Laboratory, and Rocky Flats Wildlife Refuge border the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be given these recommendations.

7. ELDORADO SPRINGS VALLEY (Moderate Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section on page 27.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Add reflective, non-combustible addressing to all driveways and homes.
- A large-animal evacuation plan should be developed where applicable.

Eldorado Springs Valley Recommendations – Rocky Mountain Fire

- Access:** Ensure that all Open Space access points are known to all responding agencies.
- Water Supply**
 - Make certain all water sources are adequately signed.
- Areas of Special Interest.** City Open Space borders the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be given these recommendations.

8. TOWN OF MARSHALL (Moderate Hazard Rating)

Recommendations - Homeowner

- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation** section, page 27.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads. For details, please refer to **Appendix D**.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- A large-animal evacuation plan should be developed where applicable.

Town of Marshall Recommendations – Rocky Mountain Fire

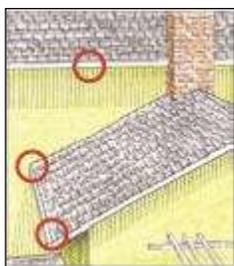
- Access**
 - Ensure that all Open Space access points are known to all responding agencies.
- Water Supply**
 - Make certain all water sources are adequately signed.
- Areas of Special Interest.** City Open Space borders the community. See **Other Areas of Special Interest**, pages 48-53. A responsible manager should be contacted and given these recommendations.

GENERAL RECOMMENDATION GUIDELINES

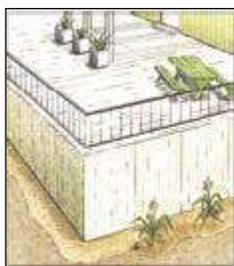
HOME MITIGATION

To improve life safety and preserve property, every home in the study area must have compliant, effective defensible space. This is especially important for homes with wood roofs and homes located on steep slopes, in chimneys, saddles, or near any other topographic feature that contributes to fire intensity. These recommendations are intended to give homeowners enough information to immediately begin making their home fire-safe or improve existing home mitigation efforts. Defensible space must be maintained throughout the year.

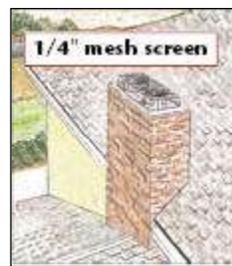
- ✓ Trees and shrubs are properly thinned and pruned within the defensible space. Slash from the thinning has been disposed of properly.
- ✓ Roof and gutters are clear of debris.
- ✓ Branches overhanging the roof and chimney are removed.
- ✓ Chimney screens are in place and in good condition.
- ✓ An outdoor water supply is available, complete with a hose and nozzle that can reach all parts of the house. Fire extinguishers are checked and in working condition.
- ✓ The driveway is wide enough. The clearance of trees and branches is adequate for fire and emergency equipment. (Check with your local fire department.)
- ✓ Road signs and your house number are posted and easily visible.
- ✓ There is an easily accessible tool storage area with rakes, hoes, axes, and shovels.
- ✓ Attic, roof, eaves, and foundation vents are screened and in good condition. Stilt foundations and decks are enclosed, screened or walled up.
- ✓ Trash and debris accumulations are removed from the defensible space. Firewood is staked on a side contour, at least 50 feet away from structures.
- ✓ Propane tanks should be located at least 30' from all structures. The area around the tank must be free of combustible material such as yard debris, weeds, etc.
- ✓ Maintain your defensible space constantly:
 - Mow non-irrigated grass to a low height. Mow early in the morning, avoiding times of wind, and avoid rocks because a grass fire could ignite from a spark.
 - Remove any branches overhanging the roof or chimney.
 - Remove all debris and cuttings from the defensible space.



Clean Gutters and Roof

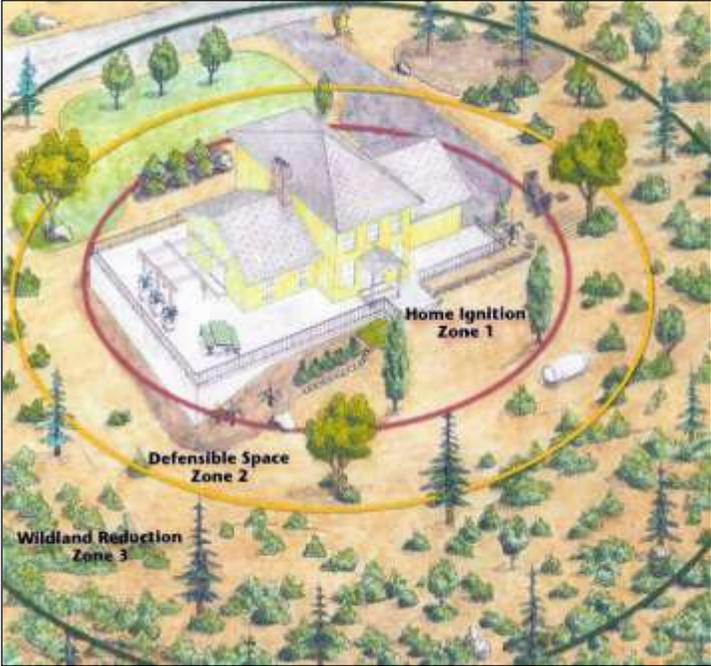


Enclose Decks

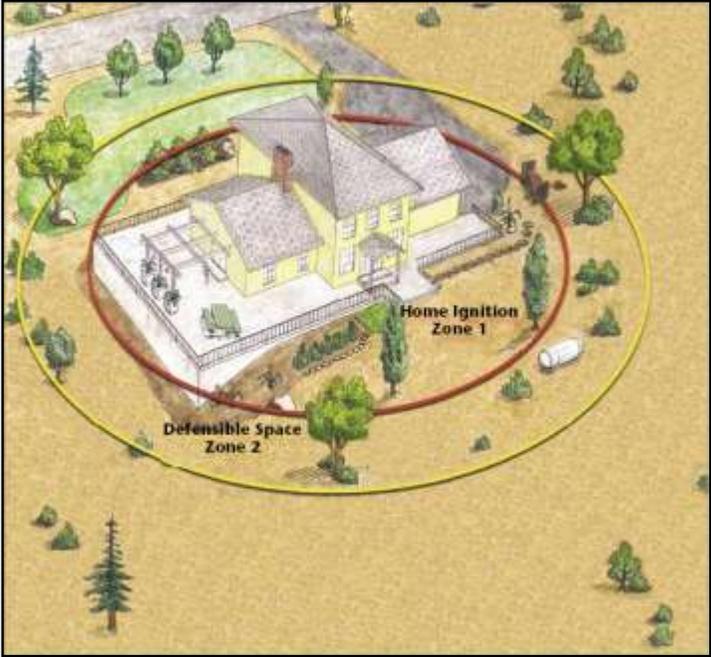


Maintain Chimneys

Defensible Space Zones (Timber and Brush Lands)¹²



Defensible Space Zones (Grass Lands)



¹² A Homeowner's Guide to Fire Safe Landscaping (2005), www.firesafecouncil.org, referenced 9/10/07

ZONE 1 (within 15 feet of the home), shown as Home Ignition Zone, suggests eliminating all flammable materials (fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.). Irrigated grass, rock gardens, non-flammable decking, or stone patios are desirable substitutions.

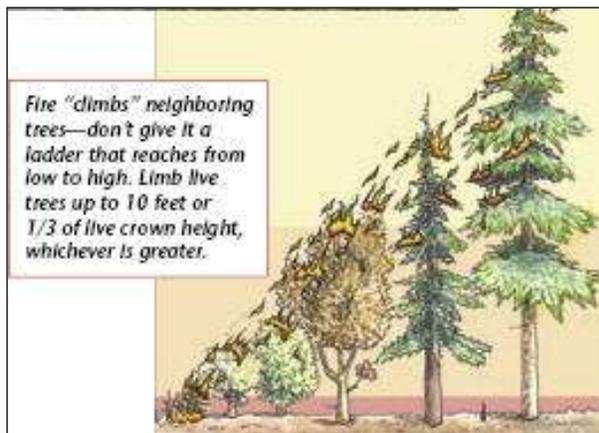
ZONE 2 Defensible Space (15 to 100 feet from the home – on steep slopes or areas of high winds the Defensible Space will need to be expanded to 150 feet) suggests thinning trees and large shrubs so there is at least 10 feet between tree tops (crowns). Crown separation is measured from the furthest branch of one tree to the nearest branch on the next tree. On steep slopes or areas subject to high winds, allow at least 1.5 times more space between tree crowns. Remove all ladder fuels from under these remaining trees. Prune all trees to a height of at least 10 feet, or 1/3 of the live crown height. Small clumps of 2 to 3 trees may be occasionally left but leave more space between the crowns of these clumps and surrounding trees. Isolated shrubs may remain, provided they are not under tree crowns. Remove dead stems from trees and shrubs annually. Where shrubs are the primary vegetation in Zone 2, refer to the “Brush and Shrubs” section below.¹³

ZONE 3 Wildland Reduction, aka Extended Defensible Space (beyond 100 feet), suggests a much more limited thinning and pruning to the standards in zone 2. The goal in this zone is to improve the health of the wildlands, which will also help to slow the approaching wildfire.

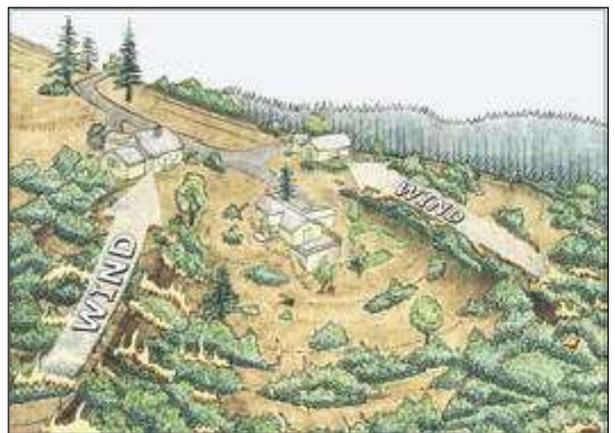
BRUSH AND SHRUBS

Brush and shrubs are smaller than trees, often formed by a number of vertical or semi-upright branches arising close to the ground. On nearly level ground (increase 1.5 times for slope and windy areas), minimum spacing recommendations between clumps of brush or shrubs is 2 1/2 times the height of the vegetation. Maximum diameter of clumps should be 2 times the height of the vegetation. All measurements are made from the edges of vegetation crowns.

For example: For shrubs 6 feet high, spacing between shrub clumps should be 15 feet or more apart (measured from the edges of the crowns of vegetation clumps). The diameter of shrub clumps should not exceed 12 feet (measured from the edges of the crowns). Branches should be pruned to a height of 3 feet.



Eliminate Ladder Fuels



Increase Defensible Space in Windy and Steep Areas

¹³ <http://www.ext.colostate.edu/PUBS/natres/06302.html>, referenced 9/10/07

PUBLIC EDUCATION

The area around Boulder is experiencing continuing development. Spiraling property values and a limited number of building sites have resulted in recently-constructed high-value residences mixed in with older homes, rental properties, and historic buildings in various states of decay. There is likely to be a varied understanding among property owners of the intrinsic hazards associated with building in these areas. An approach to wildfire education that emphasizes safety and hazard mitigation on an individual property level should be undertaken, in addition to community and emergency services efforts at risk reduction. Combining community values such as quality of life, property values, ecosystem protection, and wildlife habitat preservation with the hazard reduction message will increase the receptiveness of the public.

Field contacts and interviews indicate that some homeowners in the study area are very supportive and proactive with regards to wildfire mitigation efforts. Unfortunately there are still homeowners and landowners who refuse to acknowledge the fact that they live in an area at risk of wildfires. Continued attempts to provide educational materials through personal contact should be conducted. Property owner education and the wildfire hazard mitigation message should be an ongoing effort in the foothill portions of RMF and throughout the front-range interface.

RECOMMENDATIONS

- Update/upgrade Rocky Mountain Fire's web site.
- Visit these web sites for a list of public and homeowner education materials:
 - <http://www.nwcg.gov/pms/pubs/pubs.htm>
 - <http://www.firewise.org>
 - <http://csfs.colostate.edu/protecthomeandforest.htm>
 - <http://www.rockymountainfire.org>
 - <http://www.firesafecouncil.org/homeowner/index.cfm>
- Provide citizens with the findings of this study including:
 - Levels of risk and hazard
 - Values of fuels reduction programs
 - Consequences and results of inaction for ignitions within the community
- Create a Wildland-Urban Interface (WUI) citizen advisory council to provide peer level communications for the community. Too often, government agency advice can be construed as self-serving. Consequently, there is poor internalization of information by the citizens. The council should be used to:
 - Bring the concerns of residents to the prioritization of mitigation actions
 - Select demonstration sites
 - Assist with grant applications and awards
- A number of public recreation areas are present within RMF (see **Other Areas of Special Interest**, pages 48-53). A common recommendation is for those areas to provide wildfire education to the public via verbal contact, published literature, and signage.

ADDRESSING

A number of areas within RMF were found to have poor and/or inconsistent street signage and addressing of properties. In the worst cases, addressing was missing altogether or attached to combustible objects (**see Figure 5**). In the foothill areas of Rocky Mountain Fire with its intricate mountain roads and driveways, proper standardized reflective signage is critical to effective response. The time saved, especially at night and in difficult conditions, can make a huge difference in the effectiveness of response. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true for volunteer operators who do not have the opportunity to familiarize themselves on access issues as often as career responders.

FIGURE 5. Combustible address marker



General Recommendation

Every building should have a permanently posted, reflective address marker mounted on a non-combustible pole. The sign should be placed and maintained at each driveway entrance. Care should be taken to ensure that the location will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location and markings are adequate for easy night-time viewing. It is preferable to locate markers in a consistent manner within each community. A good guideline for this practice is to place the markers five feet above ground level on the right side of every driveway. Where multiple homes are accessed by a single driveway, all addresses that are accessed via that driveway should be clearly listed on the driveway marker. Where multi-access driveways split, each fork should indicate all residences accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate to simply mark addresses on a common pole in the center of the fork. Residential homes should have an additional reflective address marker permanently attached to the home in clear view of the driveway or access road. Homes that are marked by lot number while under construction should have the lot number removed and a permanent address marker posted before granting a certificate of occupancy.

LOCAL PREPAREDNESS AND FIREFIGHTING CAPABILITIES

Rocky Mountain Fire (RMF) provides suppression services for the study area. The district has six fire stations:

- Station 1 (includes the administrative offices) is located at 7700 Baseline Road.
 - Staffed 24/7 by career firefighters.
 - Apparatus: 1 type-1 engine, 1 type-1 Tactical Tender and 1 type-6 engine.
- Station 2 is located at 961 Cherryvale Road and is not staffed.
 - Apparatus: 1 type-1 engine and 1 type-3 engine.
- Station 3 is located at 206 Coal Creek Drive in old town Superior and is not staffed.
 - Apparatus: 1 type-1 engine.
- Station 4 is located at 5748 Flagstaff Road and is not staffed.
 - Apparatus: 1 type 2-engine and 1 type-1 water tender.
- Station 5 is located at 2701 S. Indiana Street in the Rock Creek subdivision.
 - Staffed 24/7 by career firefighters.
 - Apparatus: 1 type-1 engine, 1 aerial, and 1 type-6 engine.
- Station 6 is located at 4390 Eldorado Springs Drive (Hwy 170).
 - Apparatus: 1 type-2 engine, 1 type-6 engine and 1 type-3 water tender.
 - RMF wildfire / all-hazard cache.

Water handling accessories include:

- 3, 2000 gallon portable water tanks.
- Trailer mounted 1000 GPM pump (currently located at Kossler Lake).

The fire district survey revealed that communication “holes” exist in small portions of the study area. Although relatively small areas are affected, communication problems are very commonly linked to tragic results with regard to firefighter safety.

As mentioned in other sections of this CWPP, RMF has taken proactive steps forward in terms of preplanning their WUI response areas. Good mapping coupled with individual home assessments (created with Red Zone software) is one reason that RMF has been successful with initial fire attack outcomes.

RMF firefighters are highly trained and experienced in wildland fire. The district adheres to the National Wildfire Coordinating Group (NWCG) curriculum for training. Of RMF’s 40 members all are trained to the NWCG S-130/190 standard (basic wildland fire fighting and weather). Approximately 20 firefighters are qualified at the Crew Boss/Engine Boss level or higher.

RMF hires and trains a seasonal wildfire mitigation crew. This crew is comprised of 3 to 5 members with a range of qualifications. Their primary goal is threefold: first, to provide a rapid and effective response to wildfires (including other department incidents); second, to provide mitigation efforts by mechanically thinning fuels on individual home properties; third, to provide wildfire education to the property owners of Rocky Mountain Fire.

Of special note is that some chief officers with RMF possess more advanced wildfire qualifications. These chief officers currently participate on regional and national incident management teams and respond to wildfire incidents across the country. The experience they gain while assigned to a large on-going wildfire incidents provides numerous and important benefits. These benefits will also greatly enhance the effectiveness of RMF when confronted with larger all-hazard type incidents.

Mutual aid is available from the City of Boulder Fire Department, Boulder Rural Fire Protection District, Mountain View Fire Protection District, Louisville Fire Department, North Metro Fire Rescue, Coal Creek Canyon Fire Department, High Country Fire Protection District, Sugarloaf Fire Protection District, and the Four Mile Fire Protection District.

RECOMMENDATIONS

Firefighter Training:

- **Priority Level High:** Continue providing education and experience for all firefighters including:
 - NWCG S-130/190 for all new department members
 - Annual wildland fire refresher and “pack testing” (physical standards test)
 - S-215 Fire Operations in the Urban Interface for all members
 - S-290 Intermediate Fire Behavior for all members
 - I-200 and I-300 – Basic and Intermediate ICS (including the appropriate level of NIMS courses) to all members
 - S-230/231 Single Resource Boss/Engine Boss to all officers
 - Encourage personnel to seek higher wildfire qualifications
 - Encourage personnel to participate in out of district wildfire assignments
 - Encourage prescribed burn participation
 - Encourage incident management team participation

Equipment:

- **Priority Level High.** Adequately stock a reserve equipment cache.
- **Priority Level High.** Provide gear bags for wildland PPE and bunker gear to be placed on apparatus responding to fire calls. This will help ensure that firefighters have both bunker gear and wildland PPE available when the fire situation changes.

Communications:

- **Priority Level High.** A mobile radio repeater is in the initial phase of purchasing. This piece of equipment should be approved and ordered/received as soon as possible.
- **Priority Level High.** A complement to any communications system is the acquisition of a mobile frequency “patch” device. This device quickly allows the ability to patch together multiple radio frequencies into one common channel.

As in any fire district, firefighters’ response time to emergency calls varies throughout the jurisdiction. Within Rocky Mountain Fire, the most important variable in response time is the home’s distance from the nearest fire station staffed with personnel. Stations 1 and 5 are staffed

24/7. **Figure 6** (page 35) shows the distance from the nearest fire station to the communities of the study area. Distances were calculated in ArcGIS and take into account the road distance to a given area, rather than merely the “flight distance.” For the purposes of this report, this is not an Insurance Services Office (ISO) issue but one of defining response distance, and therefore time, to fire ignitions. This distance analysis calculates *drivable distance, not drive time*, although distance was used as a factor in rating neighborhood hazards. Response times may vary greatly over the same distance due to road conditions, steepness, curvature of roads, and evacuation traffic. However, poor road conditions and steep terrain were found to be most common in neighborhoods located furthest from the nearest fire station.

Most fire service leaders agree that response time is composed of three distinct elements.

1. **Call processing time:** the time it takes for dispatchers to ascertain the location and nature of the emergency and initiate the appropriate response.
2. **Turnout or staffing time:** the time it takes for personnel to respond to the dispatch, board apparatus, and begin traveling to the scene.
3. **Travel time:** the actual time it takes to travel from the station to the scene.

Further, the National Fire Protection Agency (NFPA) has established the following time objectives for fire response:

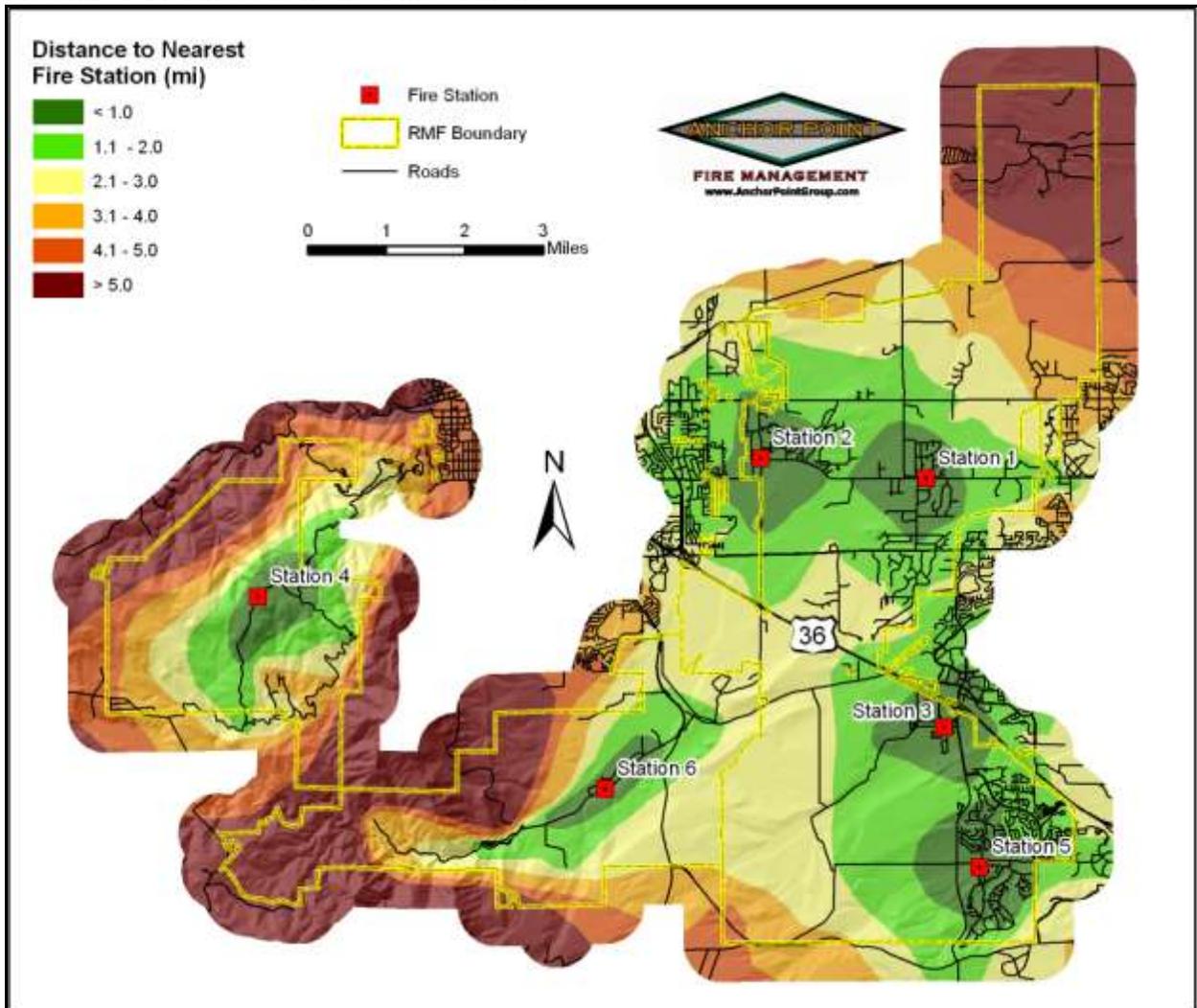
NFPA 1710 requires:

1. Turnout time of one minute.
2. Four minutes or less for the arrival of the first arriving engine company at a fire suppression incident, and/or eight minutes or less for the deployment of a full first alarm assignment at a fire suppression incident.¹⁴

If turnout time of one minute is met, and average driving speed is estimated at 30 MPH, then the engine company could drive two miles in the four minutes established by NFPA 1710. Therefore, neighborhoods with mean distances greater than two miles from a fire station fall outside the NFPA established time objectives and are more hazardous (more likely to experience significant damage from a moderately advancing wildfire) than those located less than two miles from the nearest station. A significant portion of the most hazardous communities in the study area have mean distances greater than two miles from the nearest staffed fire station. A thorough understanding of wildfire hazards is crucial to the safety of residents in these areas. Proper defensible space and hazard mitigation is the single most important factor in limiting fire damage in areas where response by fire suppression forces is inevitably delayed.

14 <http://www.iaff.org/academy/content/online/modules/1710/summary.html>

FIGURE 6. Distances to nearest fire stations



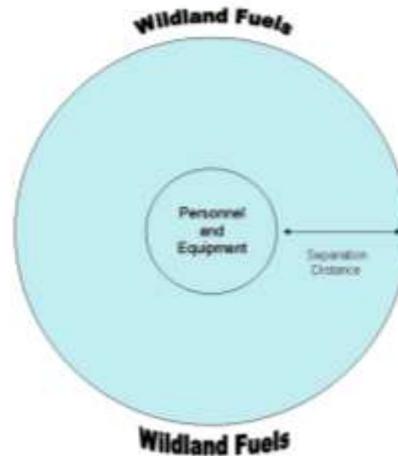
SAFETY ZONES

When pre-planning for a wildfire incident, designating safety zones for use by the responding firefighters should be top priority. More than one safety zone is advised, since fire operations can be spread out over a large geographical area. When evaluating areas to be used, they must be easily accessible and adhere to current guidelines recommended by NWCG (see **Figure 7**).

