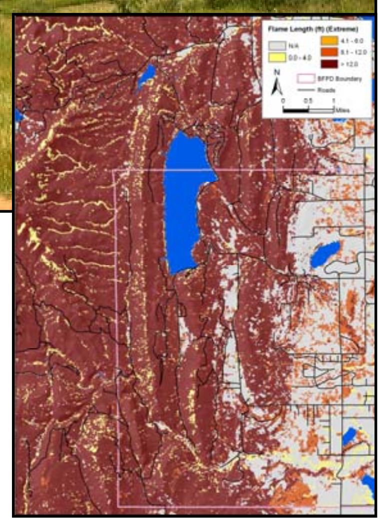
BERTHOUD FIRE PROTECTION DISTRICT

WILDLAND URBAN INTERFACE

COMMUNITY WILDFIRE PROTECTION PLAN



Prepared for:
Berthoud Fire Protection District
Berthoud, Colorado
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September 2007

ANCHOR POINT
FIRE MANAGEMENT

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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 Berthoud Fire Protection District (BFPD), Berthoud, CO. 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. For this reason, detailed findings and methodologies are included in their entirety in 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 BFPD wildfire hazard and risk assessment.

The BFPD 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, BFPD 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.

The CWPP meets the requirements of HFRA by:

1. **Identifying and prioritizing fuels reduction opportunities across the landscape**
   See section *Fuels Modification FMU* on pages 38-42 of this document.

2. **Addressing structural ignitability**
   See pages 31-37 and Appendix B

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 entitled "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) – "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. But 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 NFP is reflected in the Berthoud Fire Protection District's 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 BFPD.

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 9-11 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 (FMU) 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 BFPD 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, BFPD CWPP Collaborative Effort**.

TABLE 1. CWPP Development Team

Name	Organization	Roles / Responsibilities
Steve Charles, Chief	Berthoud Fire Protection District	Local information and expertise, including community risk and value assessment, development of community protection priorities, and establishment of fuels treatment project areas and methods.
Boyd Lebeda, District Forester	Colorado State Forest Service	Facilitation of planning process and approval of CWPP minimum standards.
Chris White, Managing Partner Mark McLean, GIS 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

The Berthoud Fire Protection District (BFPD) is located in Larimer County, Colorado. BFPD covers an area of 99 square miles, and has approximately 17,000 residents. The District is bordered by other agencies that provide suppression capabilities. including the Larimer County Emergency Services Unit, Loveland Fire Rescue, Johnstown Fire Protection District, Mountain View Fire Protection District, Hygiene Fire Protection District, and Lyons Fire Protection District.

FIGURE 1. Typical Area

For the purposes of this report, communities have been assessed for the hazards and risks that occur inside the district boundaries. Geographical Information System (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 the Berthoud Fire Protection District.

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.

Figure 2 and **Table 2** show the communities that define the WUI study area. For the purposes of this project, the most populated areas were divided into 10 communities. Each community represents certain dominant hazards from a wildfire perspective. The overall hazard ranking of these communities is determined by considering the following variables: fuels, topography, structural flammability, availability of water for fire suppression, egress and navigational difficulties, as well as other hazards, both natural and manmade. The methodology for this assessment uses the WHR community hazard rating system developed specifically to evaluate communities within the WUI for their relative wildfire hazard.[2] 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. For more information on the WHR methodology please see **Appendix B**.

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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).