FIGURE 7. Safety zone guidelines

Flame Height	Distance Separation (firefighter to flame)	Area in Acres
10 feet	40 feet	$\frac{1}{10}$ acre
20 feet	80 feet	$\frac{1}{2}$ acre
50 feet	200 feet	3 acres
75 feet	300 feet	7 acres
100 feet	400 feet	12 acres
200 feet	800 feet	50 acres

(1 acre = 208 feet x 208 feet, or the approximate size of a football field)



Distance separation is the radius from the center of the safety zone to the nearest fuels.¹⁵

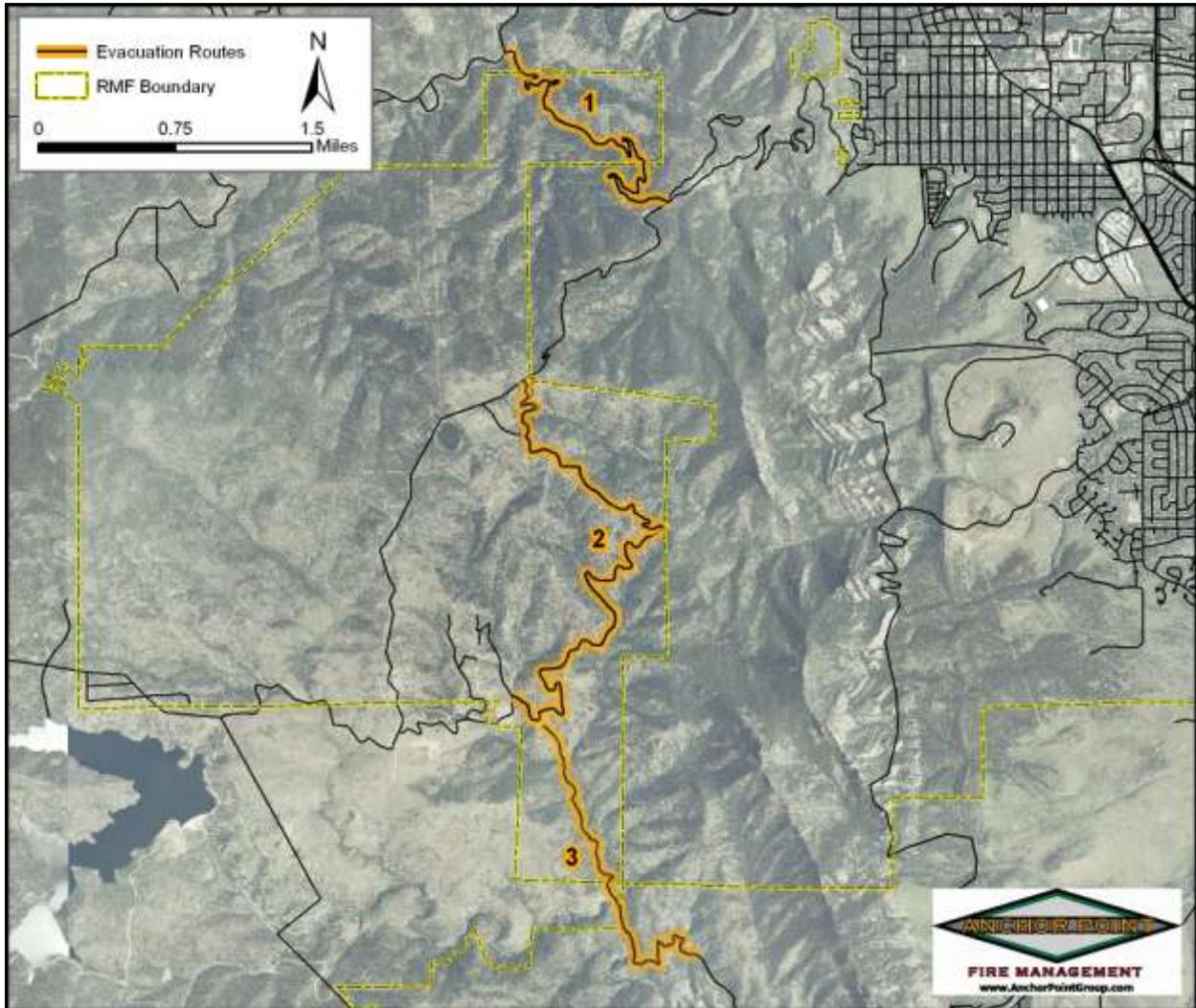
Note: The size of safety zones recommended by Figure 7 are the minimum separation distances for a three-person engine crew and take into account only radiant heat transfer. Convective heat transfer (hot gases blown by winds and funneled by terrain features) is not considered. The suitability of any area for use as a safety zone must be determined on a case-by-case basis using the current and expected fire behavior and adjusted as appropriate for the expected number of resources.

¹⁵ <http://www.nwcg.gov/pms/pubs/410-1/chapter01.pdf> referenced March 20, 2007

EVACUATION/ACCESS ROUTES

Three evacuation/access routes are recommended. Two roads have been identified as evacuation route alternatives to the primary access. Both may be compromised by land ownership issues. One road is identified to enhance fire district emergency access. These routes are highlighted in **Figure 8**, and specific recommendations follow.

FIGURE 8. Evacuation routes



OTHER ACCESS ROUTE RECOMMENDATIONS

- In order to reduce conflicts between evacuating citizens and incoming responders, it is desirable to have nearby evacuation centers for citizens and staging areas for fire resources. Evacuation centers should include heated buildings with facilities large enough to handle the population. Schools and churches are usually ideal for this purpose. Fire staging areas should contain large safety zones, a good view in the direction of the fire, easy access and turnarounds for large apparatus, a significant fuel break between the fire and the escape route, topography conducive to radio communications, and access to water. Local responders are encouraged to preplan the use of potential staging areas with property owners.
- Identify and pre-plan alternate escape routes and staging areas.
- Perform response drills to determine the timing and effectiveness of fire resource staging areas.
- Educate citizens on the proper escape routes, and evacuation centers to use in the event of an evacuation.
- Use a reverse 911 system or call lists to warn residents when an evacuation may be necessary. Notification should also be carried out by local television and radio stations. Any existing disaster notification systems, such as tornado warnings, should be expanded to include wildfire notifications.
- Emergency management personnel should be included in the development of preplans for citizen evacuation.
- Post placards clearly marking "fire escape route." This will provide functional assistance during an evacuation and communicate a constant reminder of wildfire to the community. Be sure to mount signage on non-combustible poles, preferably under the street name sign. The placards should start from the furthest point into the subdivision and work outward. These placards greatly assist responding firefighters from other agencies who may not be familiar with the layout of the subdivision.

FUELS MODIFICATION PROJECTS

INTRODUCTION

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as “shaded fuelbreak”). A fuelbreak is an easily accessible strip of land of varying width, depending on fuel and terrain, in which fuel density is reduced, thus improving fire control opportunities. Vegetation is thinned, removing diseased, fire-weakened, and most standing dead trees. Thinning should select for the more fire resistant species. Ladder fuels, such as low limbs and heavy regeneration, are removed from the remaining stand. Brush, dead and down materials, logging slash, and other heavy ground fuels are removed and disposed of to create an open park-like appearance. The use of fuelbreaks under normal burning conditions can limit the uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions, where spotting occurs for miles ahead of the main fire, and probability of ignition is high, even the best fuelbreaks are not effective. That said, fuelbreaks have proven to be effective in limiting the spread of crown fires in Colorado.¹⁶ Factors to be considered when determining the need for fuelbreaks in mountain subdivisions include:

- The presence and density of hazardous fuels
- Slope
- Other hazardous topographic features
- Crowning potential
- Ignition sources

With the exception of Aspen, all of Colorado’s major timber types represent a significant risk of wildfire. Increasing slope causes fires to move from the surface fuels to crowns more easily, due to preheating. A slope of 30% causes the fire-spread rate to double when compared to the fire-spread rate (with the same fuels and other conditions being equal) on flat ground. Chimneys, saddles, and deep ravines are all known to accelerate fire spread and influence intensity. Communities with homes located on or above such features, as well as homes located on summits and ridge tops, are good candidates for fuel breaks. Crown fire activity values for Rocky Mountain Fire were generated by the FlamMap model and classified into four standard ranges. In areas where independent and dependent crown fire activity is likely to exist, fuelbreaks should be considered. If there are known likely ignition sources (such as railroads and recreation areas that allow campfires) present in areas where there is a threat of fire being channeled into communities, fuelbreaks should be considered.

Fuelbreaks should always be connected to a good anchor point like a rock outcropping, river, lake, or road. The classic location for fuelbreaks is along the tops of ridges, in order to stop fires from backing down the other side or spotting into the next drainage. This is not always practical from a WUI standpoint, because the structures firefighters are trying to protect are usually located at the tops of ridges or mid-slope. Mid-slope positioning is considered the least desirable for fuelbreaks, but it may be easiest to achieve as an extension of defensible space work or off existing roads and escape routes. One tactic would be to create fuelbreaks on slopes below homes located mid-slope and on ridge tops, so that the area of continuous fuels

¹⁶ Frank C. Dennis, “Fuelbreak Guidelines for Forested Subdivisions” (Colorado State Forest Service, Colorado State University, 1983), p. 3.

between the defensible space of homes and the fuelbreak is less than ten acres. Another commonly employed tactic is to position fuelbreaks along the bottom of slopes. It would make sense to locate fuelbreaks mid-slope below homes to break the continuity of fuels into the smaller units mentioned above, even though this position is considered the least desirable from a fire suppression point of view.

Fuelbreaks are often easiest to locate along existing roadbeds (see the description of the fuels modification project for access routes below). The minimum recommended fuelbreak width is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuelbreak should also be increased, with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = $100' + (1.5 \times \text{slope } \%)$; above road distance = $100' - \text{slope } \%$ (see **Table 4**). Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%. Since fuelbreaks can have an undesirable effect on the aesthetics of the area, crown separation should be emphasized over stand density levels. In other words, isolating groupings rather than cutting for precise stem spacing will help to mitigate the visual impact of the fuelbreak.

It is important to note that in Colorado's dry climate, slash decomposes very slowly. One consequence of failing to remove slash is to add to the surface fuel loading, potentially making the area more hazardous than before treatment. It is imperative that all materials be disposed of by piling and burning, chipping, physical removal from the area, or lopping and scattering. Of all of these methods lopping and scattering is the cheapest, but it is also the least effective, since it adds to the surface fuel load.

It is important to consider that fuelbreaks must be maintained to be effective. Thinning usually accelerates the process of regenerative growth. The effectiveness of the fuelbreak may be lost in as little as three to four years if ladder fuels and regeneration are not controlled.

One of the most difficult issues in establishing and maintaining fuelbreaks is securing the cooperation and participation of landowners. Ownership maps of the area indicate that implementation of fuels reduction projects recommended here would require the approval of public land management agencies as well as private landowners.

ACCESS ROUTE FUELS MODIFICATION RECOMMENDATIONS

A fuel modification project for the primary access corridor should be implemented. Flagstaff Road is the primary transportation corridor through the critical sections of the district. In general, this road has adequate openings. However, some communities in the study area would benefit from fuels reduction along their principal access route.

Thinning along primary access roads of the communities should include an area of at least 100' on either side of the centerline of the road where practical. This distance should be modified to account for increased slope and other topographic features that increase fire intensity (see **Table 4**). This is especially important in communities with steep, narrow roads and few turnouts. In these areas, safer access for firefighters would make a positive impact on the number of structures that could be defended in a wildfire. Existing and natural barriers to fire should be incorporated into the project dimensions.

The cooperation of adjacent, contiguous landowners should be secured. If this is not possible, more intensive thinning may need to occur within the road easement. Landowner participation allows the project to be more flexible in selecting trees for removal. It allows greater consideration for the elements of visual screening and aesthetics. Enlarging the project dimensions allows more options for tree selection while still protecting the access/egress corridor.

Elements of the fuels modification space for access and egress routes should include:

- Tree crown separation of at least 10' with groups of trees and shrubs interspersed as desired.
- Tree crown separation greater than 10' may be required to isolate adjacent groups or clumps of trees.
- Limb all remaining trees to a height of 8' or 1/3 of the tree height (whichever is less).
- Clean up ground fuel within the project area.

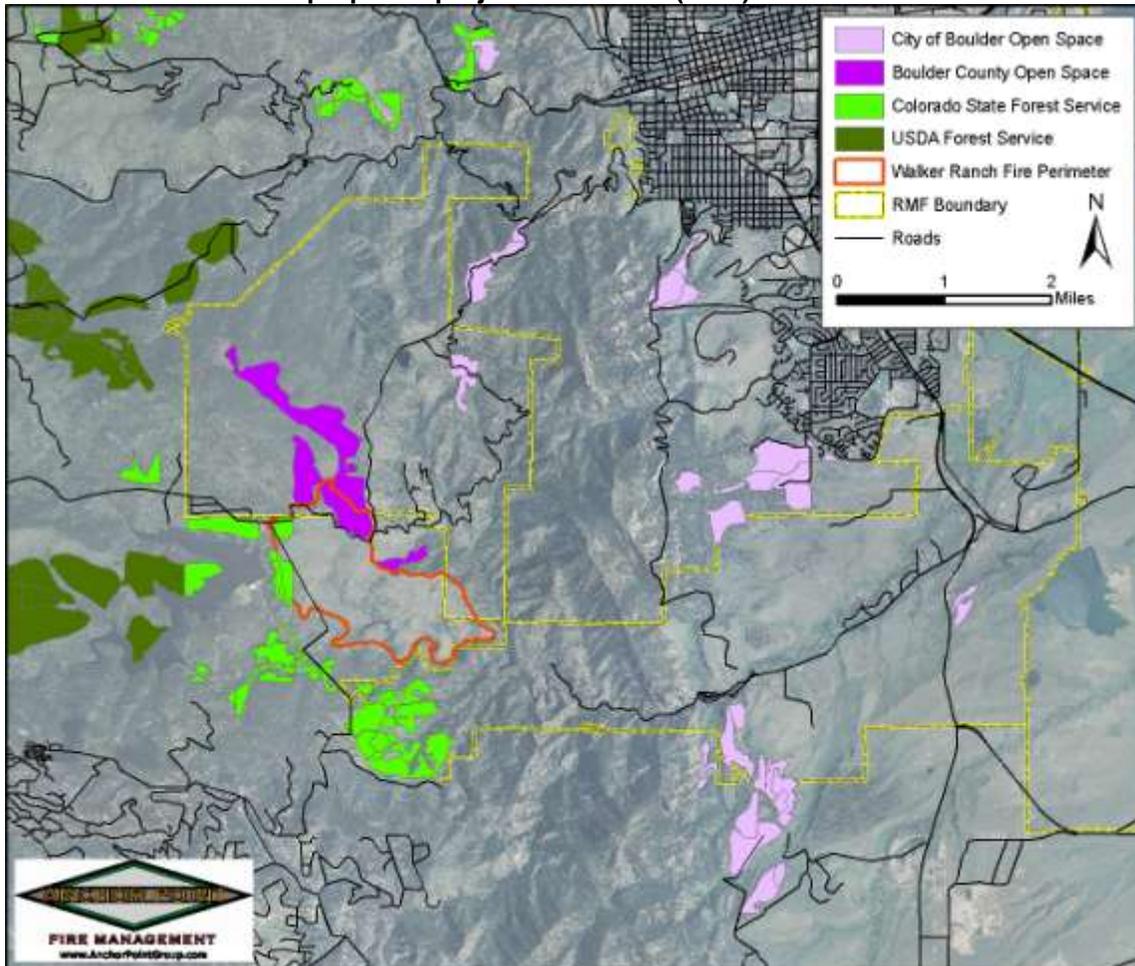
TABLE 4. Recommended treatment distances for mid-slope roads

% Slope	Distance Above Road	Distance Below Road
30	70 feet	145 feet
35	65 feet	153 feet
40	60 feet	160 feet
45	55 feet	168 feet
50	50 feet	175 feet

CURRENT AND PROPOSED CROSS-BOUNDARY PROJECTS

A very important purpose of this CWPP is to make known other agencies' fuel reduction projects which may affect Rocky Mountain Fire. **Figure 9** shows those known projects and their last known status. Following **Figure 9** are recommendations. These suggest that RMF combine efforts with other agencies so as to complete in a timely manner those projects that will ultimately serve to protect communities within RMF.

FIGURE 9. Current and proposed projects near RMF (2010)



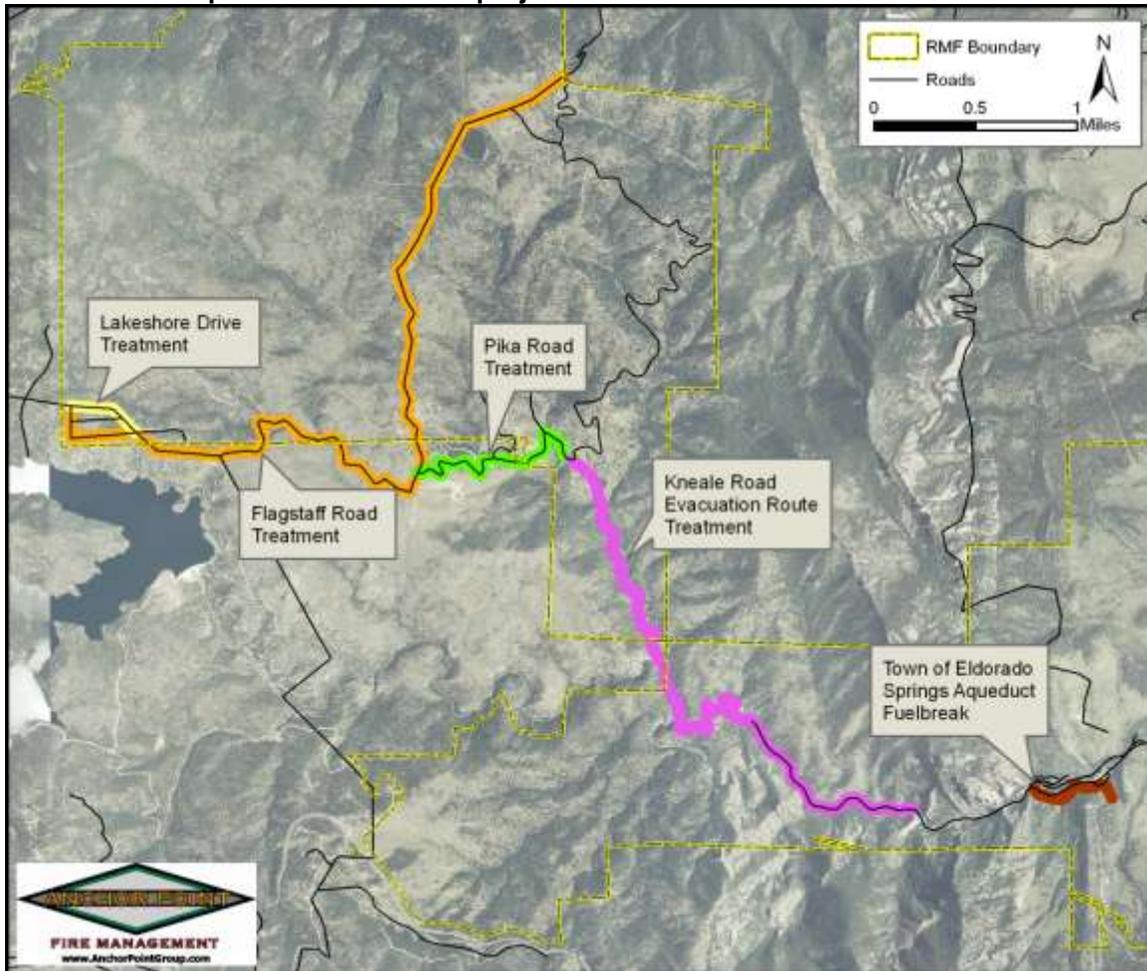
RECOMMENDATIONS

- **Boulder City OSMP (Flagstaff Road treatment). Priority Level High (see Figure 10).** This is a Boulder OSMP project which focuses on improving this very important access route. The project is being implemented as of this writing. This project will have a direct effect on access to the Flagstaff area and is an adjoining project described below in **Recommendation A** of RMF's fuels reduction projects.
- **Boulder County Open Space (Walker Ranch Projects). Priority Level High (see Figure 10).** These Boulder County projects which focus on fuels reduction work are mostly complete. The NE section of the project east of the Walker Ranch trailhead is in the final stages of cutting as of this writing. These projects will have a direct effect on the protection of the Pine Needle and Flagstaff communities.
- **Boulder City OSMP (Lindsay Property) Fuel breaks. Priority Level Moderate (see Figure 10).** These projects have been completed for the most part. A fuels reduction project recommended below (see **Recommendation E** of RMF's fuels reduction projects) will tie into a section of this completed fuel break. The fuel break will need to be evaluated to see if it needs re-entry or maintenance.
- **USFS and CSFS Treatment Projects. Priority Level Moderate (see Figure 10).** There are numerous USFS and CSFS projects which will have direct effect on the protection of communities within RMF. The CSFS also manages projects within Eldorado Canyon State Park. It is therefore recommended that RMF assist with these projects when possible.

PROPOSED FUELS REDUCTION PROJECTS FOR RMF

The following recommendations are in addition to, not in place of, the fuels reductions mentioned in the **Safety Zones, Addressing, Evacuation/Access Routes FMU**. It is important to note that the boundaries shown on the maps in this document are only approximate. Exact boundaries will be determined when treatment agreements are negotiated with the involved land owners and/or land managers.

FIGURE 10. Proposed fuel reduction projects



WATER SUPPLY

In the RMF study area, like in many of the mountainous areas of Colorado's Front Range, water is a critical fire suppression issue. Although most of the plains communities are serviced by an adequate hydrant network, the following communities are not serviced by a municipal hydrant network:

- Town of Eldorado Springs
- Pine Needle
- Kneale Road
- Lakeshore Park
- Flagstaff Road
- Eldorado Springs Valley
- Town of Marshall

Additional (not municipal hydrants) water supplies currently used by RMF are shown in **Figures 11 and 12**. **Table 5** gives a brief description of these water sources.