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

FIGURE 2. Berthoud FPD Community Hazard Rating Map

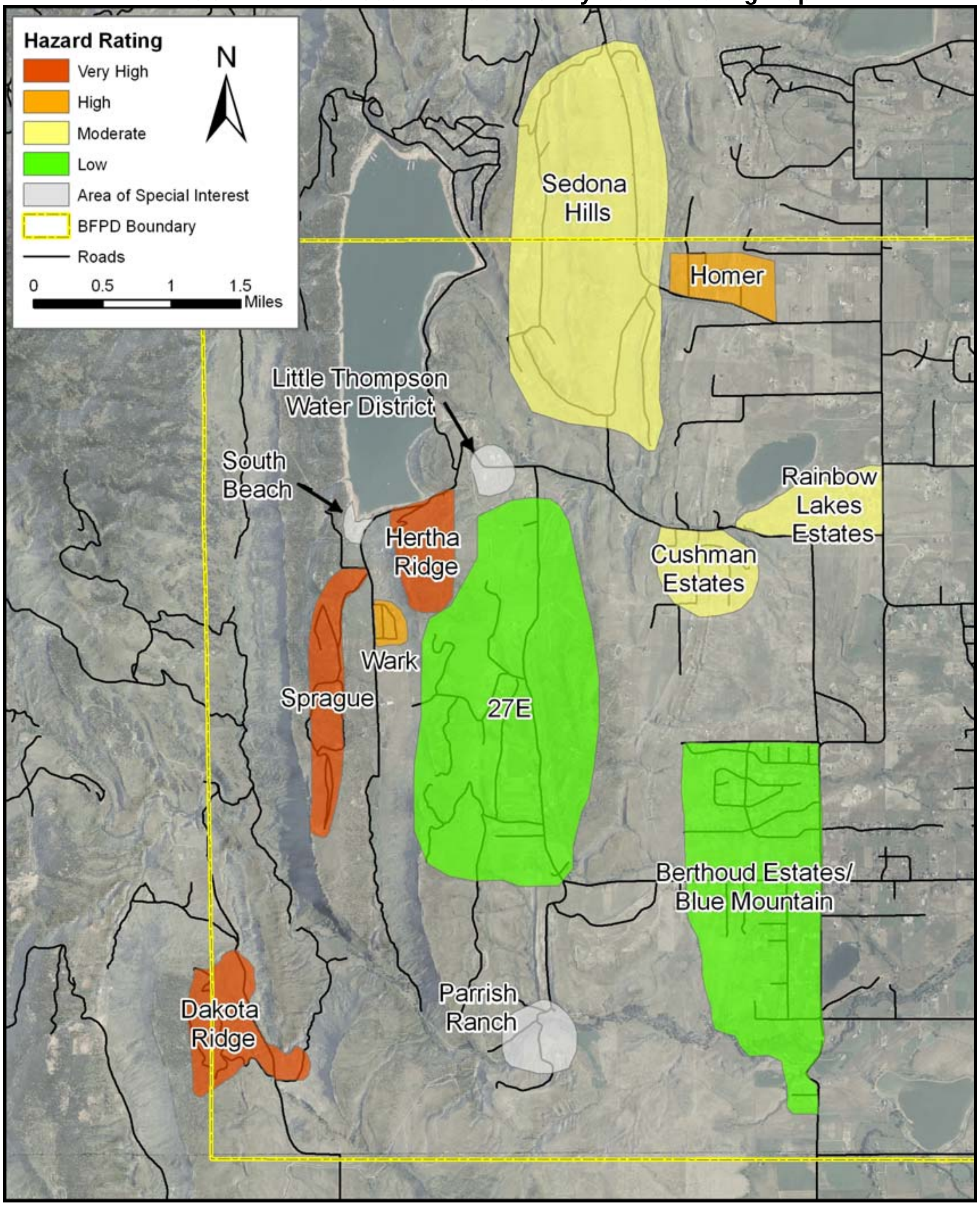


TABLE 2. Study Area Communities

1. Sprague	**6. Homer**
2. Dakota Ridge	**7. Cushman Estates**
3. Hertha Ridge	**8. Sedona Hills**
4. Wark	**9. Rainbow Lake Estates**
5. 27E	**10. Berthoud Estates / Blue Mountain**

For reference to the rest of this document, **Figure 3** and **Figure 4** show the general topography of the area. These graphic representations of the landforms of the study area (elevation and slope) will be helpful in interpreting other map products in this report.

FIGURE 3. Berthoud FPD Slopes

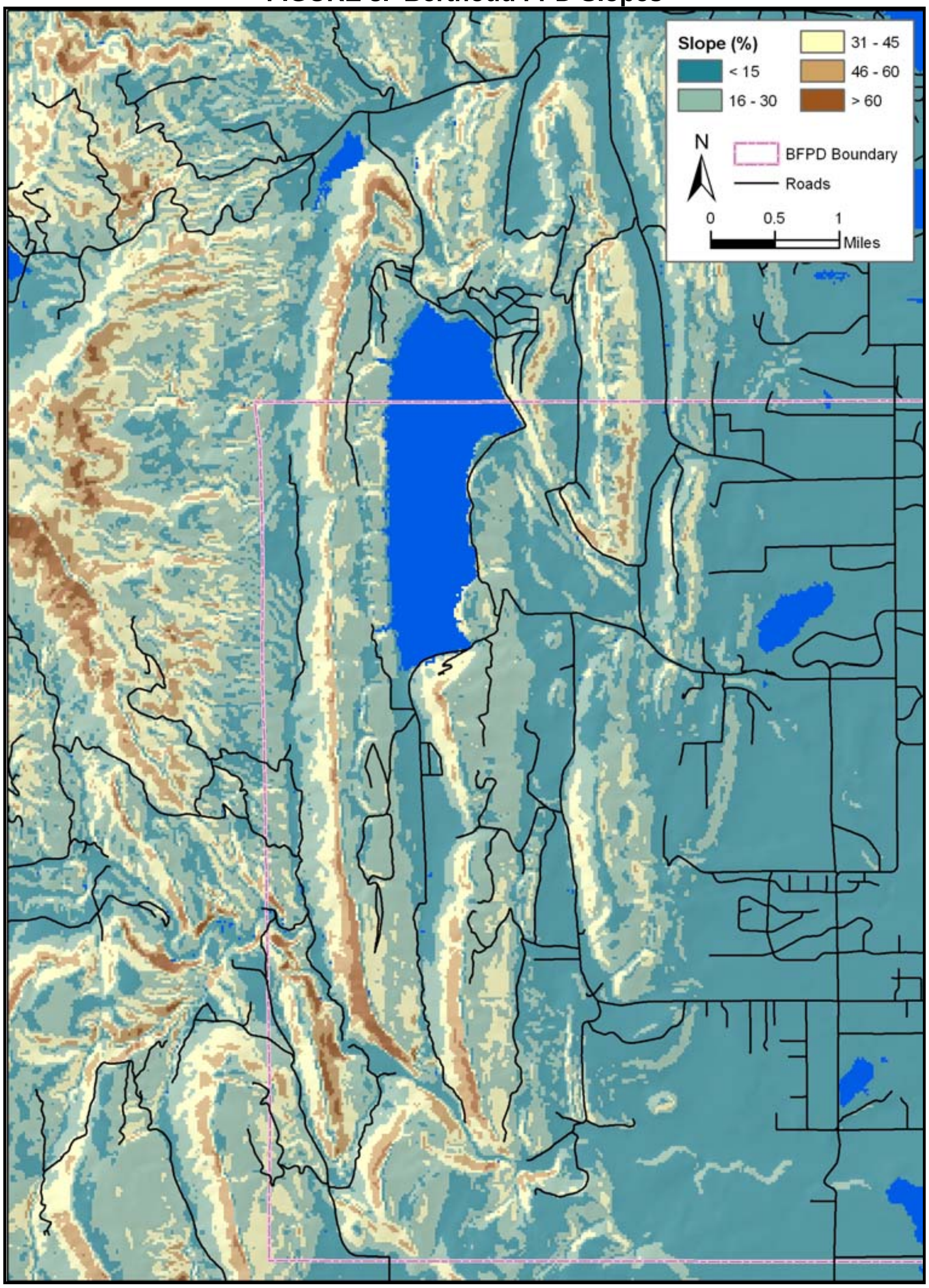
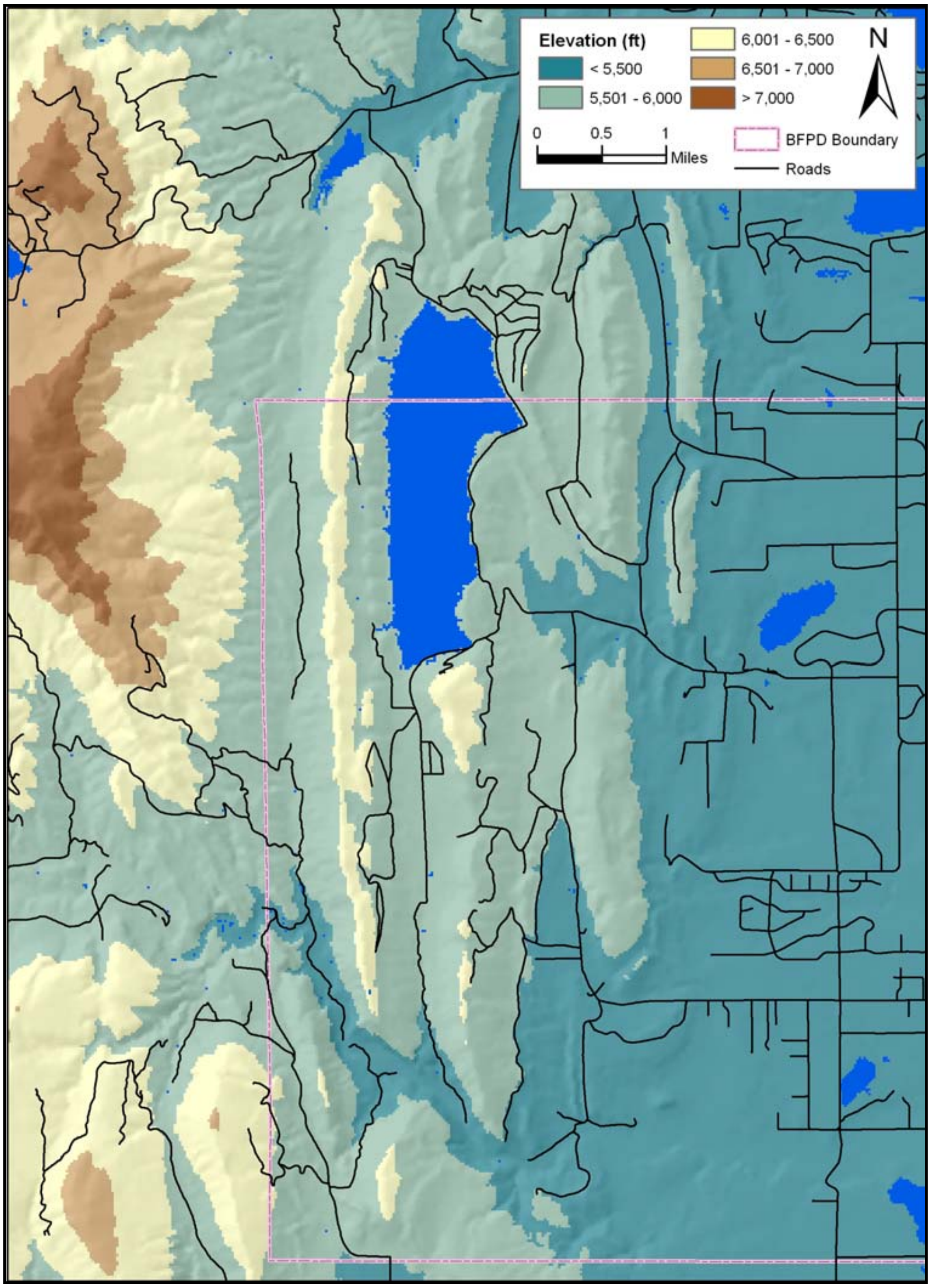