FIGURE 11. RMF water sources (west)

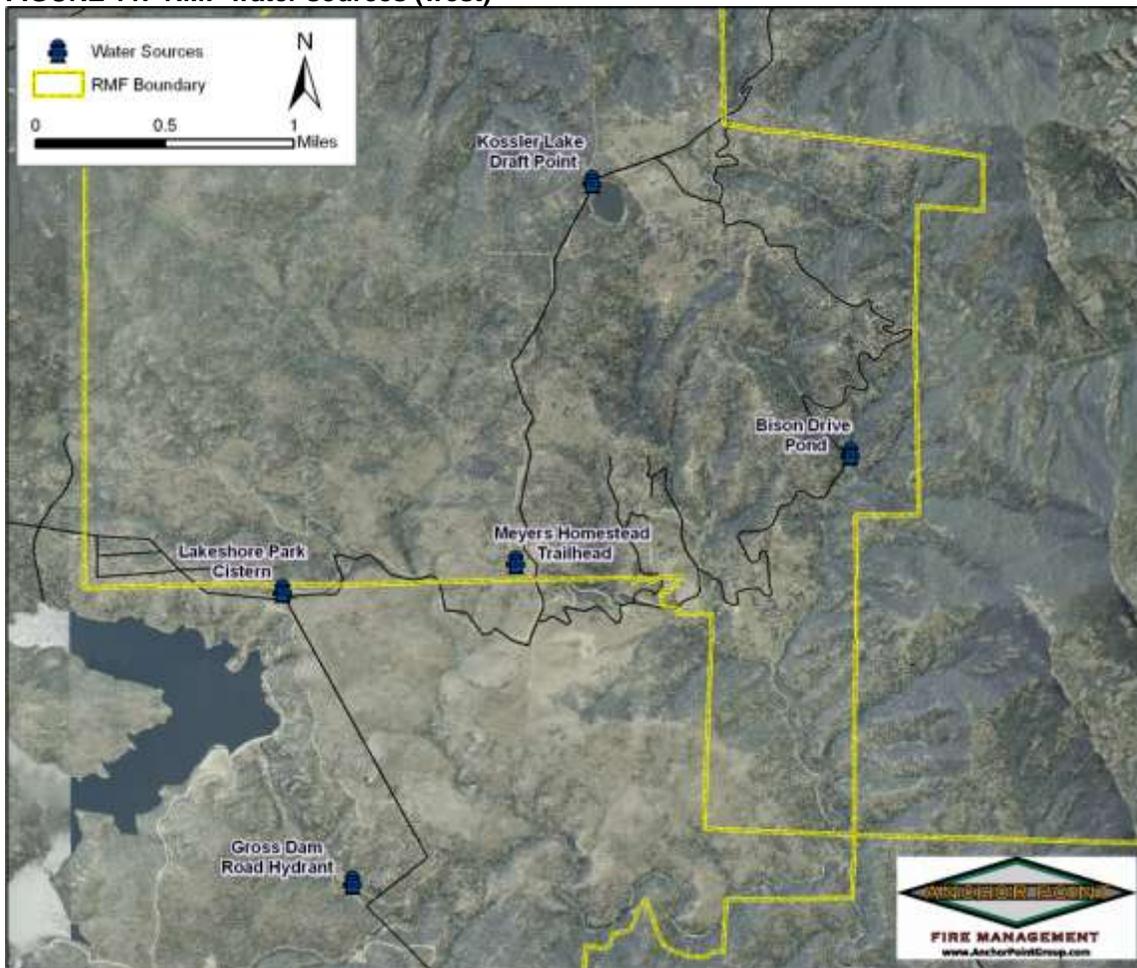


FIGURE 12. RMF water sources (east)

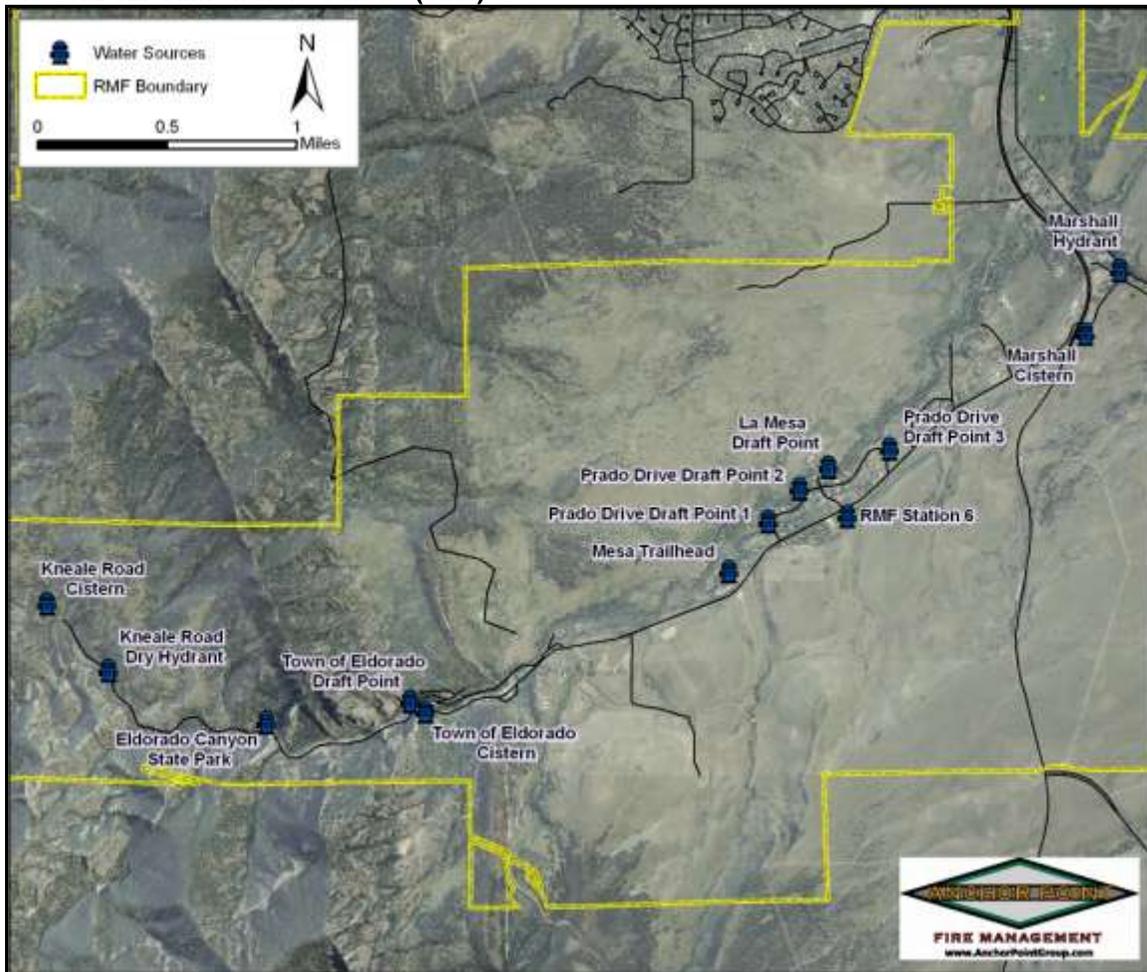


TABLE 5. RMF water sources

Water Source Name	Address / Location	Capacity (Gallons)	Type	Delivery
1. Kneale Road cistern	1100 Kneale Road	500	private cistern	2 1/2" draft
2. Kneale Road Dry Hydrant	781 Kneale Road	unlimited	creek	2 1/2' draft
3. Eldorado Canyon State Park	Picnic area	unlimited	creek	draft
4. Town of Eldorado draft point	West side of town	Unlimited*	creek	draft
5. Town of Eldorado cistern	West side pool parking lot, underneath	1000	cistern	draft
6. Mesa trailhead	Mesa trailhead & Eldorado Springs Dr.	unlimited	creek	draft
7. RMF Fire Station # 6	Eldorado Springs Drive	10,000	cistern	2 1/2" & 6" draft
8. Prado Drive draft point #1	West end of Prado Drive	unlimited	creek	draft
9. Prado Drive draft point #2	Middle of Prado Drive	unlimited	creek	draft
10. Prado Drive draft point #3	East end of Prado Drive	unlimited	creek	draft
11. La Mesa draft point	2221 La Mesa	unlimited	creek	draft
12. Marshall cistern	SE corner of Hwy 93 & Hwy 170	12,000	cistern	2 1/2" pressurized
13. Marshall hydrant	Hwy 170 & Marshall Road	Unlimited*	hydrant	2 1/2" pressurized
14. Lakeshore Park Cistern	Lakeshore Drive & Gross Dam Road	10,000	cistern	2 1/2" draft
15. Meyers Homestead trailhead	Meyers Homestead Trailhead – Flagstaff Road	10,000	cistern	2 1/2" draft
16. Kossler lake draft point	Across from Station 4	unlimited	volume pump	draft
17. Bison Drive pond	1564 Bison Drive – private	¼ acre	pond	draft
18. Gross Dam Road hydrant	Gross Dam Road, approx. 2 1/2 mi south of Lakeshore Drive.	unlimited	hydrant	Unknown fitting size, gravity pressure **

* When creek flow is low these water sources may not be reliable. See recommendations.

** This hydrant has a significant elevation drop without a pressure relief device; therefore the static hydrant pressure is approximately 200 psi.

There are private cisterns scattered throughout the district, but they are not maintained or used by the RMF.

All water sources need to be labeled to indicate their location, capabilities, and capacities. This information needs to be distributed to all mutual aid agencies. In addition all water sources should be inspected and preventive maintenance performed at least annually.

AREAS OF SPECIAL INTEREST

INTRODUCTION

In addition to residential communities, certain other properties have been identified by stakeholders as being of special concern or interest. In some cases these areas present special problems for firefighters. A brief description of each of these properties is presented in this section, followed by recommendations, where applicable, designed to address concerns specific to the individual property. These recommendations are in addition to, not in place of, other recommendations in this report concerning the community or area where these properties are located.

BOULDER COUNTY OPEN SPACE – Walker Ranch

Walker Ranch offers a rich mosaic of mountain habitats. Ponderosa pines and Douglas firs are interspersed with open meadows and aspen groves. Small streams dissect the hills before joining South Boulder Creek. On September 15th, 2000, the Walker Ranch Fire burned about 1,062 acres, almost exclusively on Walker Ranch. The historic Walker Ranch was one of the largest cattle ranches in this region of Colorado. This homestead is now the focal point of the Park's designated historic district. The homestead is closed to the public except for special events. The County now owns 2,566 acres and leases an additional 1,212 acres from the Bureau of Land Management. This open space property is listed on the National Register of Historic Places.¹⁷

RECOMMENDATIONS

- An Emergency Response plan should be developed including a wildfire management component.
- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined in the Home Mitigation section.
- All Open Space employees should attend wildland firefighting training. This will serve to educate the employees as well as provide an additional resource for RMF.
- Additional fuel reduction projects should be pursued, with priorities being cross-boundary projects with RMF. Completed projects will need to be maintained and inspected annually.
- The public should be provided with wildfire educational materials available at all the information kiosks located on Open Space properties.
- Fire danger signage should also be posted at the kiosks. The fire danger for the day should be displayed, and this information will need to be kept current.

¹⁷ http://www.co.boulder.co.us/openspace/recreating/public_parks/walker.htm

CITY OF BOULDER: Open Space and Mountain Parks, Kossler Lake

Over 43,000 acres of City Open Space land is located in and around the City of Boulder. Some of the land is in agricultural production, while the vast majority of the lands are open to passive recreational uses which include an extensive trail system available for hikers and horseback riders. Bicyclists enjoy riding on designated trails. Picnicking and fishing areas can also be found.¹⁸ With annual visitation of 5.3 million per year, human caused wildfire ignitions are a legitimate concern. There is a large amount of Open Space land adjacent to Rocky Mountain Fire communities. Kossler Lake is technically a water reservoir for the City of Boulder water supply system and is not open to the public.

RECOMMENDATIONS

- An Emergency Response plan should be developed including a wildfire management component.
- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined in the Home Mitigation section.
- Mow grass and weeds to a low height along boundaries to a width of 30 feet.
- Remove/reduce the accumulation of dead grass and weeds (tumbleweeds) from fence rows.
- Additional fuel reduction projects should be pursued, with priorities being cross-boundary projects with RMF. Completed projects will need to be maintained and inspected annually.
- All Open Space employees should attend wildland firefighting training. This will serve to educate the employees as well as provide an additional resource for RMF.
- The public should be provided with wildfire educational materials available at all the information kiosks located on Open Space properties.
- Fire danger signage should also be posted at the kiosks. The fire danger for the day should be displayed, and this information will need to be kept current.
- The area adjacent to Kossler Lake has had fuel reduction work. This area needs to be evaluated annually and maintained.

¹⁸ http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1167&Itemid=1082

GROSS RESERVOIR, Denver Water Board

Gross Reservoir serves as combination storage and regulating facility for water that flows under the Continental Divide through the Moffat Tunnel. It has a surface area of 440 acres and 10.9 miles of shoreline. The area is now open to non-motorized boats (canoes, kayaks, and rowboats). No contact with the water is allowed. Picnicking, fishing, hiking, and camping are other recreational activities commonly enjoyed in the area.¹⁹ There are a number of established and “social” hiking trails that allow access into the area of the reservoir near the Lakeshore Park community. The Gross Dam Road serves as an important access route into and out of the area.

RECOMMENDATIONS

- An Emergency Response plan should be developed including a wildfire management component.
- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined in the Home Mitigation section.
- The public should be provided with wildfire educational materials available at all the information kiosks located at the boat ramp and picnicking area.
- Fire danger signage should also be posted at the kiosks. The fire danger for the day should be displayed, and this information will need to be kept current.
- The parking area located at the west end of the Lakeshore Community is situated on USFS lands. This trailhead should have fire danger signage and literature.
- The Gross Dam Road needs to be evaluated to legitimize it as a viable secondary access route. The road surface is dirt but of sufficient width. The CSFS has coordinated the fuels reduction efforts in this area. A number of projects have been completed and are proposed.

¹⁹ <http://www.denverwater.org/recreation/gross.html>

ELDORADO CANYON STATE PARK

The Eldorado Canyon State Park occupies 885 acres within Boulder County. Eldorado is a very popular state park, and during the summer it is often filled to capacity, especially on weekends.²⁰ Fire and rescue services are provided by Rocky Mountain Fire. The park administration headquarters are located in the upper end of the park. The structures themselves have been grouped with the Kneale Road community.

RECOMMENDATIONS

- According to park personnel, Eldorado's Emergency Response plan has a limited wildfire component. A true fire management plan should be written.
- Agreements for emergency services should be created or updated.
- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined in the Home Mitigation section.
- All park employees should attend wildland firefighting training provided by RMF. This will serve to educate the park employees, and it will provide an additional resource for RMF.
- The public should be provided with wildfire educational materials upon entrance into the park.
- Fire danger signage should be posted at the park entrance and visitors center (park administration headquarters) to show the current fire danger.
- The road into the park should be improved.
- The CSFS coordinates fuels thinning and prescribed fire efforts. A number of projects have been completed. As of this writing the CSFS has thinning projects (mostly mastication) planned five years into the future for all the accessible forest acres within ECSP.

²⁰ <http://parks.state.co.us/Parks/eldoradocanyon>

NATIONAL RENEWABLE ENERGY LABORATORY²¹

The National Wind Technology Center (NWTC) is managed by managed by NREL for the U.S. Department of Energy. This facility sits on 305 acres located on the southeast corner of Hwy 93 and Hwy 128. NWTC researchers work with members of the wind energy industry to advance wind power technologies that lower the cost of wind energy through research and development of state-of-the-art wind turbine designs. The NWTC's location is ideal for research and development testing of wind turbines because it experiences distinct wind patterns.²² A pressurized hydrant system is supplied from a 75,000 gallon cistern on-site.

RECOMMENDATIONS

- All buildings and improvements adjacent to wildland fuels should follow the recommendations outlined in the Home Mitigation section.
- Employees should attend a basic wildfire awareness class provided by RMF (this could be incorporated into the “all-hazard” preplan mentioned below). This will also serve to educate the employees as to the procedures to follow in the event of a wildfire within the NREL grounds or neighboring Rocky Flats Wildlife Refuge.
- The access route to Hwy 93 should be labeled as an emergency exit. The gate should be accessible by NREL employees and firefighters in case of emergency.
- RMF should assist NREL with the creation of an “all-hazard” pre-plan, which includes wildland fire.

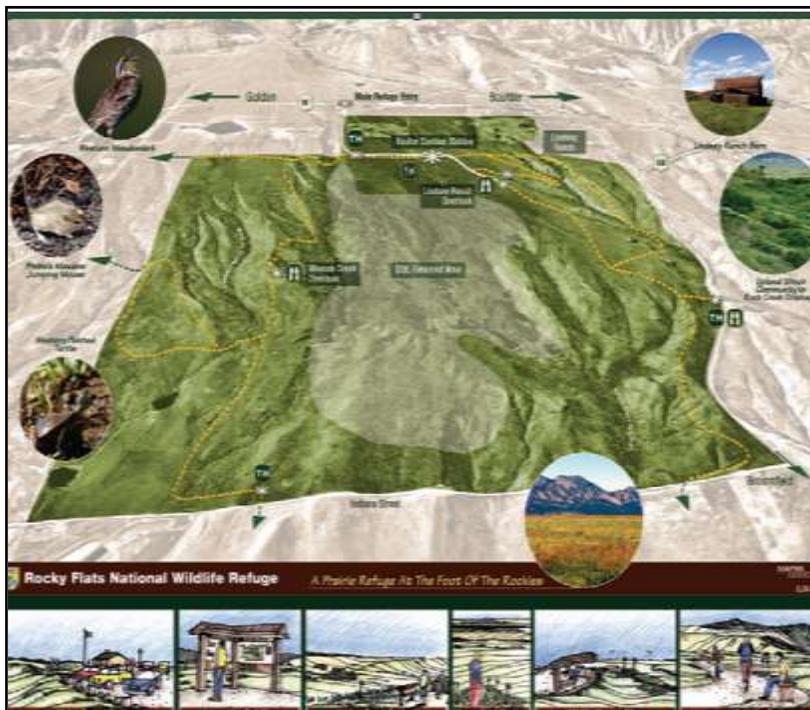
²¹ RMF contracts emergency response to this area outside the district boundary. Wildfire Mitigation planning is not part of the contract.

²² http://www.nrel.gov/visiting_nrel/nwtc.html

ROCKY FLATS NATIONAL WILDLIFE REFUGE²³

The Rocky Flats site is located at the intersection of Jefferson, Boulder, and Broomfield counties. The Rocky Flats site is a 6,240-acre former nuclear defense facility. All weapons manufacturing was performed in a 600-acre area in the middle of the site known as the Industrial Area. Under the Refuge Act, most of the 6,240-acre Rocky Flats site will become a Refuge following certification from the EPA that cleanup and closure have been completed. Many areas of the Rocky Flats site have remained relatively undisturbed for the past 30-40 years, allowing them to retain diverse natural habitat and associated wildlife. Visitor use facilities will include 12.8 miles of multi-use trails, 3.8 miles of hiking only trails, a visitor contact station, interpretive overlooks, viewing blinds, and associated access and parking facilities (see **Figure 14**).²⁴ This site is sure to become a popular recreational draw. An increase in human caused ignitions will most likely occur.

FIGURE 13. Rocky Flats National Wildlife Refuge



RECOMMENDATIONS

- RMF and FWS planners should create an “all-hazard” preplan that includes wildland fire.
- All improvements adjacent to wildland fuels should follow the recommendations outlined in the Home Mitigation section.
- All access routes should be well-signed to ensure quick access.

²³ RMF contracts emergency response to this area outside the district boundary. Wildfire Mitigation planning is not part of the contract.

²⁴ <http://www.fws.gov/rockyflats/Documents/SummaryBrochure.pdf> referenced 6-15-07.

- The area should be mapped with geographical features and common intersections named and labeled. This will help to eliminate confusion during emergency responses.
- Area details (maps, access routes, preplans) should be distributed to other responding emergency agencies. On-site tours will need to be arranged.

GLOSSARY

The following definitions apply to terms used in the Rocky Mountain Fire Community Wildfire Protection Plan.

1 hour Timelag fuels: Grasses, litter and duff; <1/4 inch in diameter.

10 hour Timelag fuels: Twigs and small stems; ¼ inch to 1 inch in diameter.

100 hour Timelag fuels: Branches; 1 to 3 inches in diameter.

1000 hour Timelag fuels: Large stems and branches; >3 inches in diameter.

Active Crown Fire: A crown fire in which the entire fuel complex – all fuel strata – become involved, but the crowning phase remains dependent on heat released from the surface fuel strata for continued spread (also called a Running Crown Fire or Continuous Crown Fire).

ArcGIS 9.x: Geographic Information System (GIS) software designed to handle mapping data in a way that can be analyzed, queried, and displayed. ArcGIS is in its ninth major revision and is published by the Environmental Systems Research Institute (ESRI).

Crown Fire (Crowning): The movement of fire through the crowns of trees or shrubs, which may or may not be independent of the surface fire.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from the structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure.

Energy Release Component: An index of how hot a fire could burn. ERC is directly related to the 24-hour, potential worst case, total available energy within the flaming front at the head of a fire.

Extended Defensible Space (also known as Zone 3): A defensible space area where treatment is continued beyond the minimum boundary. This zone focuses on forest management with fuels reduction being a secondary consideration.

Fine Fuels: Fuels that are less than ¼ inch in diameter such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

Fire Behavior Potential: The expected severity of a wildland fire expressed as the rate of spread, the level of crown fire activity, and flame length. Fire Behavior Potential is derived from fire behavior modeling programs using the following inputs: fuels, canopy cover, historical weather averages, elevation, slope, and aspect.

Fire Danger: Not used as a technical term in this document due to various and nebulous meanings that have been historically applied.

Fire Hazard: Given an ignition, the likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people, property, and/or the environment. Fire Hazard is derived from the Community Assessment and the Fire Behavior Potential.

Fire Mitigation: Any action designed to decrease the likelihood of an ignition, reduce Fire Behavior Potential, or to protect property from the impact of undesirable Fire Outcomes.

Fire Outcomes (aka Fire Effects): A description of the expected effects of a wildfire on people, property, and/or the environment based on the Fire Behavior Potential and physical presence of Values at Risk. Outcomes can be desirable as well as undesirable.

Fire Risk: The probability that an ignition will occur in an area with potential for damaging effects to people, property, and/or the environment. Risk is based primarily on historical ignitions data.

Flagged Addressing: A term describing the placement of multiple addresses on a single sign, servicing multiple structures located on a common access.

FlamMap: A software package created by the Joint Fire Sciences Program, Rocky Mountain Research Station. The software uses mapped environmental data such as Elevation, Aspect, Slope, and Fuel Model, along with fuel moisture and wind information, to generate predicted fire behavior characteristics such as Flame Length, Crown Fire Activity, and Spread Rate.

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface) – an indicator of fire intensity.

FMU (Fire Management Unit): A method of prioritizing fire mitigation work efforts. Units can be defined by function (e.g., public education efforts) or geography (e.g., fuel reduction projects in a given area).

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to isolate, stop, or reduce the spread of fire. Fuelbreaks may also make retardant lines more effective and serve as control lines for fire suppression actions. Fuel breaks in the WUI are designed to limit the spread and intensity of crown fire activity.

ICP (Incident Command Post): The base camp and command center from which fire suppression operations are directed.

ISO (Insurance Standards Office): A leading source of risk information to insurance companies. ISO provides fire risk information in the form of ratings used by insurance companies to price fire insurance products to property owners.

Jackpot Fuels: a large concentration of discontinuous fuels in a given area such as a slash pile.

Passive Crown Fire: a crown fire in which individual or small groups of trees torch out (candle), but solid flaming in the canopy fuels cannot be maintained except for short periods.

Shelter-in-Place Areas: A method of protecting the public from an advancing wildfire by instructing people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response, where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia where fast moving, short-duration fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed preplan which takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior. For a more complete discussion of the application and limitations of shelter-in-place concepts see the **Addressing, Evacuation, and Shelter-In-Place FMU** section of this report.

Slash: Debris left after logging, pruning, thinning, or brush cutting; includes logs, chips, bark, branches, stumps, and broken understory trees or brush.

Spotting: Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Structural Triage: The process of identifying, sorting, and committing resources to a specific structure.

Surface Fire: A fire that burns on the surface litter, debris, and small vegetation on the ground.

Timelag: Time needed under specified conditions for a fuel particle to lose 63 percent of the difference between its initial moisture content and its equilibrium moisture content.

Values at Risk: People, property, ecological elements, and other human and intrinsic values within the project area. Values at Risk are identified by inhabitants as important to the way of life of the study area and are specifically susceptible to damage from undesirable fire outcomes.

WHR (Community Wildfire Hazard Rating. AKA Community Assessment): A fifty-point scale analysis designed to identify factors which increase the potential for and/or severity of undesirable fire outcomes in WUI communities.

WUI (Wildland-Urban Interface): The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Sometimes referred to as Urban Wildland Interface, or UWI.

ROCKY MOUNTAIN FIRE CWPP

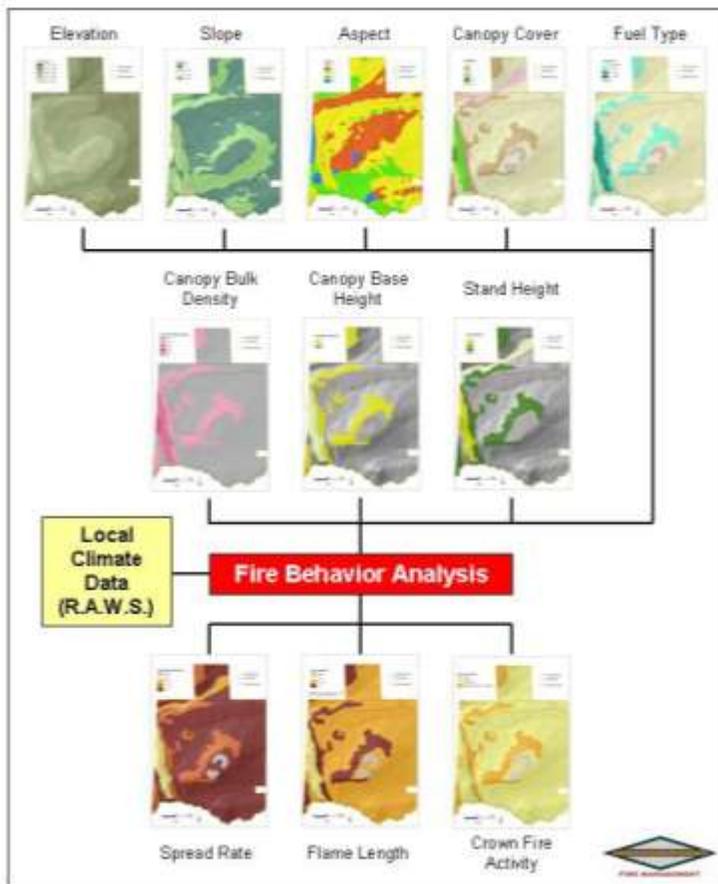
APPENDIX A

FIRE BEHAVIOR POTENTIAL ANALYSIS METHODOLOGY

Purpose

The purpose of this document is to describe the methodology used to evaluate the threat represented by physical hazards—such as fuels, weather and topography—to Values at Risk in the study area, by modeling their effects on fire behavior potential.

FIGURE 1. Flow Chart



Note: these graphics are descriptive only and are not specific to this project.

The fire behavior potential analysis reports graphically the probable range of spread rate, flame length, and crown fire potential for the analysis area, based upon a set of inputs significant to fire behavior. The model inputs include aspect, slope, elevation, canopy cover, fuel type, canopy bulk density, canopy base height, stand height, and climate data.

The model outputs are determined using FlamMap¹, which combines surface fire predictions with the potential for crown fire development. Calculations for surface fire predictions (rate of spread and flame length) are based on the USDA Forest Service's BEHAVE² model.

The BEHAVE fire behavior prediction and fuel modeling system was employed to determine surface fire behavior estimates for this study. BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread given certain conditions of topography, fuels, and weather.

The BEHAVE modeling system has been used for a variety of applications, including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, and fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space, given simple user-defined fuels, weather, and topography. Requested values depend on the modeling choices made by the user.

Assumptions of BEHAVE:

- Fire is predicted at the flaming front
- Fire is free burning
- Behavior is heavily weighted towards the fine fuels
- Continuous and uniform fuels
- Surface fires

FlamMap

Anchor Point uses FlamMap to evaluate the potential fire conditions in the fire behavior study area. Rocky Mountain Fire (RMF) encompasses 49,918 acres (78 square miles). The study area for the fire behavior analysis covers approximately 86,223 acres (135 square miles). This area includes the Fire District response area and a half-mile buffer in all directions. The use of this buffer provides the district with an analysis of potential fire behavior on adjacent lands. From both a planning and tactical perspective, it is important to evaluate exposures beyond the jurisdiction. The study area is broken down into grid cells of 10-meters per side (10M). Using existing vector and raster spatial data and field data, ArcGIS spatial analysis capabilities are used to calculate model inputs for each 10M cell. These values are input into FlamMap, along with reference weather and fuel moisture (long-term weather observations statistically

¹ Mark Finney, Stuart Brittain and Rob Seli., The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana), the Bureau of Land Management and Systems for Environmental Management (Missoula, Montana).

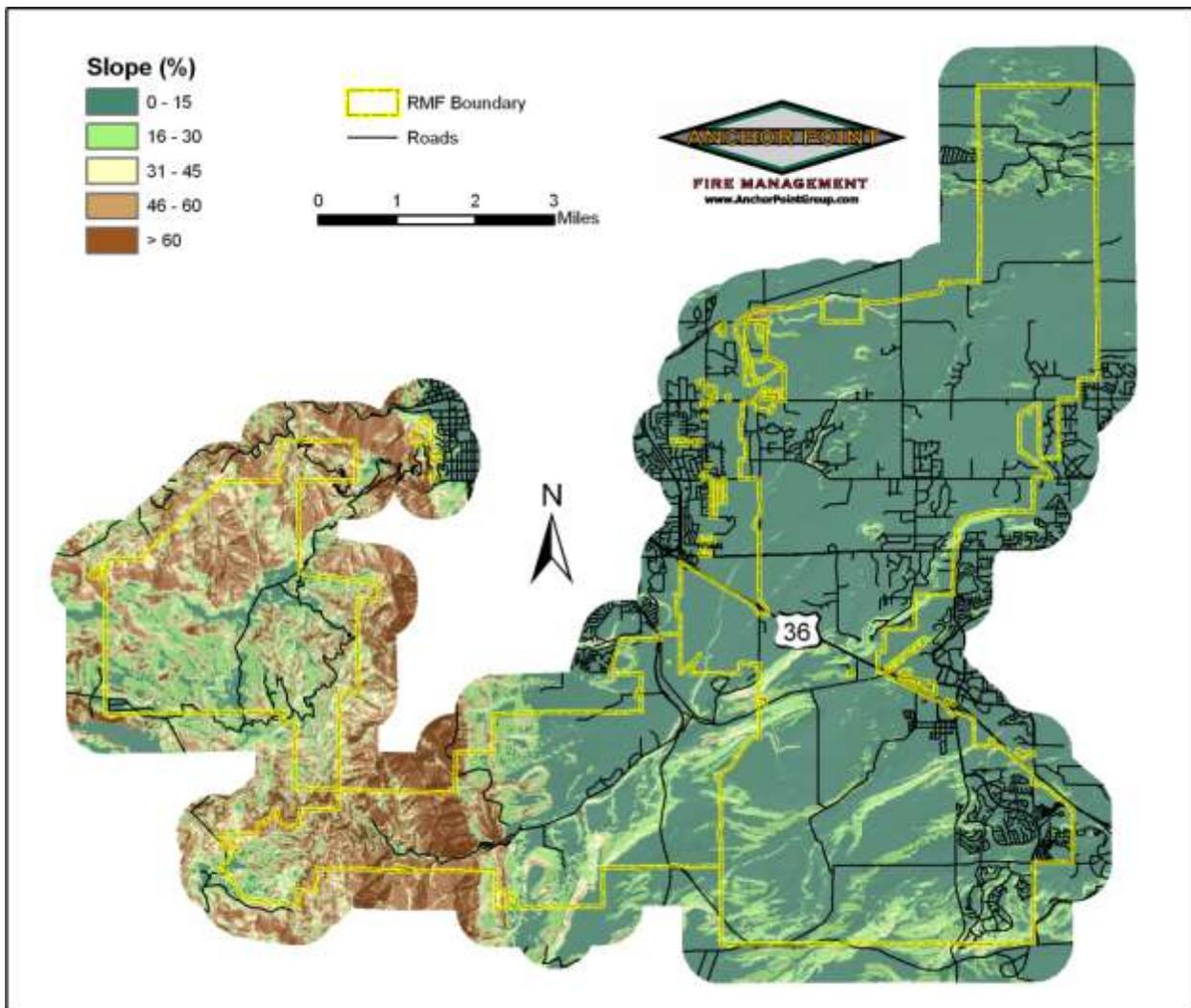
² Patricia L. Andrews, producer and designer, Collin D. Bevins, programmer and designer, The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) and Systems for Environmental Management (Missoula, Montana).

calculated from the Sugarloaf Remote Automated Weather Station information). The outputs of FlamMap include the estimated Rate of Spread (ROS) (from BEHAVE), Flame Length (FL) (from BEHAVE) and Crown Fire Activity for a fire in that 10M cell. The model computes these values for each cell in the study area independently, so the data in each cell is unaffected by adjacent cells.

Fire Behavior Inputs

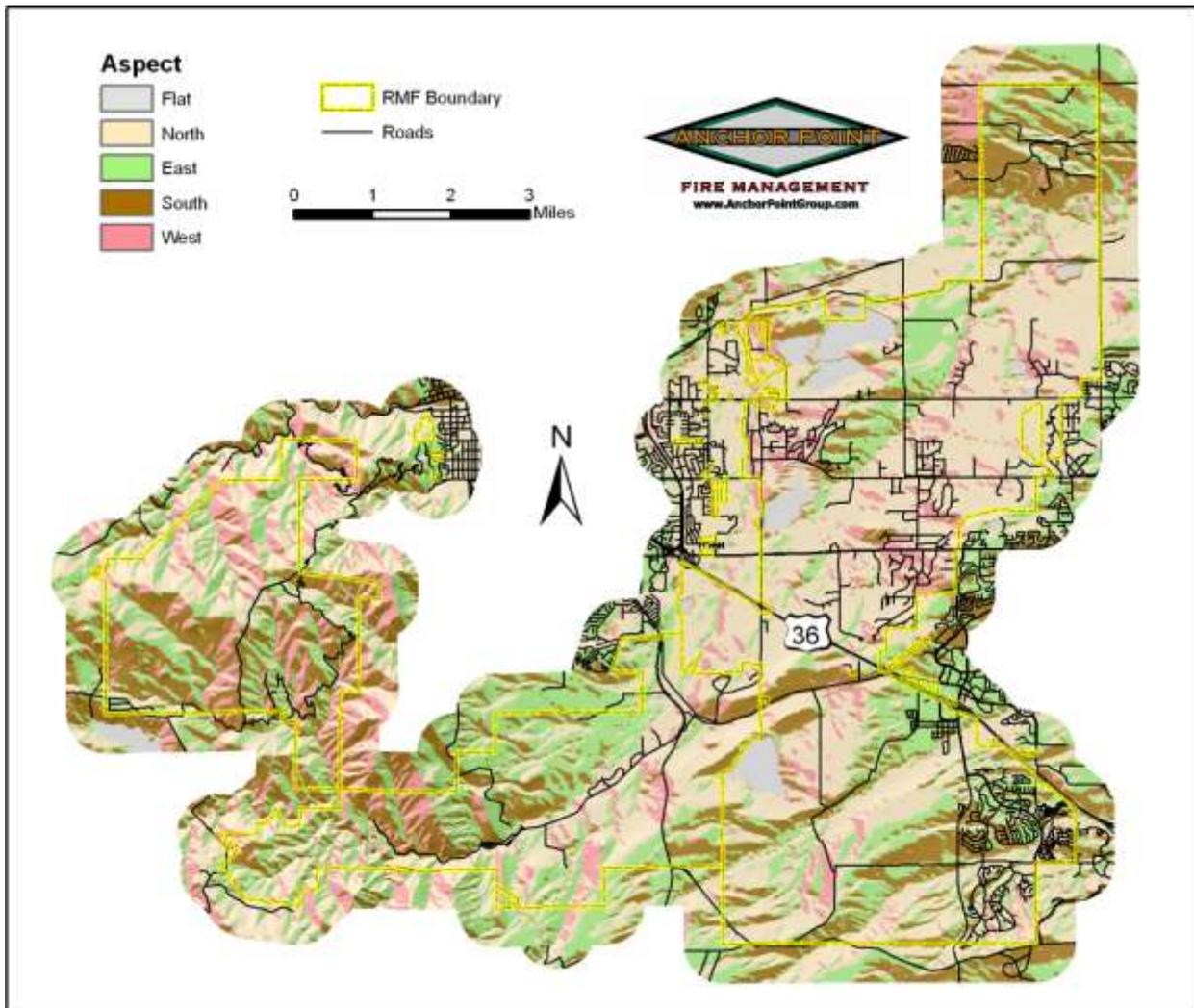
The major factors influencing fire behavior are fuels (type and coverage), weather, and topography (aspect, slope and elevation). The following pages contain a brief explanation of each.

FIGURE 2. Percent Slope



Slopes are shown here as percent (rise/run x100). Steeper slopes intensify fire behavior and thus will contribute to a higher wildfire hazard rating. Rates of spread for a slope of 30% are typically double those of flat terrain, when all other influences are equal.

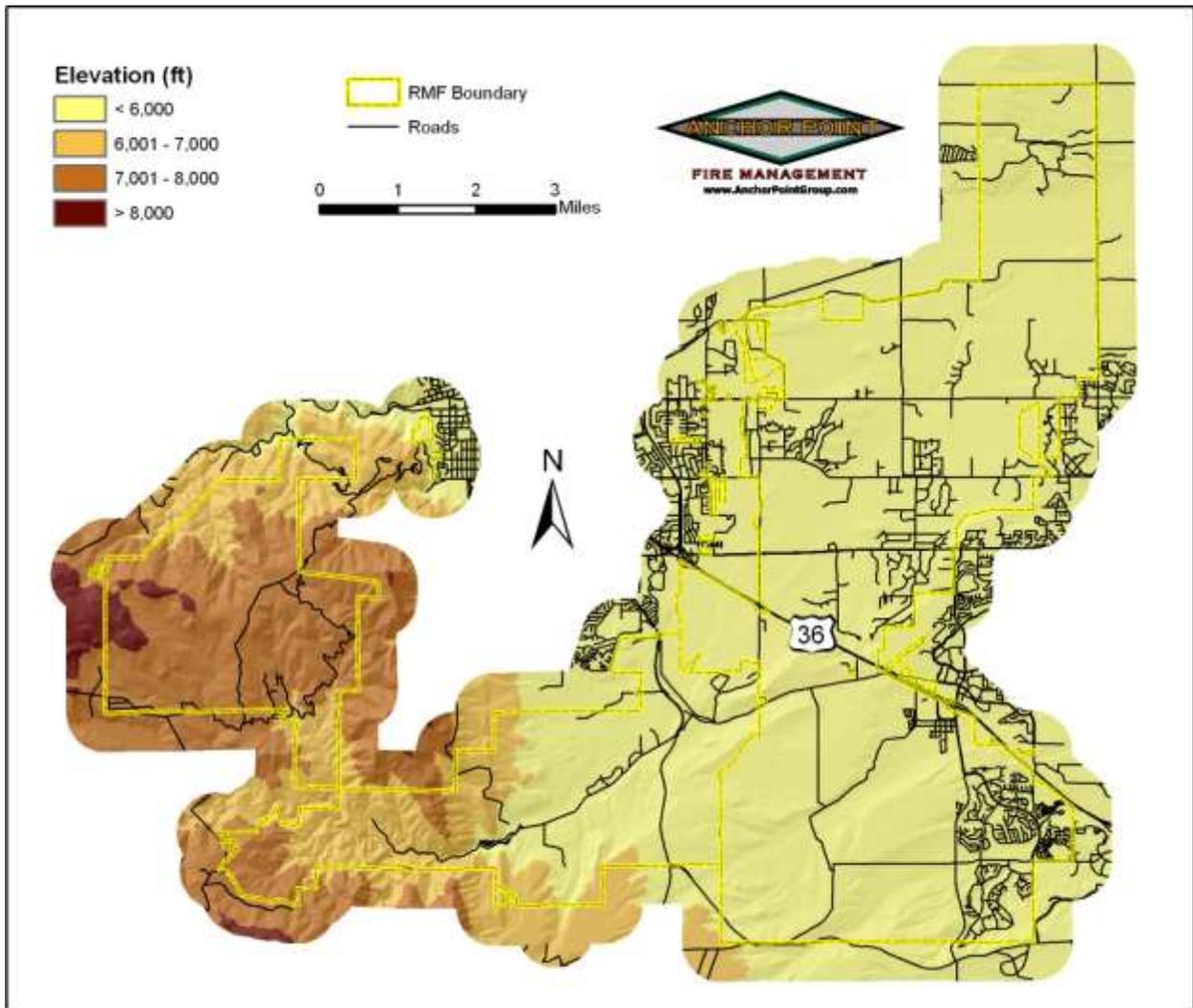
FIGURE 3. Aspect



Aspects are shown as degrees from north ranging from 0 to 360 according to their orientation. Aspects are influential in the type and quantity of vegetative fuels. Fuels on south facing slopes tend to be drier and more lightly loaded than fuels on north facing slopes, when all other influences are equal. Aspect also has an influence on plant species dominance.

Classification	North	East	South	West
Range	315-45	45-135	135-225	225-315

FIGURE 4. Elevation



Elevations within the study area range from 5,000' to over 8,000'. As elevation increases, environmental conditions, fuel species, and characteristics change.

Fuel Models and Fire Behavior

Fire behavior fuel models are a set of numbers that describe fuels in terms that a fire behavior model, in this case **FlamMap**, can use. There are seven characteristics used to categorize fuel models.

- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content

Each of the major fuel types present in the study area are described below in terms of the characteristics that coincide with that fuel model. Fuel model descriptions are taken from Anderson's *Aids to Determining Fuel Models for Estimating Fire Behavior*³, a national standard guide to fuel modeling, unless otherwise noted.

Vegetation for the project area may or may not be specifically listed in the description.

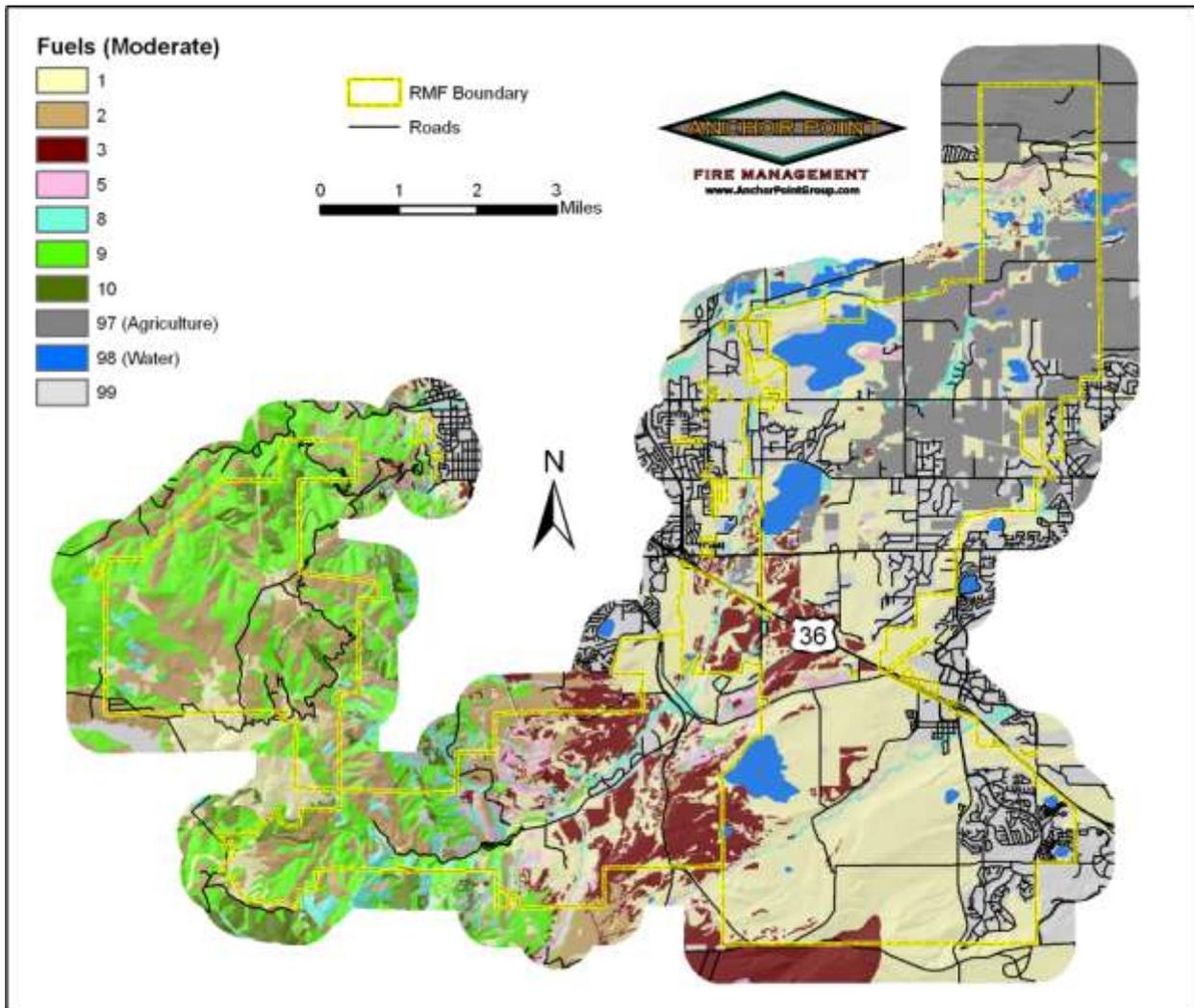
Plant species are only an aid to help visualize the characteristics of the model. The photos are taken from the project area and show where the local vegetation fits in. A table showing a range of surface fire behavior based on the **BEHAVE** system is also included.

The study area is represented primarily by seven fuel models (FM): FM 1, 2, 3, 5, 8, 9, and 10. Other fuel models may exist, but not in quantities sufficient to significantly influence fire behavior in the Wildland Urban Interface.

The following graphics (**Figures 5 and 6**) represent fuel modeling under both moderate and extreme fire conditions. The primary difference between the two fuel model maps is that Figure 5 shows agriculture land as noncombustible while Figure 6 shows agriculture land as combustible (it is characterized as FM1).

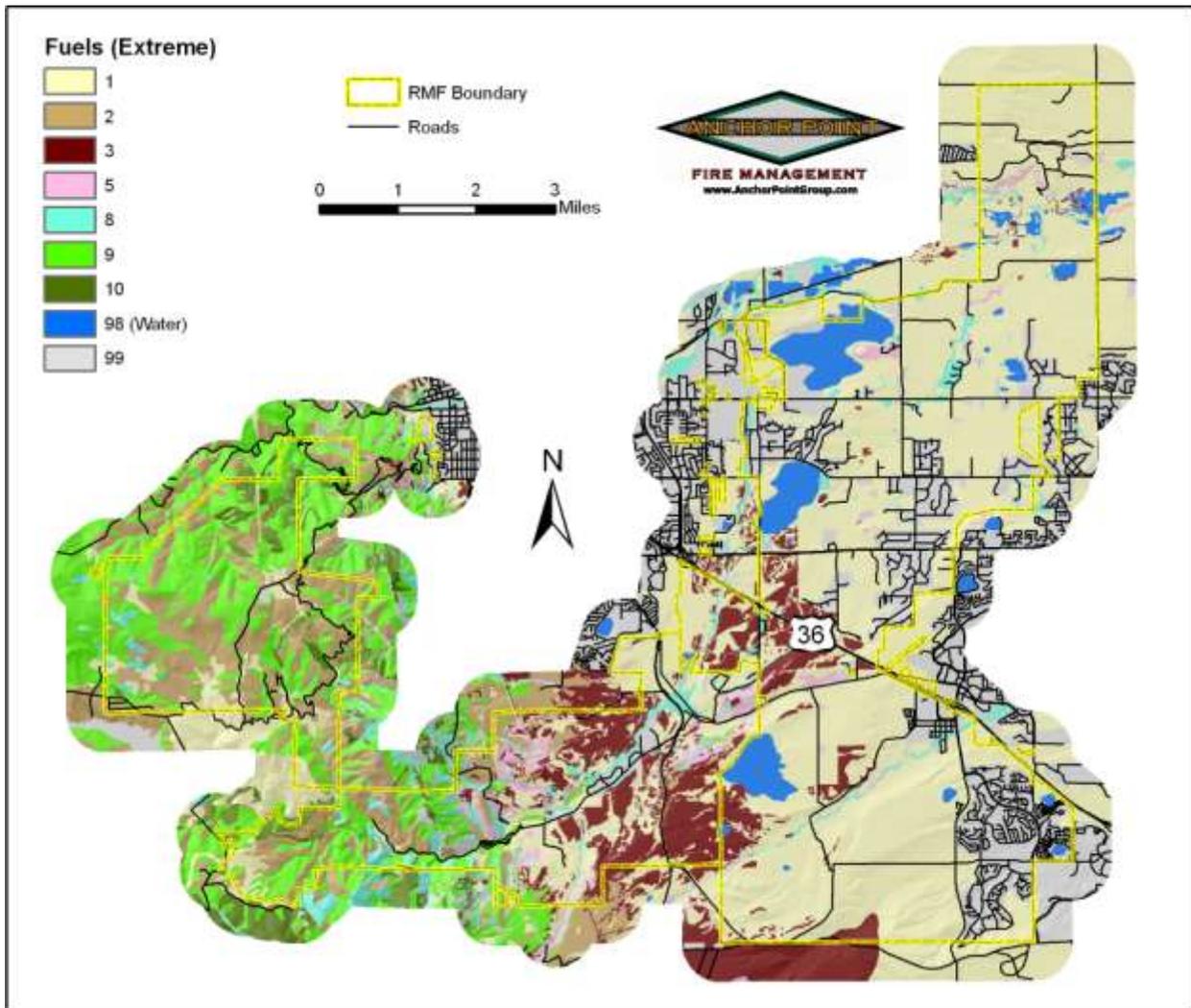
³ Anderson, Hal. 1982. *Aids to Determining Fuel Models for Estimating Fire Behavior*. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FIGURE 5. Rocky Mountain Fire Fuel Models (Moderate Conditions)



Fuel models 97, 98, and 99 in the map legend indicate areas of insignificant combustibility, under moderate conditions, such as agricultural, water, rock, sand, etc.

FIGURE 6. Rocky Mountain Fire Fuel Models (Extreme Conditions)



Note the absence of the agricultural land fuel model, which indicates that these areas could burn under extreme conditions.

FUEL MODEL 1⁴

FIGURE 7. Short Grasses



Characteristics

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations.

Common Types/Species

Annual and perennial grasses are included in this fuel model.

Fire Behavior

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires in this fuel model are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present—generally less than one third of the area.

⁴ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 1

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	28.8	92.9	203.6	362.4	570.1	665.6
	4.0	22.0	71.1	155.7	277.0	345.1	345.1
	6.0	19.4	62.4	136.8	243.4	270.1	270.1
	8.0	16.7	53.9	118.1	198.7	198.7	198.7
	10.0	11.0	35.6	64.8	64.8	64.8	64.8

10-hr fuel = 9%, 100-hr fuel = 11%, herbaceous fuel moisture = 68%, slope = 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	3.0	5.1	7.3	9.6	11.8	12.7
	4.0	2.4	4.1	5.9	7.8	8.6	8.6
	6.0	2.2	3.8	5.5	7.1	7.5	7.5
	8.0	2.0	3.4	4.9	6.3	6.3	6.3
	10.0	1.4	2.4	3.2	3.2	3.2	3.2

FUEL MODEL 2⁵

FIGURE 8. Open canopy shrubs with grass understory



Characteristics

Fire spread is primarily through the fine herbaceous fuels, either curing or dead.

Common Types/Species

Open shrub lands and pine stands or scrub oak stands that cover one third to two thirds of the area may generally fit this model. Such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some Piñon-juniper may be in this model.

Fire Behavior

These are surface fires where the herbaceous material—in addition to litter and dead-down stemwood from the open shrub or timber overstory—contributes to the fire intensity.