FIGURE 4. Berthoud FPD Elevations



VALUES AT RISK

Life Safety and Homes

Protection and promotion of the public's health, safety and welfare

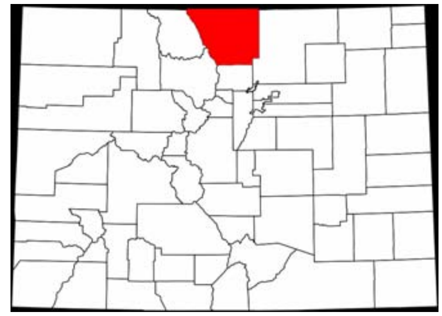
The Berthoud Fire Protection District CWPP provides guidance to promote the health, safety and welfare of the community. Through the fire planning process the safety and welfare of the community is evaluated and recommendations to mitigate risks are suggested.

There are approximately 17,000 citizens residing within the BFPD. The District is approximately 99 square miles with 46 miles encompassing the WUI study area. This area includes a ½ mile buffer beyond the District boundaries in the interface zone. The interface areas of the District were divided into 10 communities. Five of the 10 communities 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 three of the ten communities in the study area to be very high hazard areas. Under extreme burning conditions, there is a likelihood of rapid increases 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 Larimer County is vulnerable to some form of natural disturbance. Recent national disaster events have focused increased attention at the local, state and national government levels on the need to mitigate such events where possible and to prepare to cope with them when unavoidable.

Larimer County recognizes the WUI 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 strives towards balancing the natural processes of the ecosystem with development concerns so that residents may co-exist in a fire-dependent ecosystem. The county's "Code of the West" by John Clarke, former Larimer County Commissioner, captures the Larimer County ethic as it relates to living in the Wildland urban interface.

"The physical characteristics of your property can be positive and negative. Trees are a wonderful environmental amenity, but can also involve your home in a forest fire. Building at the top of a forested draw should be considered as dangerous as building in a flash flood area. Defensible perimeters are very helpful in protecting buildings from forest fire and inversely can protect the forest from igniting if your house catches on fire. If you start a forest fire, you are responsible for paying for the cost of extinguishing that fire."



Larimer County is the seventh most populous and the ninth most extensive of the 64 counties of Colorado. The County is located at the northern end of the Front Range at the edge of the Colorado eastern plains along the border with Wyoming. The United States Census estimates that the county population was 276,253 in 2006, a 9.84% increase since 2000.

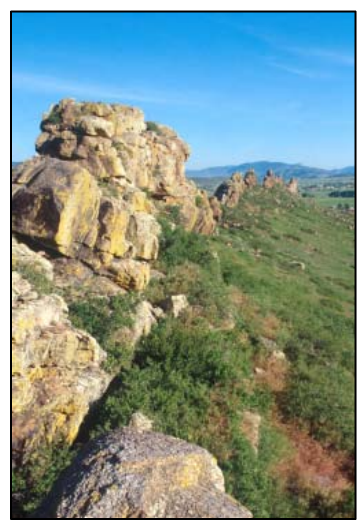
Commerce and Infrastructure

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

Recreation and Lifestyle

The Town Vision Statement, which was adopted in May of 1994 and included in the 2007 Comprehensive Plan states:

"Berthoud, Garden Spot of Colorado. A small progressive community which endeavors to provide the quality of life enjoyed by past and present generations while ensuring its position for the future within the dynamic Front Range economic corridor. A town that works together to control its own destiny by being proactive in planning for future growth while preserving and enhancing its rural character. Several core values have long been a part of the Berthoud lifestyle."



These core values include:

- Proximity to recreation and Open Space
- Water and Economic sustainability
- Landscape Views
- Appropriate development management
- The protection of private property rights
- The creation and retention of economic value
- Proximity to and management of Wildlife

Carter Lake provides numerous recreational opportunities including fishing, sailing, camping, swimming, scuba diving, rock climbing, and water skiing. The lake is open year-round and is very popular during the summer months and on weekends.

Habitat Effectiveness & Environmental Resources

Residents are in agreement that the preservation of wildlife and the environment is important to the quality of life in 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). It is felt that habitat effectiveness should not fall below 50%, and the best wildlife habitats have a much higher percentage. Wildfire, specifically severe wildfire, can have significant adverse effects on habitat effectiveness.

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, linkages in the overall county wildlife system, and aids for smog control.

The goals of the Larimer County Open Lands Master Plan are to maintain and monitor the forests on open space in ways that benefit the ecosystem and the public. The following are all crucial components of this goal:

- Provide diverse opportunities for water-based recreation
- Protect open space within the county
- Coordinate the development of a regional trail system
- Provide a safe, high quality experience for all users of county parks and facilities
- Provide adequate funding and make the most of available resources.

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

Current Risk Situation

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 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 WUI fires. This assessment is based on the analysis of the following factors:

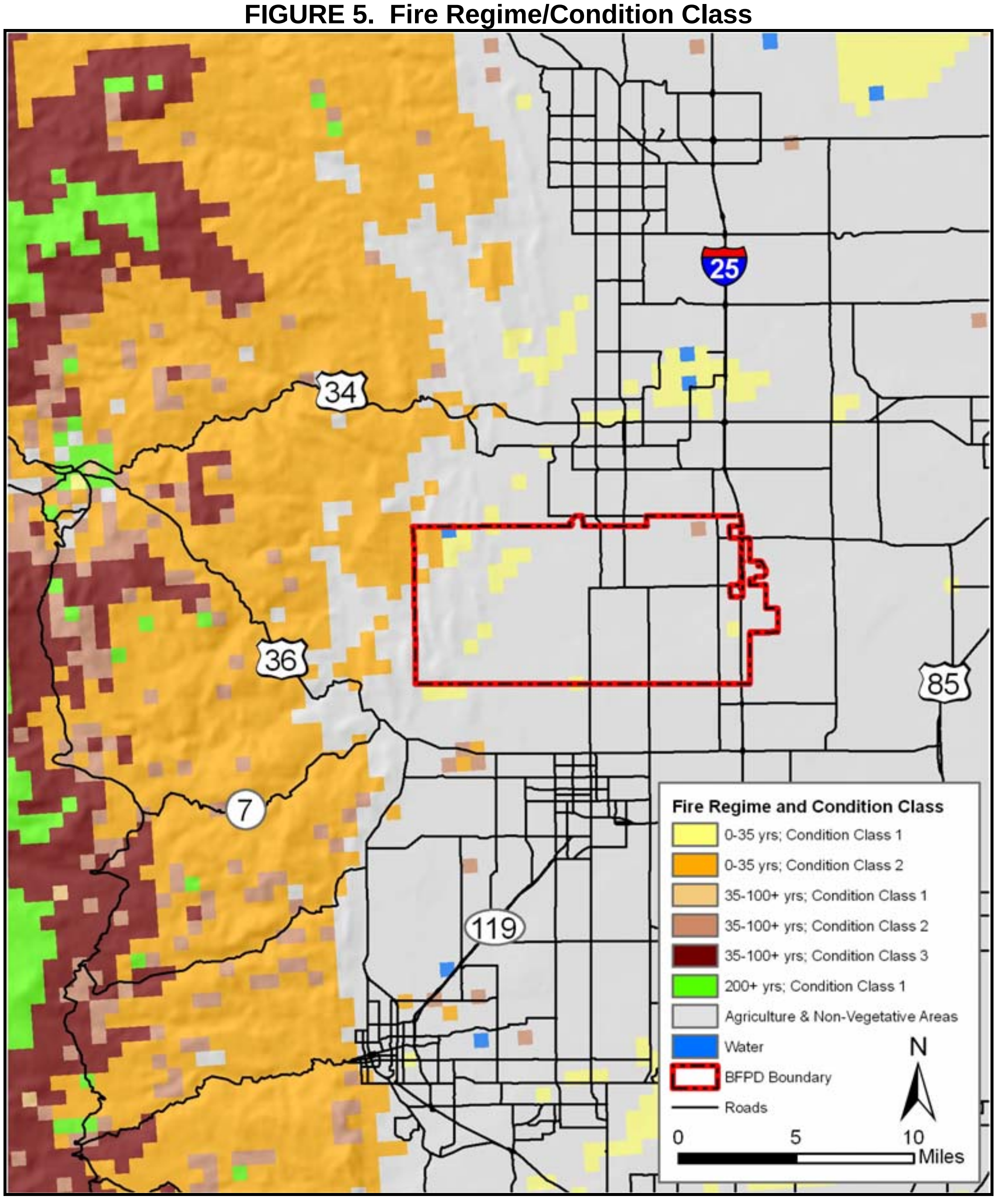
1. The area is shown in the Colorado State Forest Service WUI Hazard Assessment map to be an area of high Hazard Value (an aggregate of Hazard, Risk and Values Layers).
2. The Berthoud Fire Protection District responds to an average of 30 wildland incidents annually. It is important to note that in an average year the amount of acres burned is fairly low, except when wind driven fire conditions exist; these small acreage fires then have the potential to become quite large, as noted below.
3. At least six major fires (fires greater than 100 acres) have burned in the district since 2000. The largest was the Carter Lake Fire (2001) which burned over 1200 acres. Major fires have occurred near the District both in Larimer and Boulder counties, including the Bobcat Fire (2000), the Overland Fire (2003), and a number of large (100 acres +) grass fires in the winter of 2006. It is important to note there are over 34 fire departments in Larimer and Boulder Counties, and many mutual aid agreements are in place. The Larimer and Boulder areas have a large number of well-trained resources. Ignitions in this area attract a rapid, professional response and are generally extinguished quickly.
4. Fire history statistics from the Colorado State Forest Service (CSFS) and their 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 Larimer County for the four-year period.
5. 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.