⁵ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 2

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	13.8	37.9	75.0	123.9	184.3	255.6
	4.0	11.3	31.1	61.5	101.7	151.2	209.7
	6.0	10.0	27.7	54.7	90.4	134.4	186.4
	8.0	9.2	25.4	50.3	83.1	123.6	171.4
	10.0	8.2	22.7	44.8	74.1	110.2	152.8
	12.0	6.5	17.9	35.3	58.3	86.7	120.3

10-hr fuel 9%, 100= 11%, herbaceous fuel moisture = 68%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	4.5	7.2	9.9	12.4	14.9	17.3
	4.0	3.9	6.2	8.4	10.6	12.7	14.8
	6.0	3.5	5.7	7.7	9.7	11.7	13.6
	8.0	3.4	5.4	7.3	9.2	11.1	12.9
	10.0	3.1	4.9	6.7	8.5	10.2	11.9
	12.0	2.5	4.0	5.5	7.0	8.4	9.7

FUEL MODEL 3³

FIGURE 9. Tall Grass



Characteristics

This model consists of tall grass stands. Heights average around three feet, but considerable variation may exist.

Common Types/Species

Wild or cultivated grains that have not been harvested can be considered similar to tall prairie and marshland grasses.

Fire Behavior

Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper sections of the grass and across standing water. Approximately one-third or more of the stand is considered dead or cured and supports the fire.

³ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 3

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	61.7	139.3	230.4	331.6	441.1	557.6
	4.0	48.6	109.7	181.5	261.2	347.4	439.2
	6.0	40.2	90.7	150	215.9	287.1	363
	8.0	34.8	78.6	130	187.1	248.9	314.7
	10.0	31.4	70.8	117.2	168.7	224.4	283.6
	12.0	29	65.3	108.1	155.6	207	261.6

10-hr fuel 9%, 100= 11%, herbaceous fuel moisture = 68%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	11.3	16.5	20.7	24.5	28	31.2
	4.0	9.4	13.7	17.3	20.4	23.3	25.9
	6.0	8.2	11.9	15	17.7	20.2	22.5
	8.0	7.4	10.8	13.6	16	18.3	20.4
	10.0	6.9	10.1	12.7	15	17.1	19.1
	12.0	6.6	9.6	12.1	14.3	16.3	18.2

FUEL MODEL 5⁶

FIGURE 10. Brush



Characteristics

This model consists of continuous stands of low brush. Generally, heights do not exceed six feet. The stands will have a grass or scattered grass understory. Usually shrubs are short and almost totally cover the area.

Common Types/Species

Young, green stands with minimal dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise. Mountain grasses are also associated with this type.

Fire Behavior

The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. Cured leaves retained on shrubs can cause greater intensities.

⁶ Anderson, Hal. 1982. *Aids to Determining Fuel Models for Estimating Fire Behavior*. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 5

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	8.7	20.2	34.3	50.5	68.3	87.6
	4.0	7.4	17.2	29.3	43.1	58.3	74.7
	6.0	5.6	12.9	21.9	32.3	43.6	56
	8.0	2.6	6.1	10.4	15.3	20.7	21.7
	10.0	2.6	5.9	10.1	14.8	20.1	20.3
	12.0	2.5	5.7	9.7	14.3	18.7	18.7

10-hr fuel 9%, 100 = 11%, herbaceous fuel moisture = 68%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	4	6	7.6	9.1	10.4	11.7
	4.0	3.5	5.2	6.6	7.9	9.1	10.2
	6.0	2.7	4	5.1	6.1	7	7.8
	8.0	1.4	2	2.6	3.1	3.5	3.6
	10.0	1.3	2	2.5	3	3.4	3.5
	12.0	1.3	1.9	2.4	2.9	3.3	3.3

FUEL MODEL 8³

FIGURE 11. Timber Litter, Light Fuel Load



Characteristics

This fuel model is represented by closed canopy stands of Hardwoods, Lodgepole pine, or Ponderosa pine with little under growth. Hardwoods that have leafed out support fire in the compact litter layer. Amounts of needle and woody litter are also low.

Common Types/Species

This fuel model is most often represented by Lodgepole pine but Ponderosa pine can be included. Hardwood species would include Cottonwoods and Willows. There are little or no understory plants.

Fire Behavior

Fires in this fuel model are slow burning, low intensity fires burning in surface fuels. Fuels are mainly needles and woody litter. Heavier fuel loadings can cause flare-ups. Heavier fuel loads have the potential to develop crown fires in extreme burning conditions.

³ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 8

Rate of spread in chains/hour (1 chain=66 ft)

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %		1.1	2.3	3.8	5.6	7.7	9.7
	2.0	0.9	1.8	3.1	4.6	6.2	6.6
	4.0	0.7	1.5	2.6	3.8	4.8	4.8
	6.0	0.6	1.3	2.3	3.3	3.7	3.7
	8.0	0.6	1.2	2.0	3.0	3.1	3.1
	10.0	0.5	1.1	1.8	2.7	2.7	2.7
	12.0						

10 hr fuel=9, 100 hr fuel=11 herbaceous fuel moisture=68 slope=10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %		0.9	1.3	1.6	2.0	2.3	2.5
	2.0	0.8	1.1	1.4	1.7	1.9	2.0
	4.0	0.7	1.0	1.2	1.5	1.6	1.6
	6.0	0.6	0.9	1.1	1.3	1.4	1.4
	8.0	0.6	0.8	1.0	1.2	1.3	1.3
	10.0	0.5	0.8	1.0	1.2	1.2	1.2
	12.0						

FUEL MODEL 9⁴

FIGURE 12. Timber Litter (note heavier surface fuels)



Characteristics

Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

Common Types/Species

Closed stands of long-needled pine like Ponderosa, Jeffrey, and Red pines, or southern pine plantations are grouped in this fuel model.

Fire Behavior

Fires in this fuel model run through the surface litter faster than model 8 and have longer flame height. 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.

⁴ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 9

Rate of spread in chains/hour (1 chain=66 ft)

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	4.0	9.7	18.0	28.7	41.4	56.1
	4.0	3.1	7.7	14.2	22.6	32.7	44.3
	6.0	2.6	6.4	11.8	18.7	27.0	36.6
	8.0	2.3	5.5	10.2	16.2	23.5	31.8
	10.0	2.0	5.0	9.2	14.7	21.2	28.7
	12.0	1.9	4.6	8.5	13.5	19.5	26.5

10 hr fuel=9, 100 hr fuel=11%, herbaceous fuel moisture=68%, slope=10%

Flame Length in Feet

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	2.3	3.5	4.7	5.8	6.8	7.9
	4.0	1.9	2.9	3.9	4.8	5.7	6.5
	6.0	1.7	2.5	3.4	4.2	4.9	5.7
	8.0	1.5	2.3	3.1	3.8	4.5	5.2
	10.0	1.4	2.2	2.9	3.5	4.2	4.8
	12.0	1.4	2.1	2.7	3.4	4.0	4.6

Fuel Model 10⁵

FIGURE 13. Timber Litter (note heavier fuels and understory)



Characteristics

This fuel model is represented by dense stands of over-mature Ponderosa pine, Lodgepole pine, mixed conifer and continuous stands of Douglas fir. In all stand types, heavy downed material is present. There is also a large amount of dead-down woody fuels. Reproduction of vegetation may be present, acting as ladder fuels. This fuel model includes stands of budworm-killed Douglas fir, and closed stands of Ponderosa pine with large amounts of ladder and surface fuels. Stands of Lodgepole pine with heavy loadings of downed trees are also present. This fuel model can occur from the foothills through the sub-alpine zone.

Common Types/Species

All types of vegetation can occur in this fuel model, but primary species are Douglas fir, Ponderosa pine and Lodgepole pine.

Fire Behavior

Fire intensities in this fuel model can be moderate to extreme. Fire moves through dead, downed woody material. Torching of trees and spot fires are more frequent. Crown fires are quite possible.

⁵ Anderson, Hal. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station 22 p. (NFES 1574).

FUEL MODEL 10

Rate of spread in chains/hour (1 chain=66 ft)

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.5	7.5	12.6	18.5	25.1	32.2
	4.0	3.1	6.7	11.2	16.4	22.2	28.6
	6.0	2.8	6.1	10.2	14.9	20.2	26
	8.0	2.6	5.7	9.5	13.9	18.8	24.1
	10.0	2.5	5.3	9	13.1	17.8	22.9
	12.0	2.4	5.1	8.6	12.6	17	21.9

10 hr fuel=9%, 100 hr fuel=11%, herbaceous fuel moisture=68%, slope=10%

Flame Length in Feet

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.7	5.2	6.6	7.9	9.1	10.2
	4.0	3.3	4.7	6	7.1	8.2	9.2
	6.0	3.1	4.4	5.5	6.6	7.6	8.5
	8.0	2.9	4.1	5.2	6.2	7.2	8
	10.0	2.8	4	5	6	6.9	7.7
	12.0	2.7	3.8	4.9	5.8	6.7	7.5

Reference Weather Used in the Fire Behavior Potential Evaluation

The weather inputs for FlamMap were created by using weather data collected at the Sugarloaf Remote Automated Weather Station (RAWS).

Sugarloaf Site Information

Latitude (dd mm ss)	40 ° 01 ' 81 " N
Longitude (dd mm ss)	105 ° 36 ' 14 " W
Elevation (ft.)	6,733

Weather observations from the Sugarloaf RAWS were averaged for a thirty-year period (1977-2006) to calculate these conditions. The moderate conditions class (16th to 89th percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed) using Fire Family Plus. This weather condition class most closely represents a moderate fire season day.

The extreme conditions class was calculated using 97th percentile weather data. In other words, the weather conditions on the four most severe fire weather days (sorted by Spread Component) in each season for the thirty-year period were averaged together. It is reasonable to assume that similar conditions may exist for at least four days of the fire season during an average year. In fact, during extreme years such conditions may exist for significantly longer periods. Even these calculations may be conservative compared to observed fire behavior. The following values were used in **FlamMap**:

Moderate Weather Conditions	
Variable	Value
20 ft Wind speed up slope	10 mph
Herbaceous fuel moisture	68%
Woody fuel moisture	110%
100-hr fuel moisture	11%
10-hr fuel moisture	9%

Extreme Weather Conditions	
Variable	Value
20 ft Wind speed up slope	19 mph
Herbaceous fuel moisture	62%
Woody fuel moisture	99%
100-hr fuel moisture	9%
10-hr fuel moisture	6%

Note: Strong winds at 20 ft will feel significantly less noticeable on the skin at ground level. For example, a “gentle breeze” on the skin may constitute an 11 MPH 20-foot wind, adding one of the components necessary for extreme weather conditions.

Dead Fuel Moisture

Dead fuel moisture responds solely to ambient environmental conditions and is critical in determining fire potential. Dead fuel moistures are classed by timelag. A fuel's timelag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. Dead fuels in NFDRS fall into four classes: 1, 10, 100, and 1000 hour.

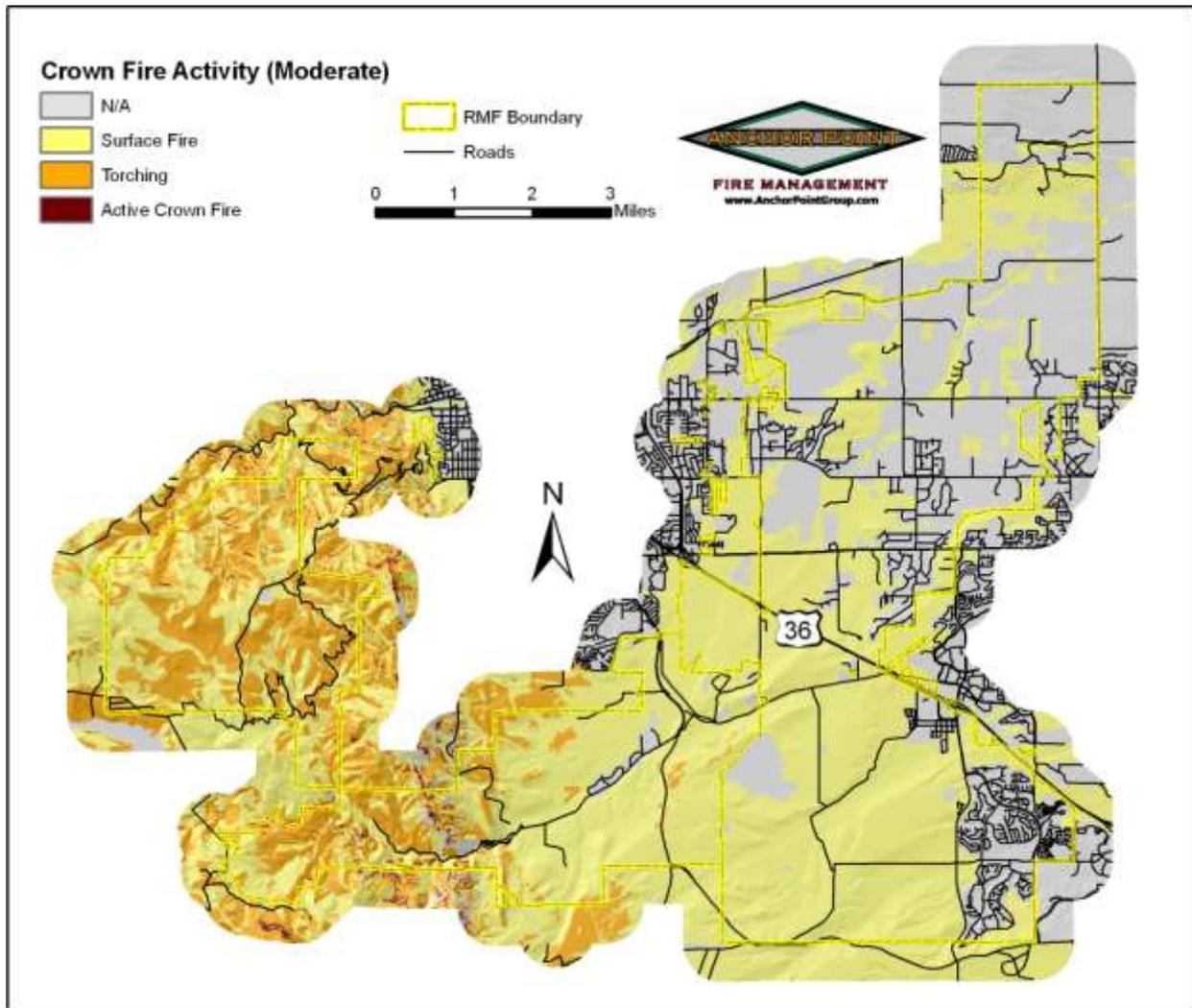
Live Fuel Moisture

Live fuel Moisture is the amount of water in a fuel, expressed as a percent of the oven-dry weight of that fuel. A fuel moisture between 300% and 30% is considered live. Anything below 30% is considered dead fuel. Fuel moistures can exceed 100% because the living cells can expand beyond their normal size to hold more water when available.

Fire Behavior Analysis Outputs

Crown fire activity, rate of spread, and flame length are derived from the fire behavior predictions. The following maps graphically display the outputs of **FlamMap** for both moderate and extreme weather conditions.

FIGURE 6. Predictions of Crown Fire Activity (Moderate Weather Conditions)



Crown fire activity values are generated by the **FlamMap** model and classified into four categories based on standard ranges: Active, Passive, Surface, and Not Applicable. In the surface fire category, little or no tree torching will be expected. During passive crown fire activity, isolated torching of trees or groups of trees will be observed and canopy runs will be limited to short distances. During active crown fire activity, sustained runs through the canopy will be observed that may be independent of surface fire activity.

FIGURE 7. Predictions of Crown Fire Activity (Moderate Weather Conditions) Expanded View

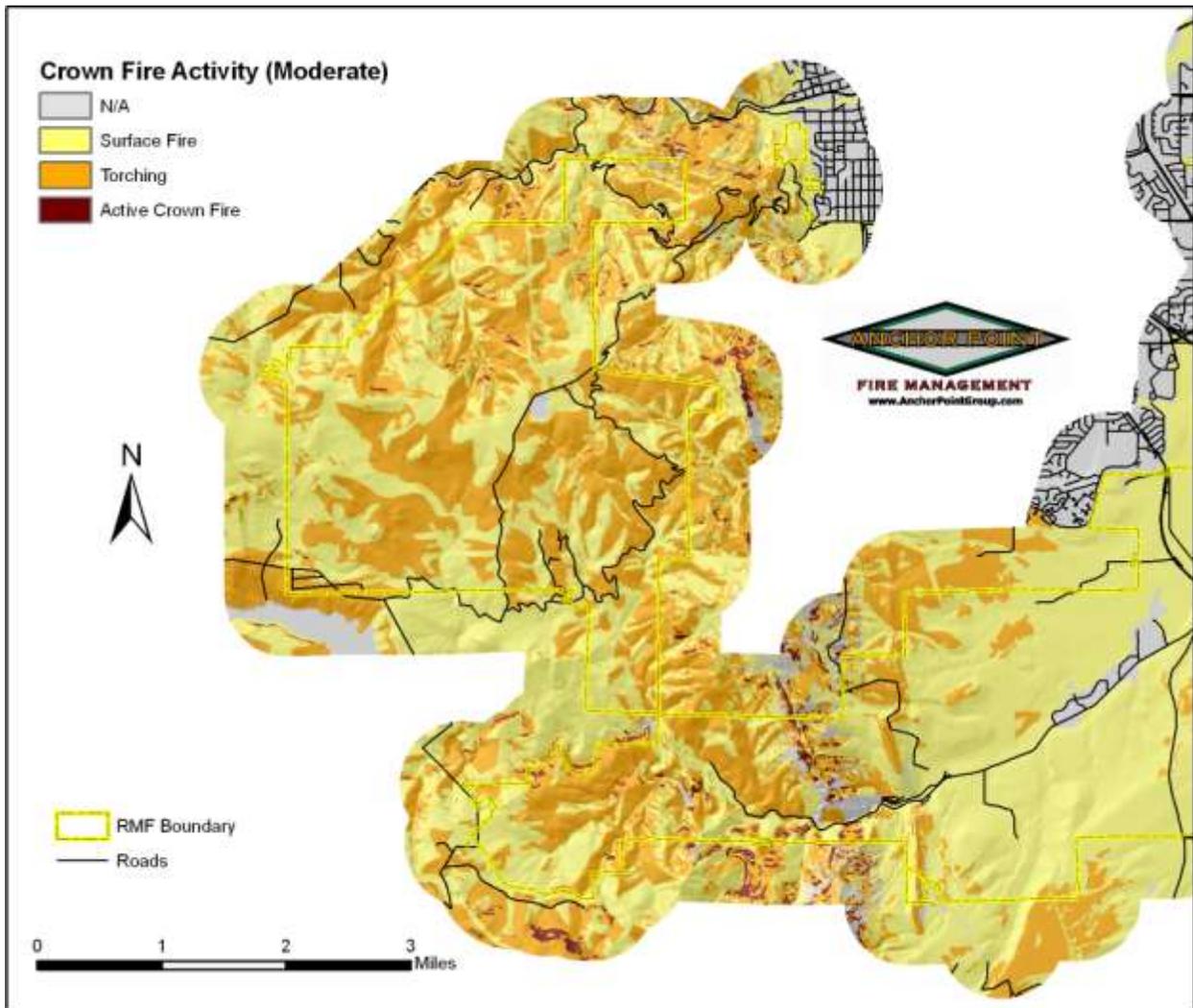


FIGURE 8. Predictions of Crown Fire Activity (Extreme Weather Conditions)

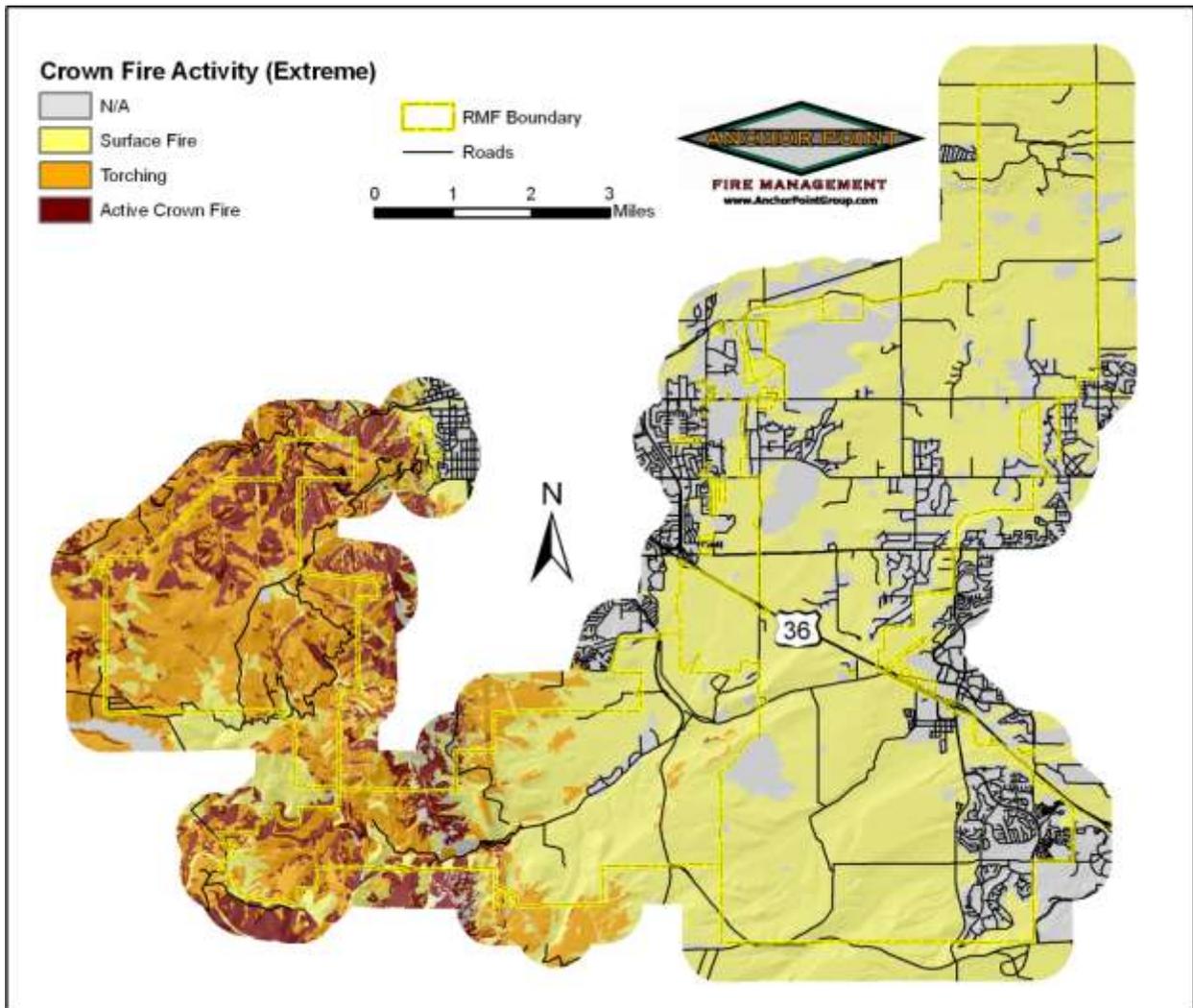


FIGURE 9. Predictions of Crown Fire Activity (Extreme Weather Conditions) Expanded View