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 1 square kilometer. FRCC is not to be confused with BEHAVE and 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 of the departure of the current condition from the historical fire regime. It is used as a proxy for the probability of severe fire effects (e.g., the loss of key ecosystem components - soil, vegetation structure, species, or alteration of key ecosystem processes - 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 7** displays graphically the return interval and condition class of the study area.

FIGURE 5. Fire Regime/Condition Class



Deriving FRCC entails comparing current conditions to some 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 for probable 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 portions of the BFPD. It should be noted that a key ecosystem component can represent virtually any attribute of an ecosystem (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 3. Condition Class Descriptions[3]

Condition Class	***Condition Class Description***
1	Fire regimes are within their historical range and 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 have areas classified under Condition Class 1 and 2. By definition class 2 has had historic fire regimes that have been moderately altered. Consequently, wildfires are likely to be larger, more severe, and have altered burn patterns, as compared with those expected under historic fire regimes.

3 Fire Regime Condition Class, website, http://www.frcc.gov/, July 2005.

Fire Behavior Potential

As a part of the wildfire hazard analysis carried out for this study, the fire behavior potential of the study area was modeled (see **Appendix A**). This model can be combined with the community wildfire hazard ratings (WHR), structure density and Values at Risk information to generate current and future "areas of concern." **Figures 8-10** shows the fire behavior potential for the analysis area, given the average weather conditions existing between May 1 and October 31. Weather observations from the Redstone Remote Automated Weather Station (RAWS) were averaged for a six-year period (2001-2006) to calculate these conditions.

Figures 11-13 show the fire behavior potential for the analysis area, given ninety-seventh percentile weather data. In other words, the weather conditions existing on the five most severe fire weather days in each season for the thirty-year period were averaged together to provide the weather data for this calculation. It is a reasonable assumption that similar conditions may exist for at least five days of the fire season during an average year. In fact, during extreme years such as 2000 and 2002, such conditions may exist for significantly longer periods.

Weather conditions are extremely variable and not all combinations are accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical operations. This model can be combined with the WHR and Values at Risk information to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. It is recommended that when this information is used for tactical operations, fire behavior calculations be done with actual weather observations during the fire event. For greatest accuracy, the most current Energy Release Component (ERC) values should be calculated and distributed during the fire season to be used as a guideline for fire behavior potential. For a more complete discussion of the fire behavior potential methodology, please see **Appendix A**.

FIGURE 6. Flame Length, Moderate Weather Conditions

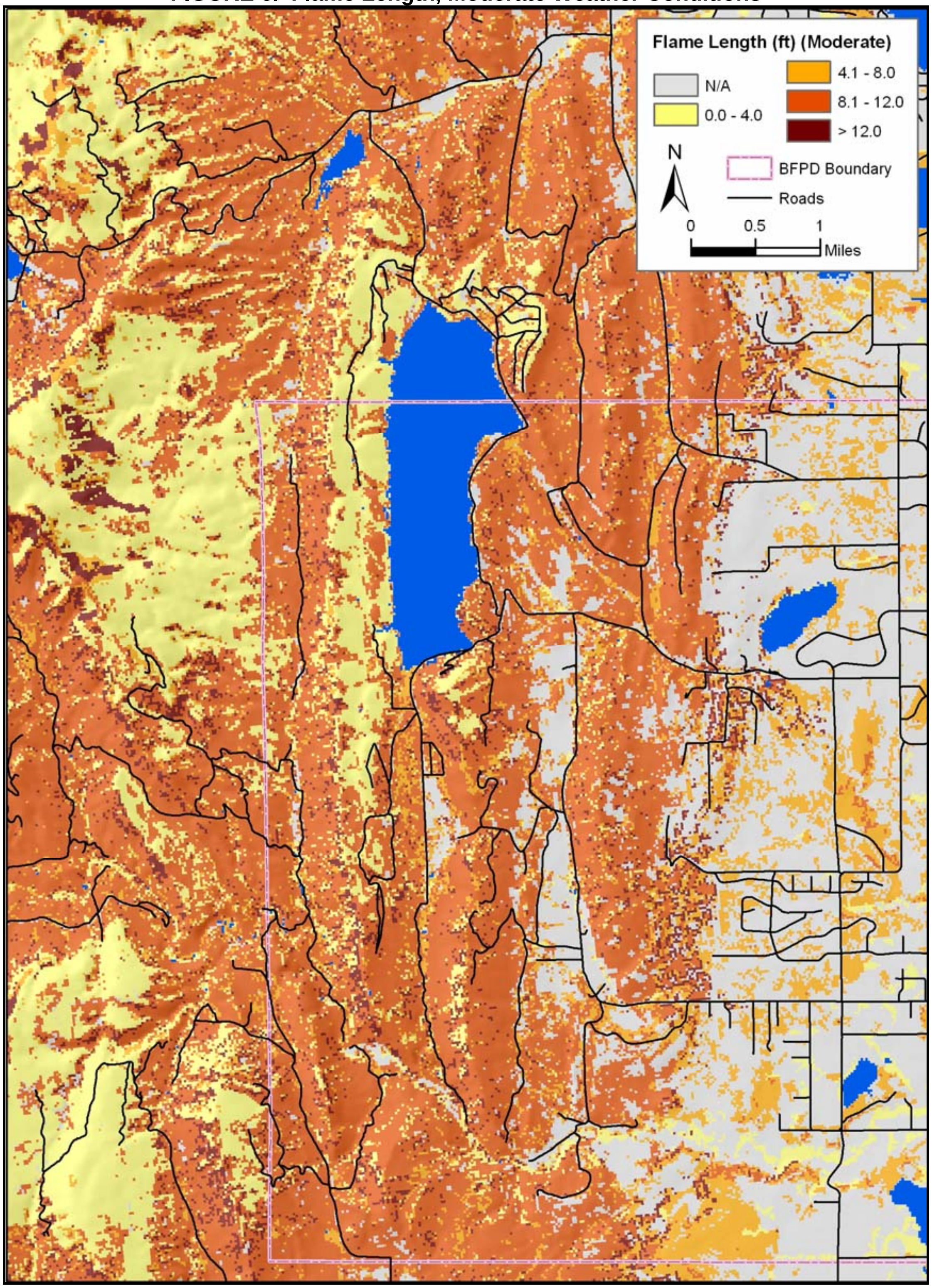


FIGURE 7. Rate of Spread, Moderate Weather Conditions

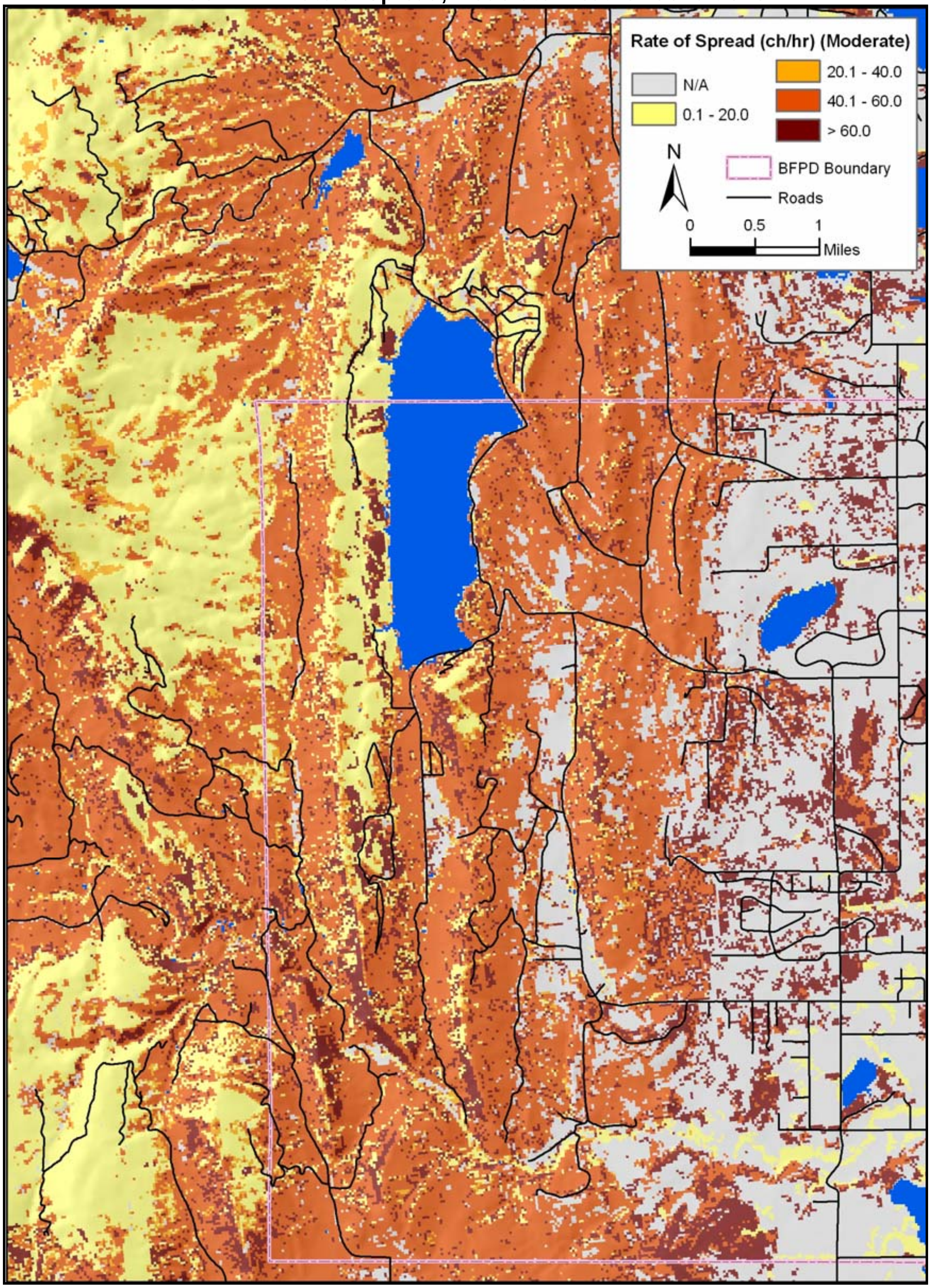