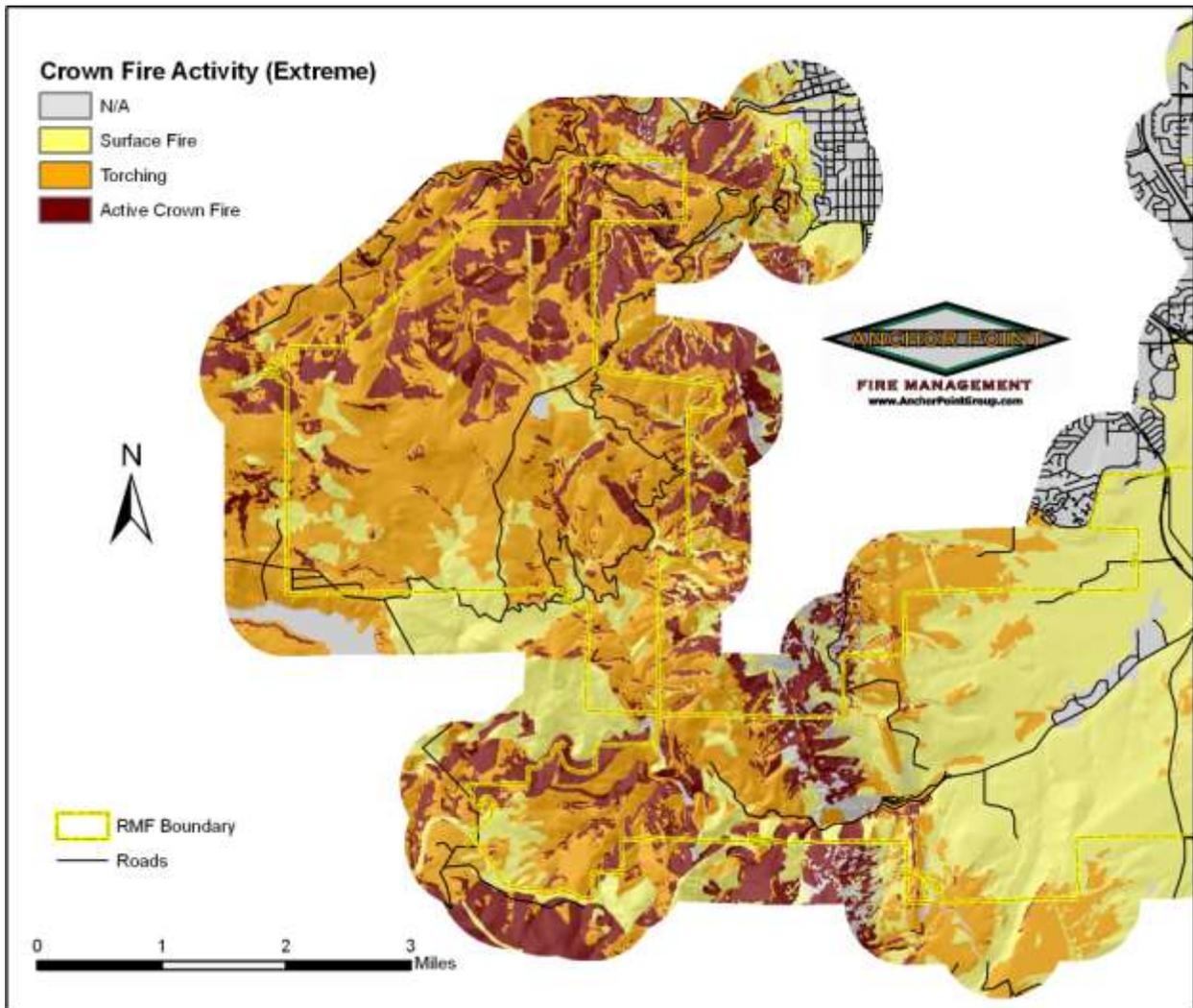
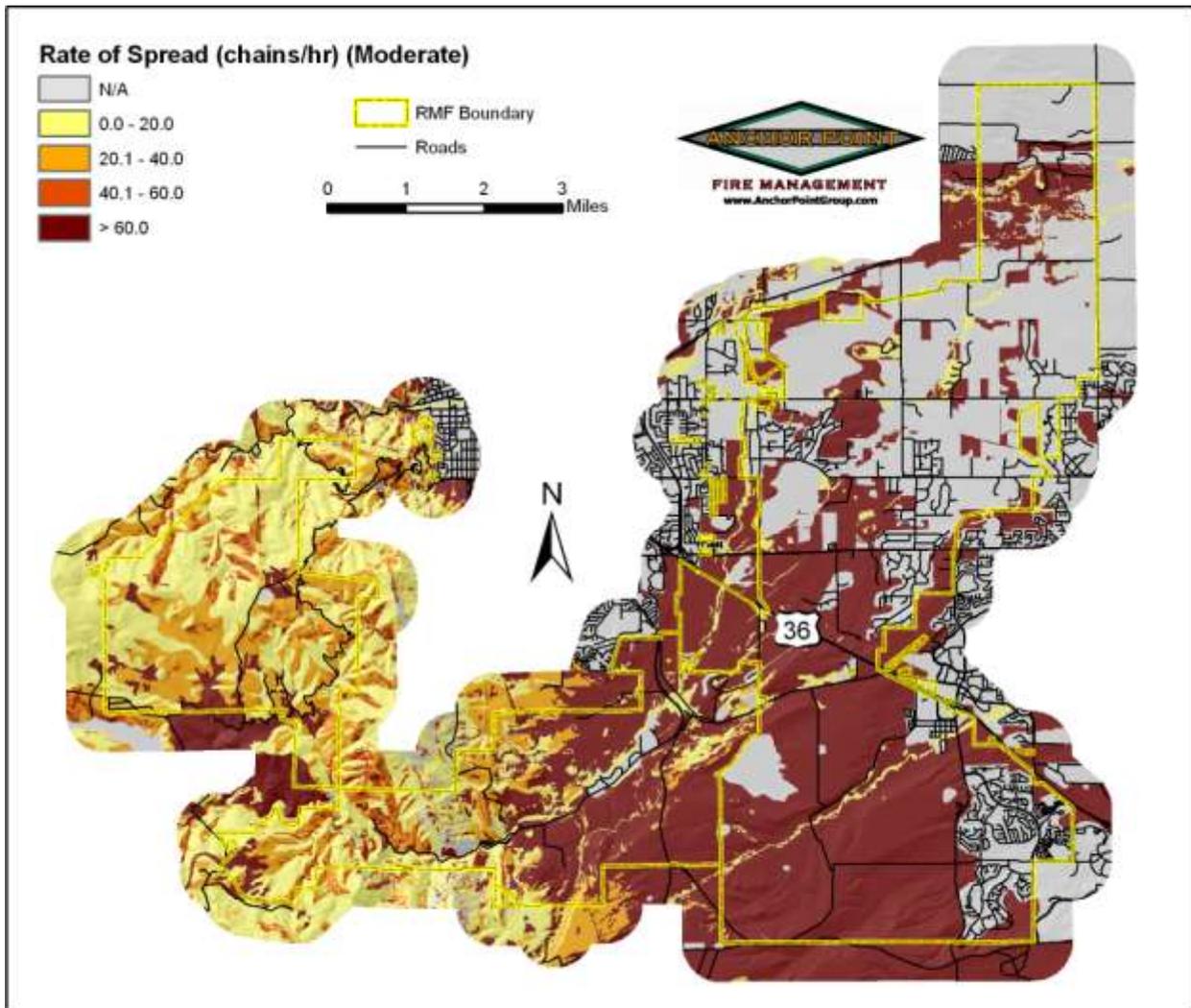


FIGURE 10. Rate of Spread Predictions (Moderate Weather Conditions)



Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains. 1 ch/h equals approximately 1 foot/minute or 80 chains per hour equals 1 mile per hour.

FIGURE 11. Rate of Spread Predictions (Moderate Weather Conditions) Expanded View

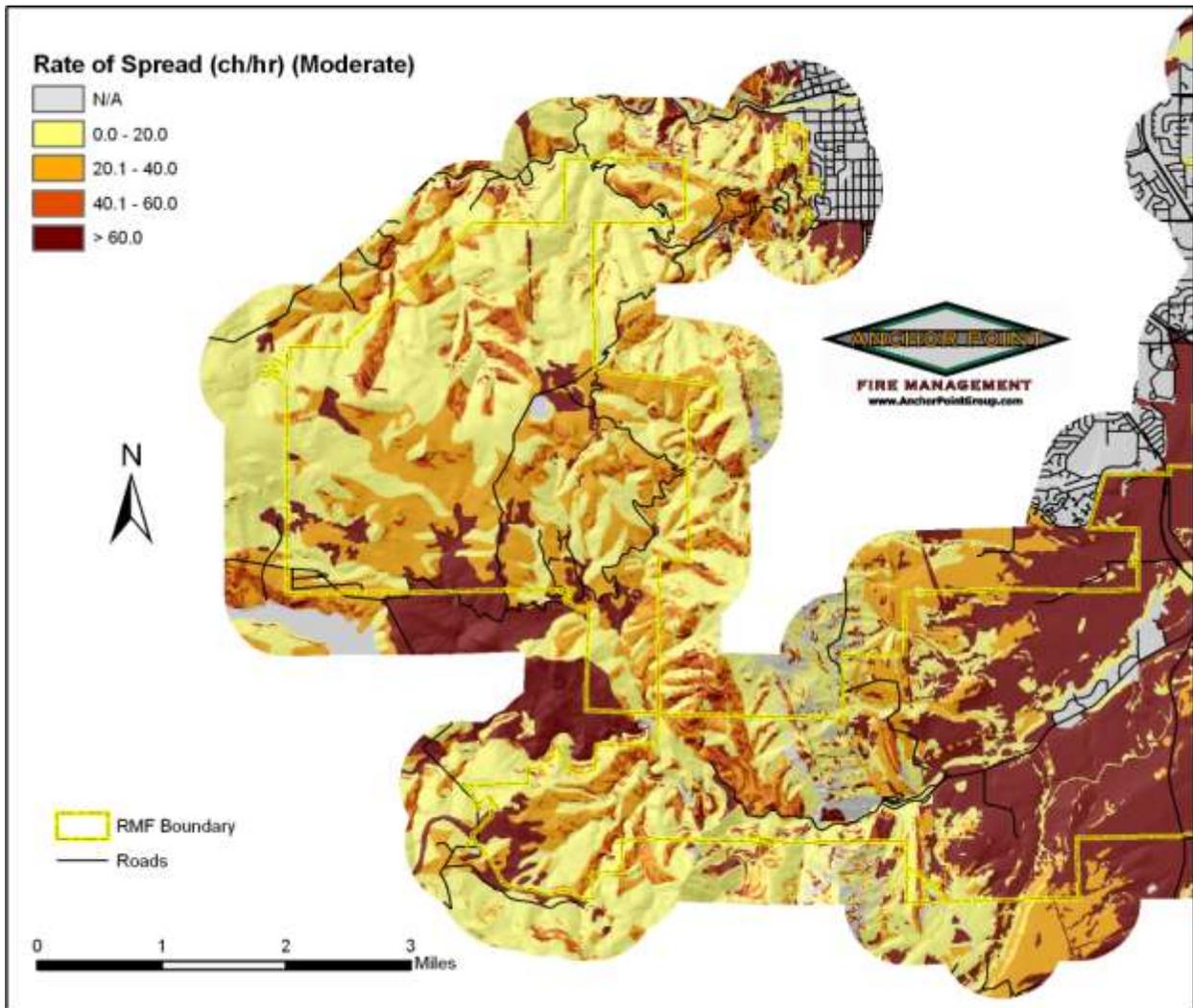
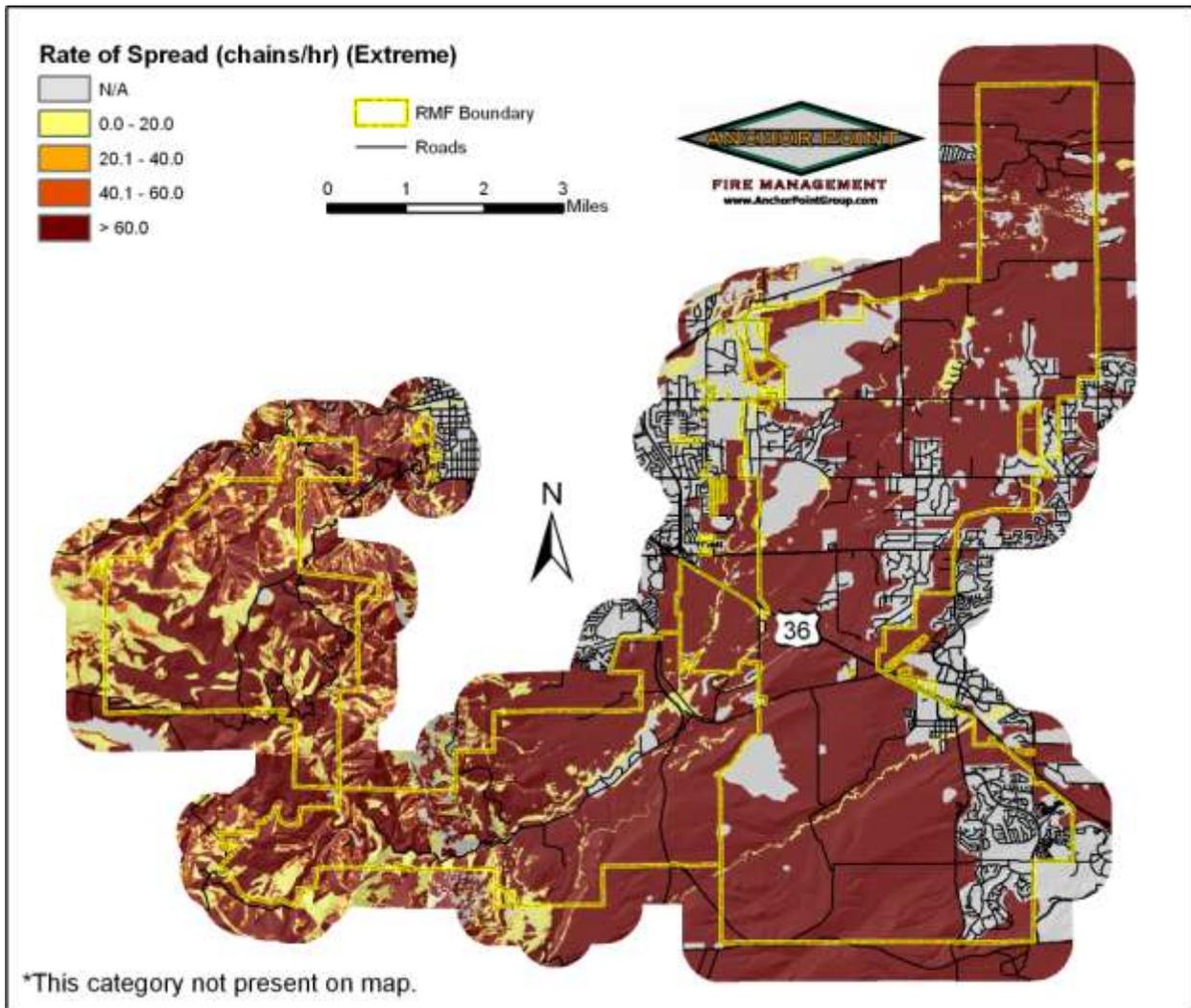


FIGURE 20. Rate of Spread Predictions (Extreme Weather Conditions)



Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

FIGURE 21. Rate of Spread Predictions (Extreme Weather Conditions) Expanded View

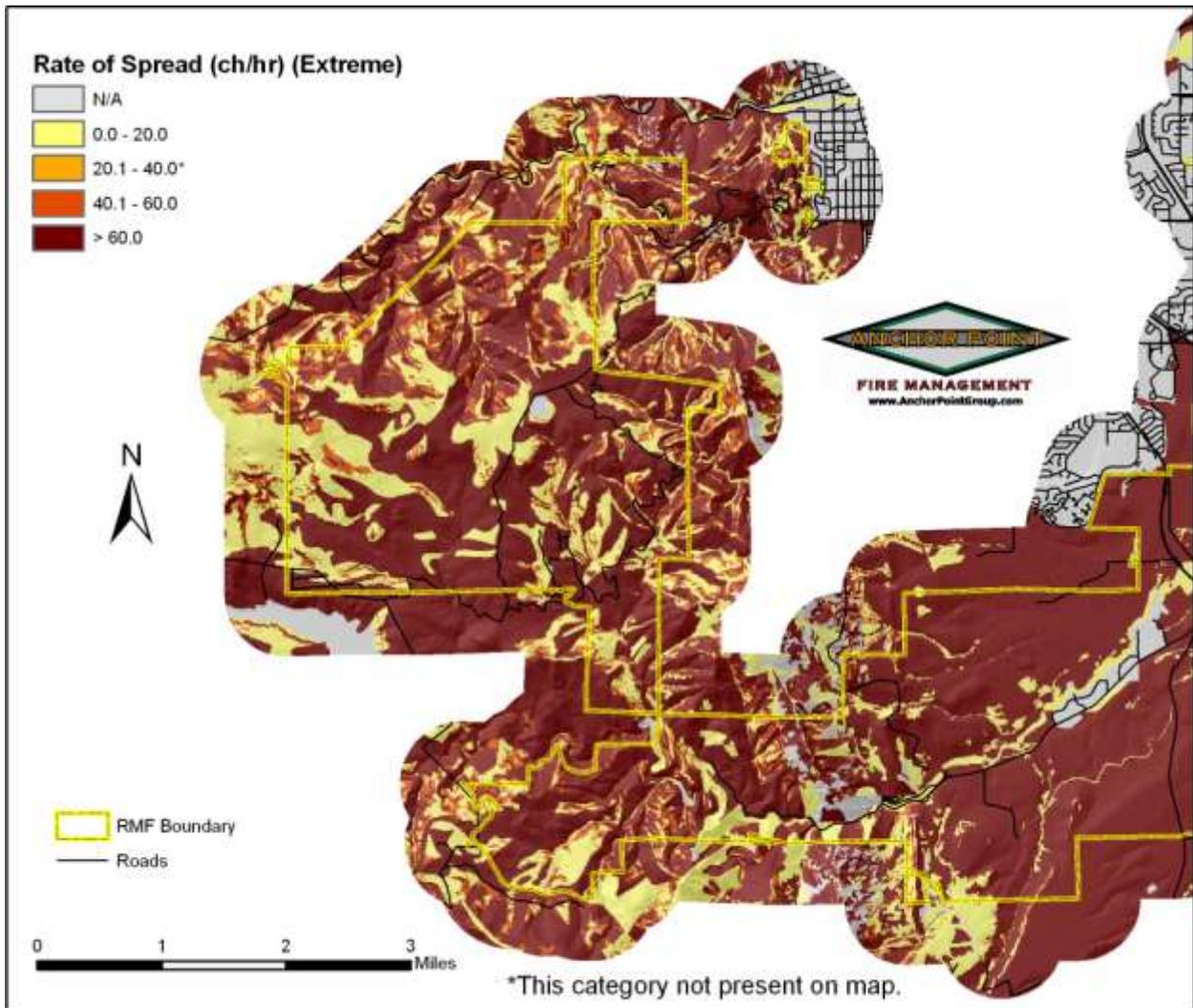
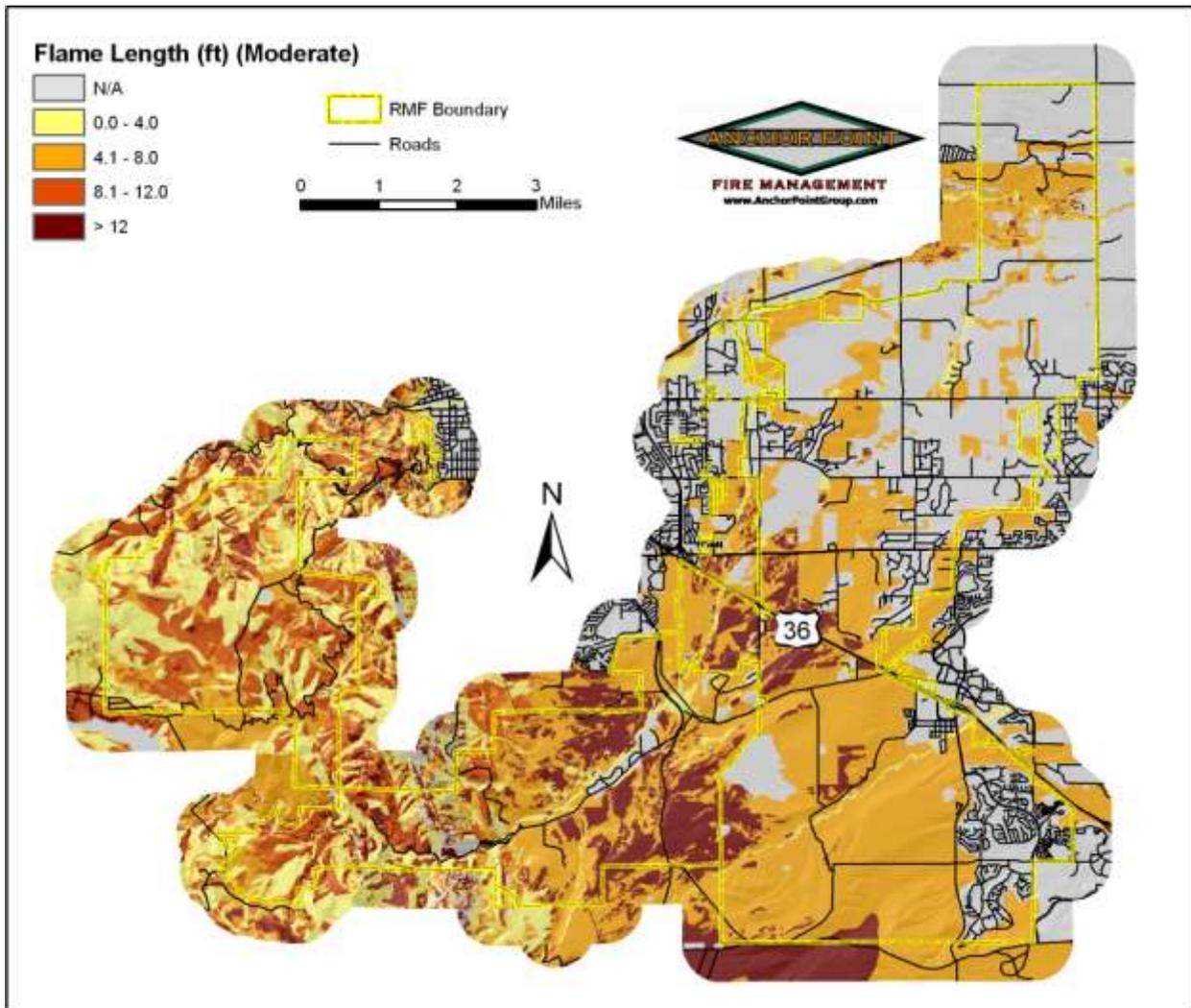


FIGURE 22. Flame Length Predictions (Moderate Weather Conditions)



Flame length values are generated by the **FlamMap** model and classified in the four categories based on standard ranges: 0-4 feet, 4.1-8 feet, 8.1-12 feet and 12.1-60 feet. Flame lengths of 4 feet and less are acceptable for direct attack by hand crews. Flame lengths of 8 feet and less are suitable for direct attack by machinery. With flame lengths of greater than 8 feet, indirect attack and aerial attack are the preferred methods.

FIGURE 23. Flame Length Predictions (Moderate Weather Conditions) Expanded View

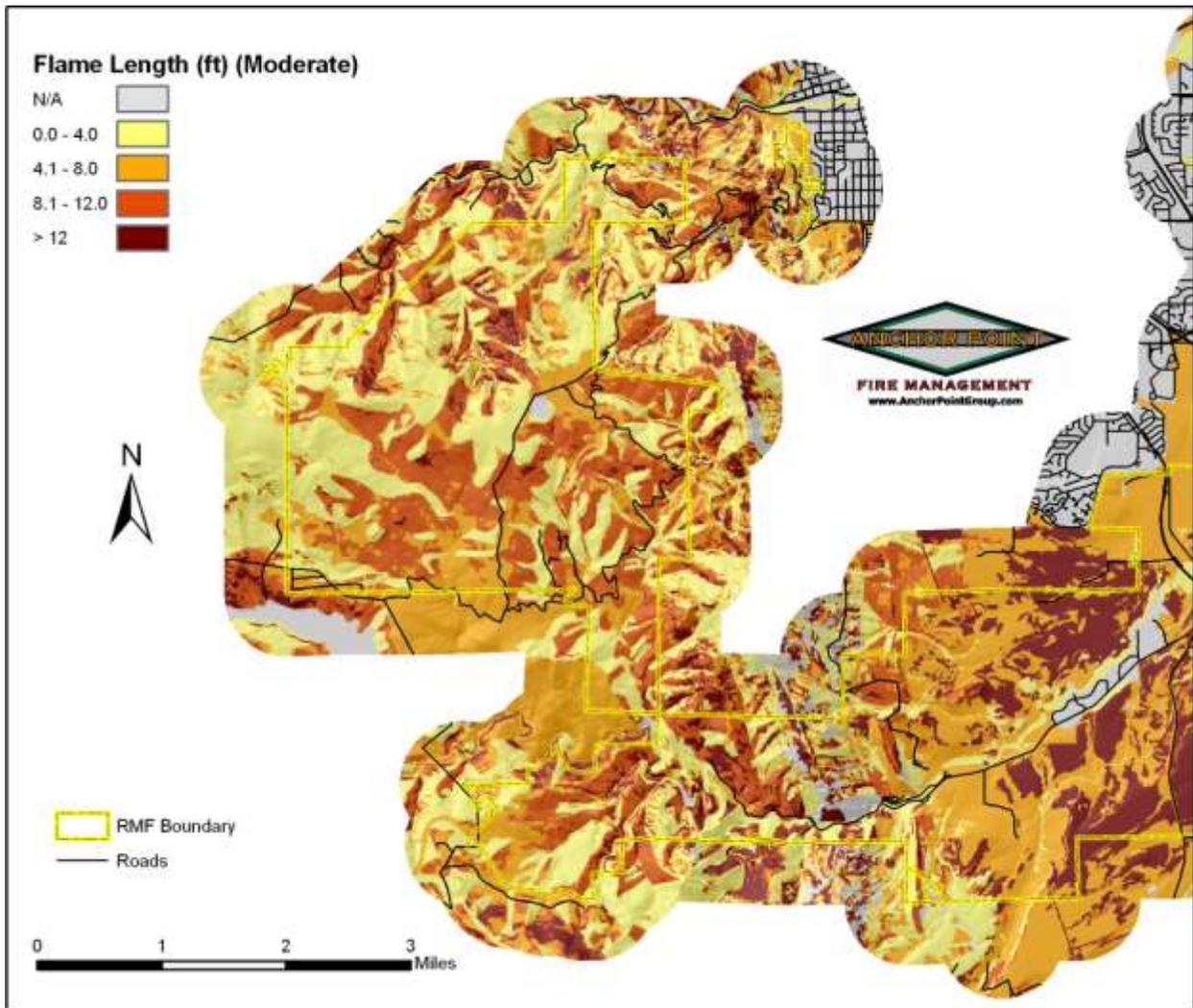


FIGURE 24. Flame Length Predictions (Extreme Weather Conditions)

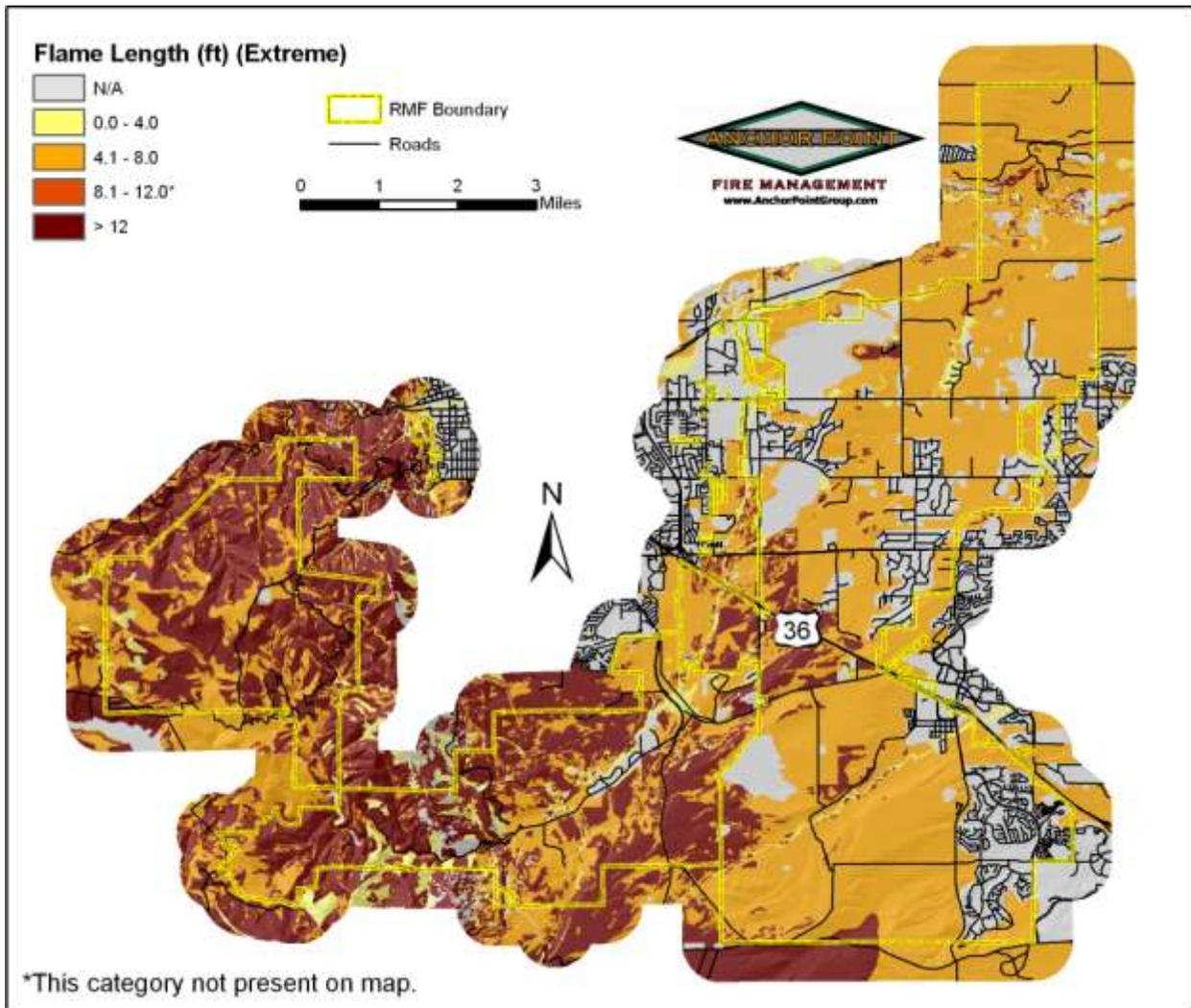
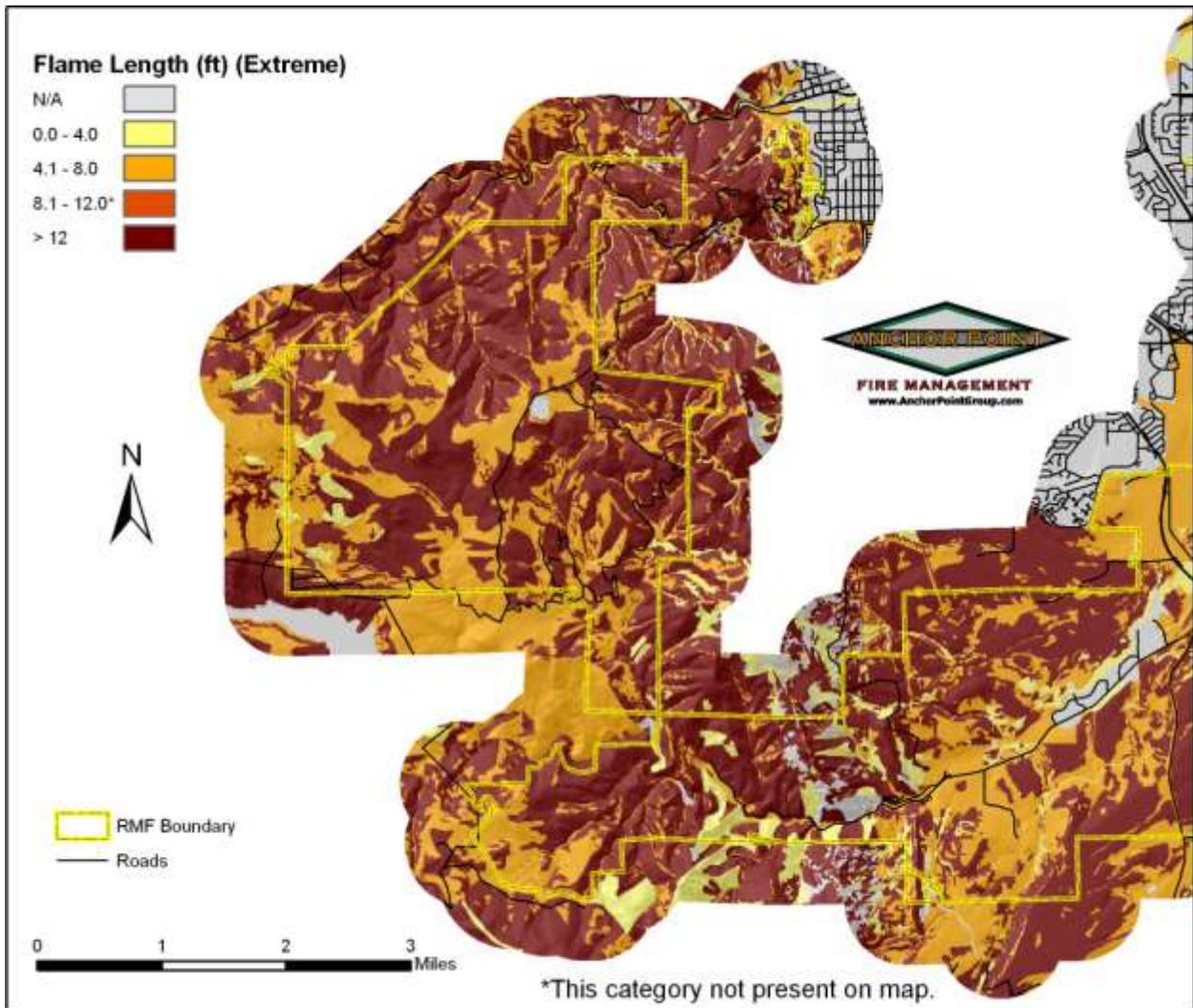


FIGURE 25. Flame Length Predictions (Extreme Weather Conditions) Expanded View



Fire Behavior Interpretation and Limitations

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point source ignition at every point. It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability that a wildfire will occur. It assumes an ignition occurrence for every cell (each 10 x 10 meter area).

Weather conditions are extremely variable and all possible combinations cannot be accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical planning. Whenever possible, fire behavior calculations should be done with actual weather observations during the fire. The most current ERC values should also be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

ROCKY MOUNTAIN FIRE CWPP

APPENDIX B COMMUNITIES



The purpose of this appendix is to examine in greater detail the communities in the study area. Of the eight communities in the Rocky Mountain Fire Protection District, two were rated extreme, two were found to represent a very high hazard; one was rated as high hazard, one as moderate hazard and two as low hazard. For easy reference, the map of communities presented in the main text has been reproduced here as **Figure 1**. **Figure 2** displays this grouping graphically. **Table 1** has been included for quick identification.

FIGURE 1. Community Hazard Ratings

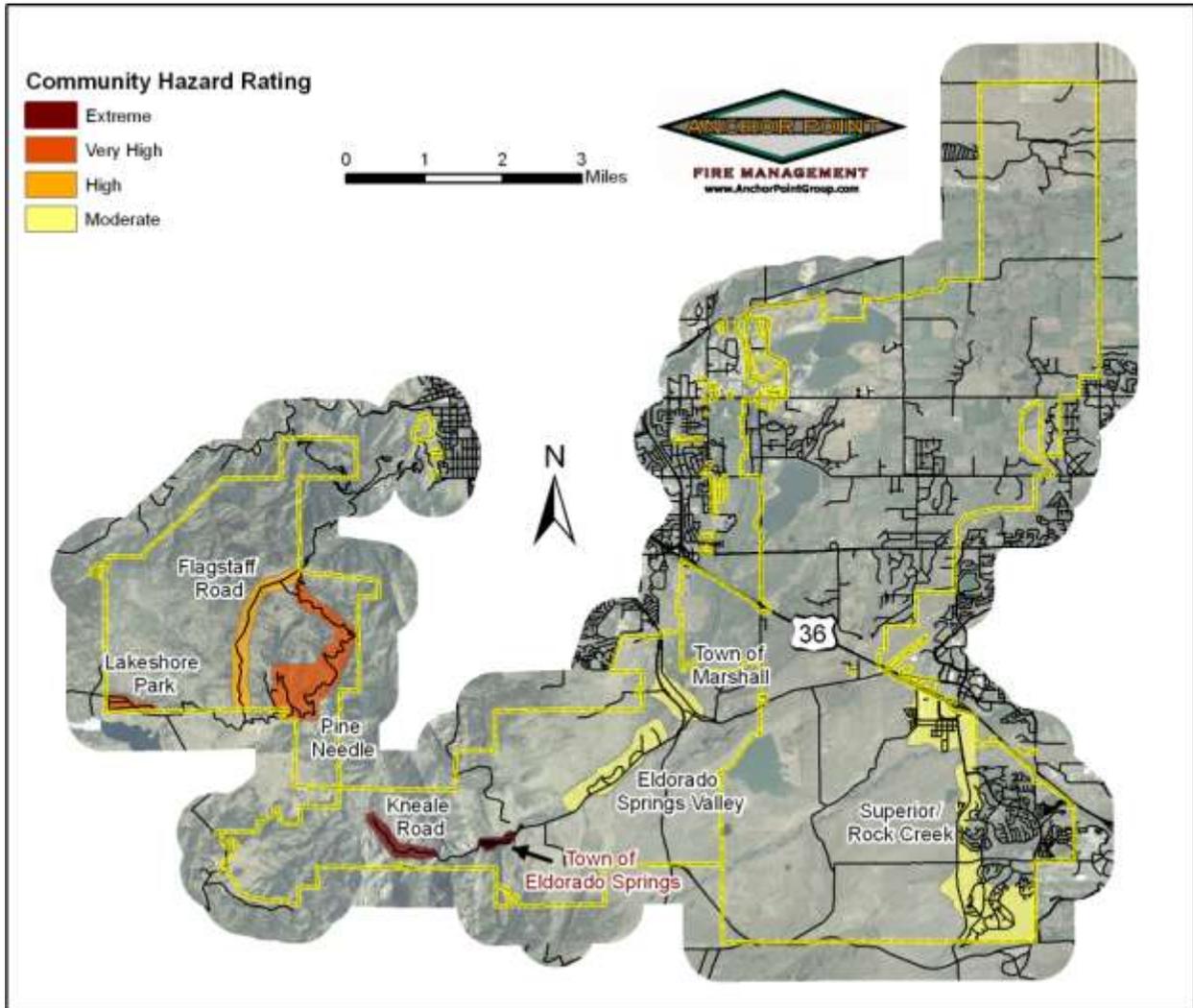


TABLE 1. Communities by Hazard Rating

Hazard Ratings for Rocky Mountain Fire Communities					
Number	Community	(Ref.#)	WP #	Rank	Score
1	Kneale Road		3	Extreme	10
2	Town of Eldorado Springs		3	Extreme	10
3	Pine Needle		2	Very High	14
4	Lake Shore Park		2	Very High	16
5	Flagstaff Road		2	High	20
6	Superior / Rock Creek		11 & 12	Moderate	29
7	Town of Marshall		4	Moderate	31
8	Eldorado Springs Valley		5	Moderate	31

General Recommendations

A combination of adequate access, ignition-resistant construction, and fuels reduction will help to create a safe environment for emergency service personnel and should provide reasonable protection to structures from a wildfire. These techniques will also significantly reduce the chances of a structure fire becoming an ignition source to the surrounding wildlands.

In addition to the suggested mitigations listed for the individual communities, several general measures can be taken to improve fire safety. The following recommendations should be noted and practiced by anyone living in the Wildland-Urban Interface:

1. Be aware of the current fire danger in the area.
2. Clean roofs and gutters at least two times a year, especially during cure-up in autumn.
3. Stack firewood on a side contour, at least 30 feet away from structures.
4. Don't store combustibles or firewood under decks.
5. Maintain and clean spark arresters on chimneys.
6. When possible, maintain an irrigated greenbelt around the home.
7. Connect, and have available, a minimum of 50 feet of garden hose.
8. Post reflective lot and/or house numbers so that they are clearly visible from the main road. Reflective numbers should also be visible on the structure itself.
9. Trees along driveways should be limbed and thinned as necessary to maintain a minimum 13'6" vertical clearance for emergency vehicle access.
10. Maintain your defensible space constantly:
 - Mow grass and weeds to a low height.
 - Remove any branches overhanging the roof or chimney.
 - Remove all trash, debris, and cuttings from the defensible space.

Note

All communities that rate as extreme, very high, and high hazard level were recommended for a parcel-level analysis. In the moderate level communities a parcel-level analysis was recommended only if the evaluator found a significant number of homes that had no or ineffective defensible space or a significant number of hazards near homes was detected. In short, the recommendation was made only if the evaluator felt a parcel-level analysis would generate a noticeable improvement in the community's defensibility.

Technical Terms

The following definitions apply to terms used in the community description and recommendations sections of this appendix.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from the structure. The design and extent of the defensible space is based on fuels, topography, and the design and materials of the structure.

Extended Defensible Space (also known as Zone 3): In this defensible space zone, treatment is continued beyond the recommended minimum boundary for defensible space. This zone focuses on forest management with fuels reduction being a secondary function.

Citizen Safety Zone: An area that can be used by residents for protection in the event that the main evacuation route is compromised. The area should be maintained, cleared of fuels, and large enough for all residents of the area to survive an advancing wildfire without special equipment or training.

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to segregate, stop, or reduce the spread of fire. As a practical matter, fuelbreaks in the WUI are most effective against crown fires.

Community Assessment Methodology

The community level methodology for this assessment uses a Wildfire Hazard Rating (WHR) that was developed specifically to evaluate communities within the Wildland Urban Interface (WUI) for their relative wildfire hazard.¹ The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. It has been proven and refined by use in rating over 1,400 neighborhoods throughout the United States.

Many knowledgeable and experienced fire management professionals were queried about specific environmental and infrastructure factors, and wildfire behavior and hazards. Weightings within the WHR model were established through these queries. The model was designed to be applicable throughout the western United States.

The model was developed from the perspective of performing structural triage on a threatened community in the path of an advancing wildfire with moderate fire behavior. The WHR survey and fuel model ground truthing are accomplished by field surveyors with WUI fire experience. The rating system assigns up to a maximum of 60 points based on seven categories:

- Average Lot Size
- Slope
- Primary Aspect
- Average Fuel Type
- Fuel Continuity
- Dominant Construction Type
- Surface Fuel Loading

The higher the score for a given community, the lower its wildfire hazard. For example, a community with an average lot size of less than 1 acre and slopes of greater than 30% would receive 0 points for those factors, whereas a community with an average lot size of 5 acres and slopes of less than 15% would receive 16 points for the same factors. Additional hazards are then subtracted from the subtotal of points earned in the seven categories to give a final numeric value. The final value is then used to group communities into one of five hazard ratings: Extreme, Very High, High, Moderate, or Low.

It is important to note that not all groupings occur in every geographic region. There are some areas with no low hazard communities, just as there are some areas with no extreme communities. The rankings are also related to what is customary for the area. For example, a high hazard area on the plains of Kansas may not look like a high hazard area in the Sierra Nevada. The system creates a relative ranking of community hazards in relation to the other communities in the study area. It is designed to be used by experienced wildland firefighters who have a familiarity with structural triage operations and fire behavior in the interface.

¹ C. White, "Community Wildfire Hazard Rating Form" *Wildfire Hazard Mitigation and Response Plan*, Colorado State Forest Service, Ft. Collins, CO, 1986.

Communities

1. Kneale Road

FIGURE 4.



Hazard Rating:

Extreme

Does the neighborhood have dual access roads?

No

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

No

Average lot size:

> 5 acres

Fuel models found in the neighborhood:

2, 8, 9, 10

Water supply:

Creek, dry hydrant, private cistern

Hazards:

Steep slopes, ravines, inadequate roads, power lines, propane tanks

Description:

- Moderate to large sized homes on large lots.
- Dominant construction is wood siding with composite roofs.
 - Decks and other structural projections built over flammable vegetation exist.
- Defensible space is adequate in most cases.
 - Flammable outbuildings are present.
- Access is poor because of the need to enter through Eldorado Canyon State Park. Sections of the road just before the community gate are too narrow for a large piece of fire apparatus.
- Addressing is generally good, but markers are attached to metal posts with nylon zip ties which would rapidly melt during a fire, rendering the signs useless.
- Manmade hazards such as outbuildings and overhead power lines exist in many places.

- Bridge load limits are not marked.
- Water supply is adequate via the creek and a small (500 gallon) cistern.
- Average distance to a fire station is 3.24 miles.
- Fuels are mixed.
 - Riparian fuels near the creek.
 - The south facing slopes are primarily open timber with grass understory; some shrubs also exist (FM 2).
 - The north facing slopes are comprised of mixed conifer (FM 9 & 10). Ladder fuels combined with dead and down fuels are present in moderate to heavy loads.
- Topography overall is steep and complex. Most homes sit in the valley bottom or on the southern aspects.
- The Kneale Road community is bordered by Eldorado Canyon State Park and Boulder Open Space.

Kneale Road Recommendations

- A parcel-level analysis is recommended.
- Extended defensible space is ***strongly advised*** for all homes in the Kneale Road community, because of its remoteness and high number of homes located in or near dangerous topography. Additionally, nearly all homes in this community have heavy fuel loads near or below them. For details on defensible space, please refer to the **Home Mitigation FMU** in the main report.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” located in the **Fuels Modification Projects FMU** section of the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- An improved turnaround should be constructed at the point where Kneale Road leaves South Boulder Creek.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Home Mitigation FMU** section in the main report.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- Ensure that all Open Space access points are known to all responding agencies.
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed if applicable.

2. Town of Eldorado Springs

FIGURE 5.



Hazard Rating:

Extreme

Does the neighborhood have dual access roads?

No

Are there road grades > 8%?

No

Are all access roads of adequate width?

No

Average lot size:

<1 acre

Fuel models found in the neighborhood:

2, 5, 8, 9, 10

Water supply:

Creek draft point and small cistern

Hazards:

Steep slopes, ravines, inadequate roads, natural chimneys, power lines, wood roofs

Description:

- Small to moderate sized homes on mostly small lots.
- Dominant construction is older wood siding with composite roofs; some wood shake roofs are present.
- Decks and other structural projections built over flammable vegetation.
- Poor and non-existent defensible space in some cases:
 - Flammable outbuildings are present.
 - Dangerous amounts of yard clutter.
- Access is poor in some areas due to narrow dead-end roads and/or driveways with loose dirt surfaces.
- Very poor addressing overall – markers are missing or are inconsistent in placement, and have low visibility.
- Manmade hazards such as outbuildings and overhead power lines exist in many places.

- Bridge load limits are not marked.
- Water supply is via a draft point near the creek on the west end of town that is marked with a small sign. There is also a small (1000 gallon) cistern under the pool parking lot on the west side of the main road.
- Average distance to a fire station is 1.73 miles.
 - Fire station is seasonally staffed. 0700-1900, 7 days a week, June 1 – Oct. 15.
- Fuels are mixed:
 - Riparian fuels in the area of the creek corridor.
 - The south facing side of town transitions into grass and shrubs (FM 2 & 5) with some scattered conifers.
 - On the north facing side fuels are a mixture of grass, shrubs and timber (FM 2, 9 & 10) and very thick in some areas. Ladder fuels combined with dead and down fuels are present in moderate to heavy loads.
- The community sits in a valley with steep slopes rising out.
 - The rocky soil could create a problem with rolling, burning material. However, an aqueduct running along the south side of town would help to stop rolling material at this point.
 - Other topographic features exist in this community.
- Eldorado Canyon State Park and Boulder Open Space completely encircle the town.

Town of Eldorado Springs Recommendations

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes, or on summits) that have heavy fuel loads near or below the home.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” located in the **Fuels Modification Projects FMU** section of the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Home Mitigation FMU** section in the main report.
- Where slopes rise steeply, consider creating barriers such as rock walls to protect areas from burning rolling material.
- Ensure that all road signs are made of non-combustible materials.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all Open Space access points are known to all responding agencies.
- Make certain all water sources are adequately signed.
- Post weight restrictions on bridges. Consult with Boulder County.

3. Pine Needle

FIGURE 6.



Hazard Rating:

Very High

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

No

Average lot size:

1-5 acres

Fuel models found in the neighborhood:

2, 9, 10

Water supply:

Cistern and private ponds

Hazards:

Steep slopes, ravines, inadequate roads, power lines, propane tanks, limited water supply, wood roofs

Description:

- Small to large homes on medium to large sized lots
- Mix of old and new construction.
- Dominant construction is wood siding with composite roofs; some steel, tile and wood shake roofs are present.
 - Decks and structural projections built over flammable vegetation exist.
- Defensible space generally appears to be adequate, but not all homes were accessible at the time of surveying, due to locked gates and private driveways.
- Dual access is possible, but the alternate route is a narrow (private?) road.
- Addressing needs to be improved. Road signage is acceptable.
- Manmade hazards such as outbuildings and overhead power lines exist in many places.

- Water supply is via a cistern located on the far west side of the community, south of the entrance to the Meyers Homestead trail head on Flagstaff Road. A ¼ acre pond exists at 1564 Bison Drive.
- Average distance to a fire station is 2.38 miles.
 - Fire station is voluntarily staffed.
- Fuels are primarily timber with grass understory (FM 2). Drainages and other areas have concentrations of heavier timber (FM 9 & 10).
 - Overall ladder fuels are moderately abundant.
- Topography is complex overall, and steep in places. Most of the community sits on mid and upper slopes.
- The Pine Needle neighborhood is bordered by Open Space lands on the south and east sides.

Pine Needle Recommendations

- A parcel-level analysis is recommended. If already completed, update as needed.
- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes, or on summits) that have heavy fuel loads near or below the home.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” located in the **Fuels Modification Projects FMU** section of the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Home Mitigation FMU** section in the main report.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs are made of non-combustible materials.
- Ensure that all Open Space access points are known to all responding agencies.
- Investigate the capabilities of the private pond. What steps would be necessary to make this an emergency water source?
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed where applicable.

4. Lakeshore Park

FIGURE 7.



Hazard Rating:

Very High

Does the neighborhood have dual access roads?

No

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

No

Average lot size:

1-5 Acres

Fuel models found in the neighborhood:

2, 9, 10

Water supply:

Cisterns

Hazards:

Poor addressing, ravines, inadequate roads, manmade hazards, wood roofs

Description:

- Small to medium sized homes on small to medium sized lots.
- Older construction is dominant with wood siding and composite roofs, but there are some wood shake roofs.
 - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
 - Dangerous yard clutter and flammable outbuildings exist.
- Access / egress is one-way and dirt. The western end has poor road conditions with long driveways.
- Addressing is generally poor. The markers that do exist are not consistent or reflective.
- Manmade hazards such as outbuildings and overhead power lines exist in many places.

- Water supply is via cistern. The primary source is located outside of the community to the east. Private cisterns exist within the community, but are not signed to their capability.
- Average distance to a fire station is 3.99 miles.
 - Fire station is voluntarily staffed.
- Fuels range from scattered timber with grass understory to heavy timber.
 - Minimal slash.
- Topography is mainly a broad east/west running ridge with some ravines present.
- The Lakeshore Park community is bordered on the south by Gross Reservoir.

Lakeshore Park Recommendations

- A parcel-level analysis is recommended. If already completed, update as needed.
- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes, or on summits) with heavy fuel loads near or below the home.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” located in the **Fuels Modification Projects FMU** section of the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Home Mitigation FMU** section in the main report.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed where applicable.
- The trailhead parking lot located at the far west end of the community should be signed indicating the importance of “being careful with fire”, “no open fires”, or similar wording.

5. Flagstaff Road

FIGURE 8.



Hazard Rating:

High

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

Yes

Average lot size:

1 – 5 acres

Fuel models found in the neighborhood:

2, 9, 10

Water supply:

Cistern & Lake

Hazards:

Propane tanks, overhead power lines, steep slopes, long narrow driveways

Description:

- Small to large sized homes on small to medium sized lots.
- Construction is mainly wood siding with composite roofs; there are some new homes built with ignition-resistant materials.
 - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
- Main access road is paved, but very steep in places. Most driveways are dirt, some are very long.
- Addressing is generally poor. The markers that do exist are not consistent, and most are not reflective.
- Manmade hazards such as outbuildings and overhead power lines exist in many places.
- Water supply is via a cistern located south of the entrance to the Meyers Homestead trail head on Flagstaff Road. A volume pump and hose is dedicated to Kossler Lake across from the fire station.

- Average distance to a fire station is .69 miles.
 - Fire station is voluntarily staffed and is within the community.
- Fuels are primarily timber with grass understory (FM 2). Some heavy timber / mixed conifer exists in the northern end of the community.
 - Moderate loads of ladder fuels exist in areas.
 - Minimal slash.
- Topography is mainly a broad south-to-north running ridge with some ravines present.
 - Most homes are situated mid and upper slope, south aspect.
- Boulder Open Space borders portions of the community, mainly the west side.

Flagstaff Road Recommendations

- A parcel-level analysis is recommended. If already completed, update as needed.
- Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes, or on summits) with heavy fuel loads near or below the home.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments. For details, please refer to the “Access Route Fuels Modification Recommendations,” located in the **Fuels Modification Projects FMU** section of the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Home Mitigation FMU** section in the main report.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all road signs and attachments are made of non-combustible materials.
- Ensure that all Open Space access points are known to all responding agencies.
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed where applicable.

6. Superior / Rock Creek

FIGURE 9.



Hazard Rating:

Moderate

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

No

Are all access roads of adequate width?

Yes

Average lot size:

< 1 acre

Fuel models found in the neighborhood:

1, 8

Water supply:

Hydrants

Hazards:

Open space

Description:

- This community has two distinct areas:
 - Rock Creek, which is a newer suburban type neighborhood. Small to medium sized homes on small lots.
 - The Town of Superior, which is an older community. Small homes on small lots.
- Construction is primarily wood siding with composite or tile roofs. Decks exist over urban type yards.
- Defensible space is mostly good, but some yard clutter exists.
- Access is via good paved roads and short driveways. Main roads are congested at times.
- Addressing is generally good, urban type.
- A good hydrant system services the area.
- Average distance to a fire station is .64 miles.
 - Fire station is career staffed and is within the community.

- The primary fuel is short grass. Patches of tall grass (FM 3) exist in certain areas.
- Topography is flat overall. Short, steep hills exist in some places.
- Open Space exists on the south and west borders.

Superior / Rock Creek Recommendations

- Adequate defensible space is recommended for all homes, especially those located on the perimeter. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- Discourage the use of combustible materials for decks, siding, and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** section in the main report.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that Open Space access points are known to all responding agencies.
- Ensure that greenbelts remain irrigated.

7. Eldorado Springs Valley

FIGURE 10.



Hazard Rating:

Moderate

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

No

Are all access roads of adequate width?

No

Average lot size:

1 - 5 acres

Fuel models found in the neighborhood:

1, 3, 8

Water supply:

Cistern & creek

Hazards:

Narrow access roads, some wood roofs

Description:

- Small to large homes on medium sized lots.
- Homes are a mix of new and old construction.
 - Wood siding with composite roofs, some wooden roofs.
 - Numerous out buildings.
- Defensible space is generally poor.
 - Flammable ornamental vegetation is too close to structures.
 - Significant yard clutter in some places.
- Most access roads are paved, but narrow. Long driveways exist.
- Addressing is present for most residences, but not reflective.
- Overhead power lines exist in many places.
- Water supply is from the creek (identified draft points) and a medium sized (10,000 gallon) cistern.

- Average distance to a fire station is .47 miles.
 - Fire station is seasonally staffed. 0700-1900, 7 days a week, June 1 – Oct. 15.
- Fuels are mostly short grass with isolated areas of tall grass (FM 3). A riparian corridor runs from west to east.
- Topography is mostly flat.
- Boulder Open Space borders the subdivision on most sides.

Eldorado Springs Valley Recommendations

- Adequate defensible space is recommended for all homes, especially those located on the perimeter. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- Discourage the use of combustible materials for decks, siding, and roofs. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** section in the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all Open Space access points are known to all responding agencies.
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed where applicable.

8. Town of Marshall

FIGURE 11.



Hazard Rating:

Moderate

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

No

Are all access roads of adequate width?

Yes

Average lot size:

1-5 acres

Fuel models found in the neighborhood:

1, 5, 8

Water supply:

Pressurized cistern & limited flow hydrant

Hazards:

Power line, wood roofs

Description:

- Small to moderate homes on small to medium sized lots.
- Homes are a mix of new and old construction.
 - Wood siding with composite roofs. A few wood roofs.
 - Lit industrial buildings exist in some places.
 - Numerous outbuildings.
- Defensible space is generally good. However:
 - Flammable ornamental vegetation is too close to structures in many places.
 - Significant yard clutter in some places.
- Most access roads are paved. Long driveways exist in some places.
- Addressing is present for most residences, but is not reflective.
- Overhead power lines exist in many places.

- Water supply is from a pressurized cistern (10,000 gallon) located east of the Hwy 170 and Hwy 93 intersection. A single hydrant is located at the 170 / Marshall Road intersection, but it is creek-fed, therefore limiting its flow during certain times of the year.
- Average distance to a fire station is 1.81 miles.
 - Fire station is seasonally staffed. 0700-1900, 7 days a week, June 1 – Oct. 15.
- Fuels are mostly short grass with isolated areas of tall grass (FM 3). A riparian corridor runs from west to east. Sizeable areas of brush also exist in some places.
- Topography is mostly flat.
- The Town of Marshall is bordered on most sides by Boulder Open Space.

Town of Marshall Recommendations

- Adequate defensible space is recommended for all homes, especially those located on the perimeter. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- Discourage the use of combustible materials for decks, siding, and roofs. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers, and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings; especially within 30 feet of homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** section in the main report.
- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing made of non-combustible materials to all driveways and homes.
- Ensure that all Open Space access points are known to all responding agencies.
- Make certain all water sources are adequately signed.
- A large-animal evacuation plan should be developed where applicable.

ROCKY MOUNTAIN FIRE CWPP

APPENDIX C

STRUCTURAL TRIAGE AND PREPARATION

Size Up Considerations

- What is the current and expected weather?
- Are fuels heavy, moderate, or light? What is the arrangement and continuity of fuels?
- Note any hazardous topography.
- What have fires in this area done before?
- What is the fire's current and expected behavior?
 - What is the rate and direction of spread?
 - What is the potential for spotting and firebrands?
 - Will topographical features or expected weather changes affect the rate of spread?
- What are the number and density of structures threatened?
- What are the available resources?
- Will you have to evacuate people or animals?
 - Are there residents who will not evacuate?
- How hazardous is the structure?
 - What is the roofing material?
 - Are the gutters full of litter?
 - Are there open eaves and unscreened vents?
 - Does the structure have wooden decking?
 - Is there defensible space?
 - Are there large windows with flammable drapes or curtains?
 - What is the size and location of propane tanks and/or fuel storage tanks?

Fire Fighter Safety

- What are the routes of egress and ingress?
 - What is the largest engine that can access the structure safely?
 - Are the roads two-way or one-way?
 - Are there road grades steeper than 8%?
 - Are the road surfaces all-weather?
 - Are there load-limited bridges?
- Are there anchor points for line construction?
- Are there adequate safety zones?
- What are the escape routes?
- Are there special hazards such as hazardous materials, explosives, high-voltage lines, or above ground fuel tanks?
- Are communications adequate?

Structural Triage Categories

Sort structures into one of three categories:

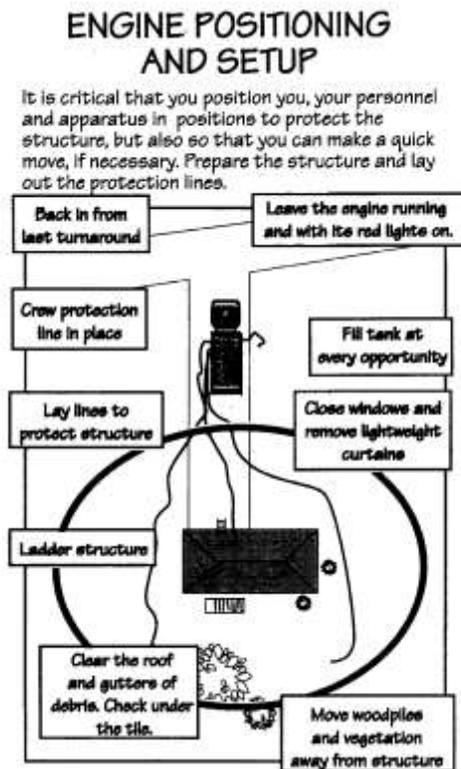
1. Stand Alone or Not Threatened
2. Defendable
3. Not Defendable.

- Factors that may make an attempt to save a structure too dangerous or hopeless:
 - The fire is making sustained runs in live fuels and there is little or no defensible space
 - Spot fires are too numerous to control with existing resources
 - Water supply will be exhausted before the threat has passed
 - The roof is more than ¼ involved in flames
 - There is fire inside the structure
 - Rapid egress from the area is dangerous or may be delayed

Apparatus Placement Considerations

Common Ignition Points

- Flammable roof coverings and debris
- Unscreened vents, windows, or holes
- Open doors, windows, or crawl spaces
- Wooden decks, lawn furniture, stacked wood, and trash piles
- In windy conditions, firebrands can enter almost any opening
- Openings under porches or patio covers



1

ROCKY MOUNTAIN FIRE CWPP

APPENDIX D

Access and Water Supply Guidelines

Introduction

This appendix has been designed with public education in mind. It should be used to help familiarize homeowners, contractors, and developers with the general principles of the access and water supply needs of firefighters. The recommendations in this section are based on proven practices. However, they are not intended to be a substitute for locally adopted codes.

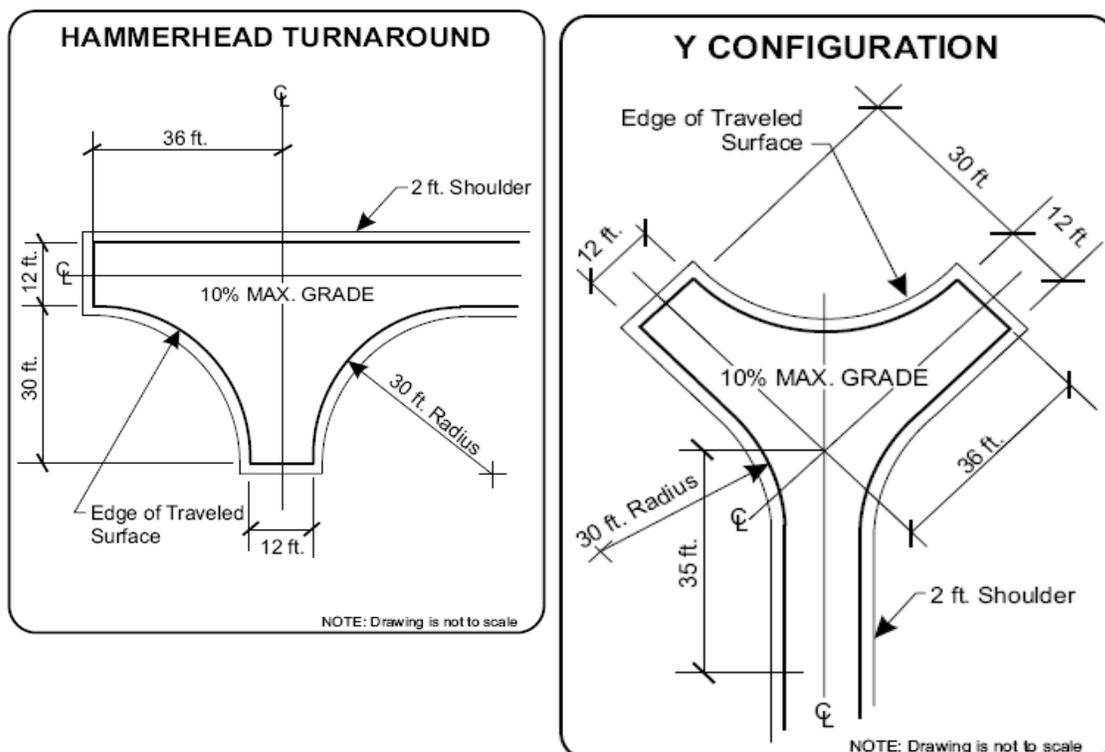
Access Guidelines

Driveway Turnarounds

Turnarounds that are unobstructed by parked vehicles are designed to allow for the safe reversal of direction by emergency equipment. The “Y” and “Hammerhead” turnarounds shown below are preferred because they provide the necessary access, while minimizing disturbance to the site. Turnarounds should be located at the end of every driveway.

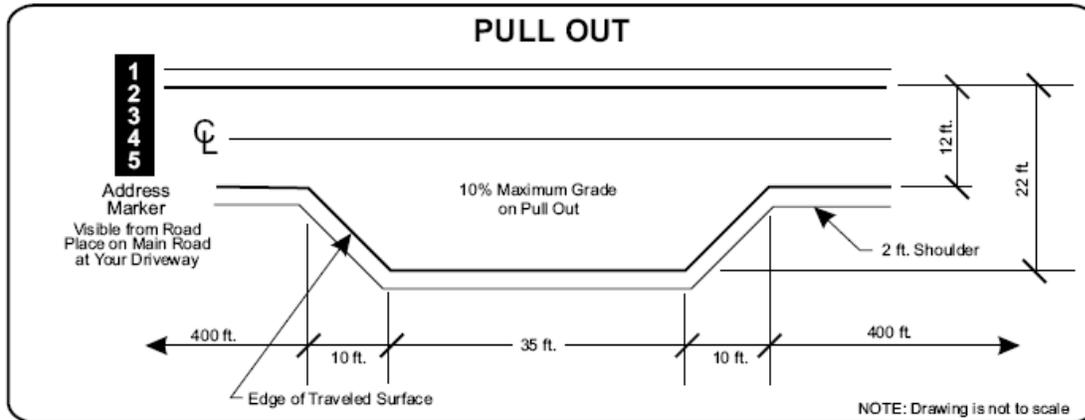
Driveway Width and Height

Driveways should have an unobstructed vertical clearance of 13' 6". Trees may need to be limbed, and utility lines relocated to provide the necessary clearance. Driveways should have a 12' wide drivable surface and 14' of horizontal clearance.



Driveway Pullouts

Driveway pullouts are designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400' intervals along driveways and private access roads (community driveways). The location of pullouts may be modified slightly to accommodate physical barriers such as rock outcroppings, wetlands, and other natural or manmade features.



Bridge Load Limits

Bridge load limits should be posted with a permanently mounted, reflective marker at both entrances to the bridge. Care should be taken to ensure that these markers will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location of the markings and the markings themselves be adequate for easy night-time viewing.

Alternative Water Sources

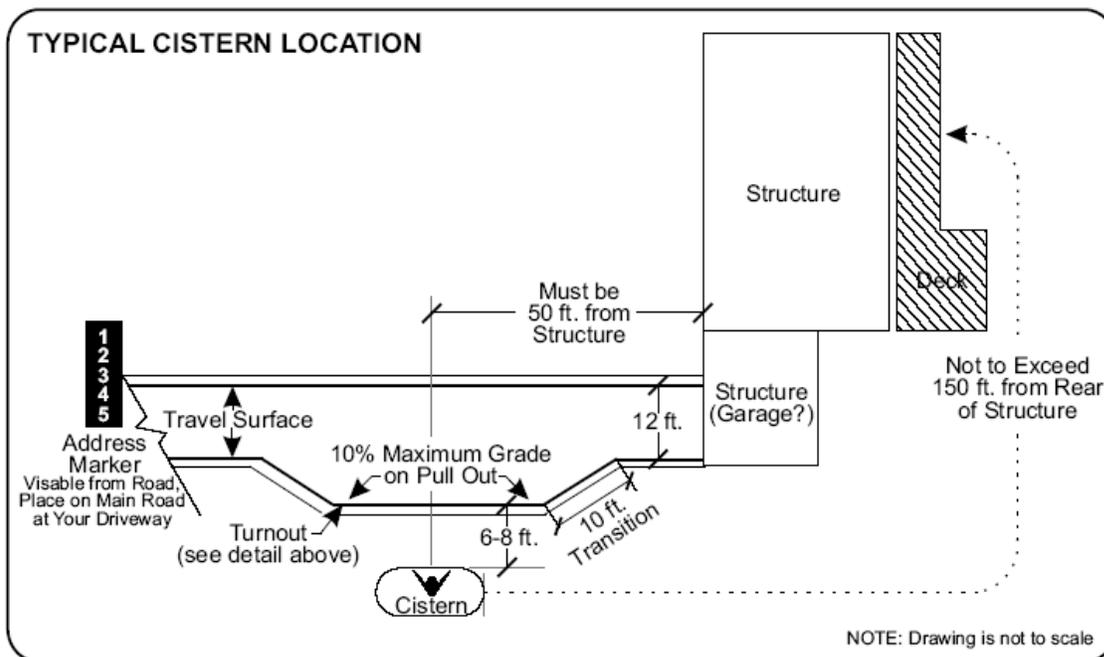
In portions of the study area, like many of the rural and mountainous areas of Colorado, water is a critical fire suppression issue. Although Rocky Mountain Fire (RMF) has a good network of pressurized hydrants in the majority of the plains subdivisions, the hazard assessment revealed several communities in the study area which are a considerable distance from reliable water sources for fire suppression. The following information on the use of cisterns and dry hydrant installations has been included to provide information about supplementing the existing system of pressurized hydrants. It is not intended to be a substitute for the existing hydrants. For more detailed recommendations regarding enhancement of the existing water supply system, please see the **Water Supply** section of the main report (page 45).

Cisterns

Once emergency vehicles have arrived on site, they will need a dependable supply of water to help control the fire. Although residential wells with outdoor taps can be used by fire crews to help fill engine tanks, they are not adequate for fire control. If the property is a significant distance from a reliable water supply or fire station, it may be advisable to employ one of the following water supply options:

- An on-site 1,800 to 2,500 gallon cistern for each residence
- A monetary contribution to a large community cistern fund

For more information about local standards and regulations, please contact RMF.



Dry Hydrants

Dry hydrant installations allow much faster and more reliable access to ponds and tanks than conventional drafting. Specific recommendations for dry hydrant locations may be found in the **Water Supply** section of the main report (page 45). Guidelines for the construction and maintenance of dry hydrants may be found in the **Dry Hydrant Manual** included as a supplement to this report.

It is always helpful to discuss any potential construction project with the fire department. RMF officials can help determine what kind of access and water supply options will work best for your site. While the guidelines in this appendix have been assembled by querying firefighters with extensive Wildland-Urban Interface firefighting and fire code experience, RMF is in the best position to offer site-specific information.

Appendix E

Rocky Mountain Fire Collaborative Effort

The Need for a CWPP

In response to the Healthy Forest Restoration Act (HFRA), and in an effort to create incentives, Congress directed interface communities to prepare a Community Wildfire Protection Plan (CWPP). Once completed, a CWPP provides statutory incentives for the US Forest Service (USFS) to consider the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. In the case of the Rocky Mountain Fire (RMF), the need for a community-based hazard and risk assessment (HRA) was born from an internal need, not a federal directive.

CWPPs can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, structure protection, or all of the above.

The minimum requirements for a CWPP are:

- Collaboration between local and state government representatives, in consultation with federal agencies and other interested parties.
- Prioritized fuel reduction in identified areas, as well as recommendations for the type and methods of treatments
- Recommendations and treatment measures for homeowners and communities to reduce the ignitability of those structures in the project area.

Project Funding and Coordination

Rocky Mountain Fire used internal budgets to complete a district-wide hazard and risk assessment and the resultant CWPP.

Future community education and private landowner assistance will be coordinated through the RMF. RMF will continue to be instrumental in public education related to wildfire hazard reduction. The fire district will continue to identify funding for the implementation of mitigation projects. A RMF representative will coordinate all community-wide mitigation projects. Homeowner cooperation and permission for projects on private land is more likely if there is a fire district representative overseeing the details in partnership with CSFS and City/County representatives. This collaborative management structure allows for more effective implementation of cross-boundary projects.

Inter-Agency Collaboration

Roles and Responsibilities

To be successful, wildfire mitigation in the interface must be a community-based, collaborative effort. Stakeholders and, primarily, the RMF, will have the greatest responsibility for implementing the recommended mitigation projects. The CSFS and the City and County of Boulder will also be valuable participants in addressing cross-boundary projects throughout the district. Nearly all of the recommendations from this report affect private land or access roads to private land. As such, implementation of the recommendations will be largely dependent on the participation of landowners. Rocky Mountain Fire is committed to encouraging the participation of as many interested landowners as possible. There are also mitigation recommendations for individual structures which are the responsibility of the homeowner. Homeowners will, however, need a point of contact, most likely a member of the RMF, to help them implement these recommendations. The best defensible space will be created with oversight and expert advice from the fire district and or government forestry personnel. One-on-one dialog will continue to build the relationship with community members. This level of involvement will allow agencies to keep track of the progress and update this plan to reflect the latest modifications at the community level. The RMF web site is <http://www.rockymountainfire.org>. This site has information for citizens, as well as a way to contact the district for more information or input regarding current and planned mitigation actions.

The Collaborative Process

“The initial step in developing a CWPP should be the formation of an operating group with representation from local government, local fire authorities, and the state agency responsible for forest management ... Once convened; members of the core team should engage local representatives ... to begin sharing perspectives, priorities, and other information relevant to the planning process.”¹³

Nine federal, state, local, and private agencies (stakeholders) participated in the Rocky Mountain Fire CWPP stakeholder meeting. These stakeholders are:

- Rocky Mountain Fire District
- US Forest Service
- Colorado State Forest Service
- Anchor Point Group
- City of Boulder
- Town of Superior
- US Fish and Wildlife Service
- National Renewable Energy Laboratory
- Sugarloaf Fire Protection District
- Boulder Rural Fire Protection District

The true collaborative process was initiated thru a stakeholder meeting held within Boulder County. The purpose of the meetings was to bring all past, current, and future efforts and needs to the table. The primary focus was on the identification and delineation of communities, areas of concern, and values at risk. Best practices and anticipated “roadblocks” were identified. Within the Rocky Mountain Fire ten communities were delineated and analyzed for hazard and risk.

Three meetings were held, two RMF fire board meetings and a public meeting located at Fairview High School. The purpose of these meetings was to discuss the purpose and intent of the CWPP and to begin the process of prioritizing future actions based on the recommendations in the CWPP. Options for homeowners and land managers to reduce structural ignitability and protect values in their communities were presented in the public meeting as well as landscape scale and cross-boundary mitigation project recommendations.

In the two years since the CWPP was published in draft format, RMF staff have been meeting with landowners on a one-on-one basis to discuss site-specific mitigation opportunities. Over 80 homeowners, who reside within the identified “extreme” and “very high hazard areas,” have been contacted and many small-scale, parcel-level projects have been implemented. Larger, landscape-scale projects have been contemplated but are dependent on outside sources of revenue (e.g., grants).

Funding CWPP Recommendations

There are many sources of funds available for implementing the recommendations within the CWPP. Some available grants and websites where more information can be found are provided below.

- Agency: Homeland Security, Office for Domestic Preparedness
 - Purpose: to assist local, state, regional, or national organizations in addressing fire prevention and safety. The emphasis for these grants is the prevention of fire-related injuries to children.
 - More information: <http://www.firegrantsupport.com/>

- Agency: Federal Emergency Management Agency (FEMA)
 - Purpose: to improve firefighting operations, purchase firefighting vehicles, equipment, and personal protective equipment, fund fire prevention programs, and establish wellness and fitness programs.
 - More information: <http://usfa.fema.gov/dhtml/inside-usfa/grants.cfm>

- Agency: National Volunteer Fire Council
 - Purpose: to support volunteer fire departments
 - More information: <http://www.nvfc.org/federal/funding.html>

- Agency: Community Facilities Grant Program
 - Purpose: to help rural communities. Funding is provided for fire stations
 - More information: www.rurdev.usda.gov/rhs/

- Agency: Firehouse.com
 - Purpose: emergency services grants
 - More information: www.firehouse.com/funding/grants.html

- Agency: Cooperative Forestry Assistance
 - Purpose: to assist in the advancement of forest resources management, the control of insects and diseases affecting trees and forests, the improvement and

maintenance of fish and wildlife habitat, and the planning and conduct of urban and community forestry programs

- More information: www.usfa.fema.gov/dhtml/inside-usfa/cfda10664.html
- Agency: Forest Service, Economic Action Programs
 - Purpose: Economic Action Programs that work with local communities to identify, develop, and expand economic opportunities related to traditionally underutilized wood products and to expand the utilization of wood removed through hazardous fuel reduction treatments.
 - More information: www.fireplan.gov/community_assist.cfm
- Agency: FEMA
 - Purpose: Assistance to Firefighters Grant Program
 - More information: www.usfa.fema.gov/dhtml/inside-usfa/apply.cfm and www.nvfc.org/federalfunding.html