FIGURE 8. Crown Fire Potential, Moderate Weather Conditions

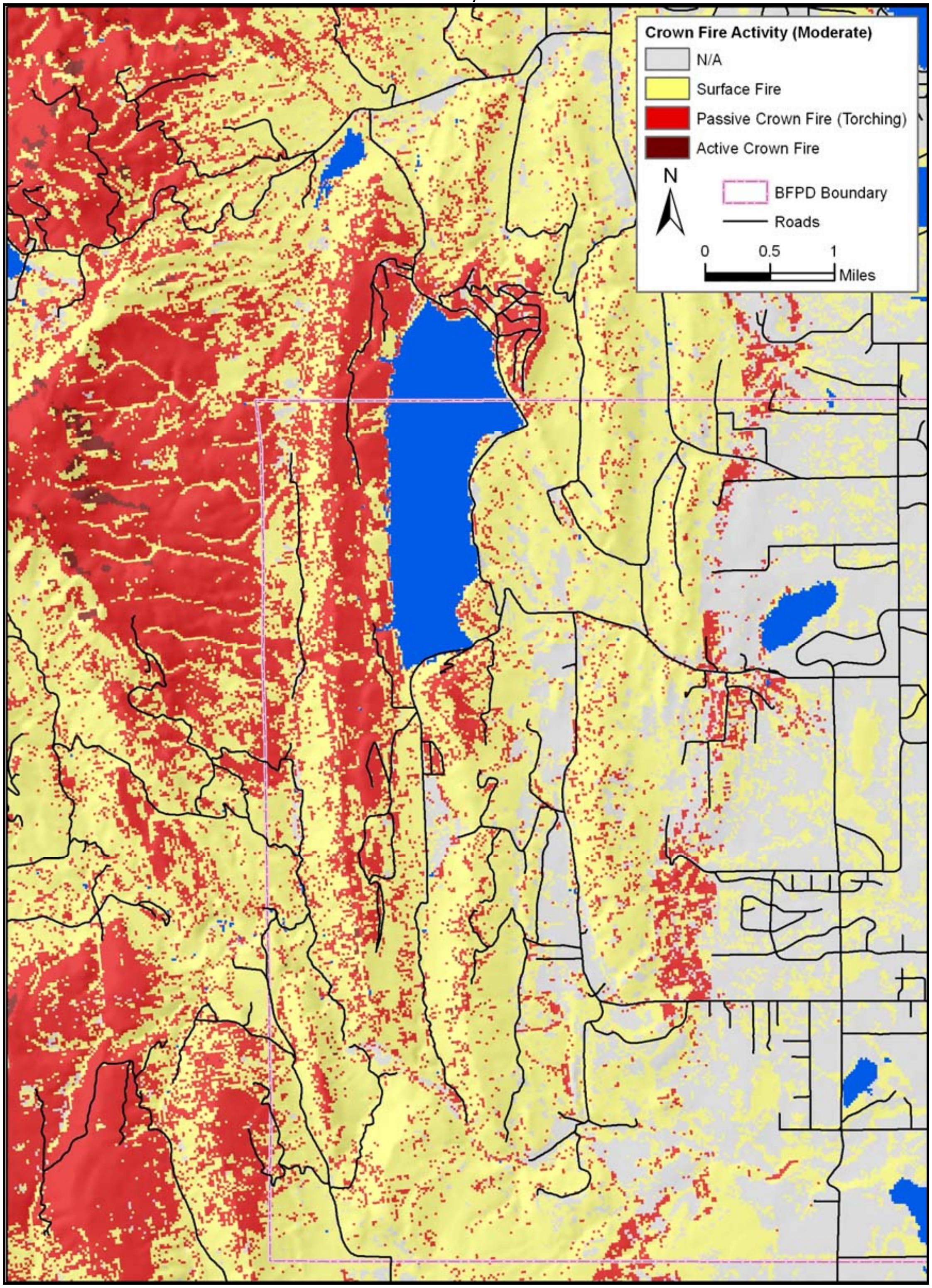


FIGURE 9. Flame Length, Extreme Weather Conditions

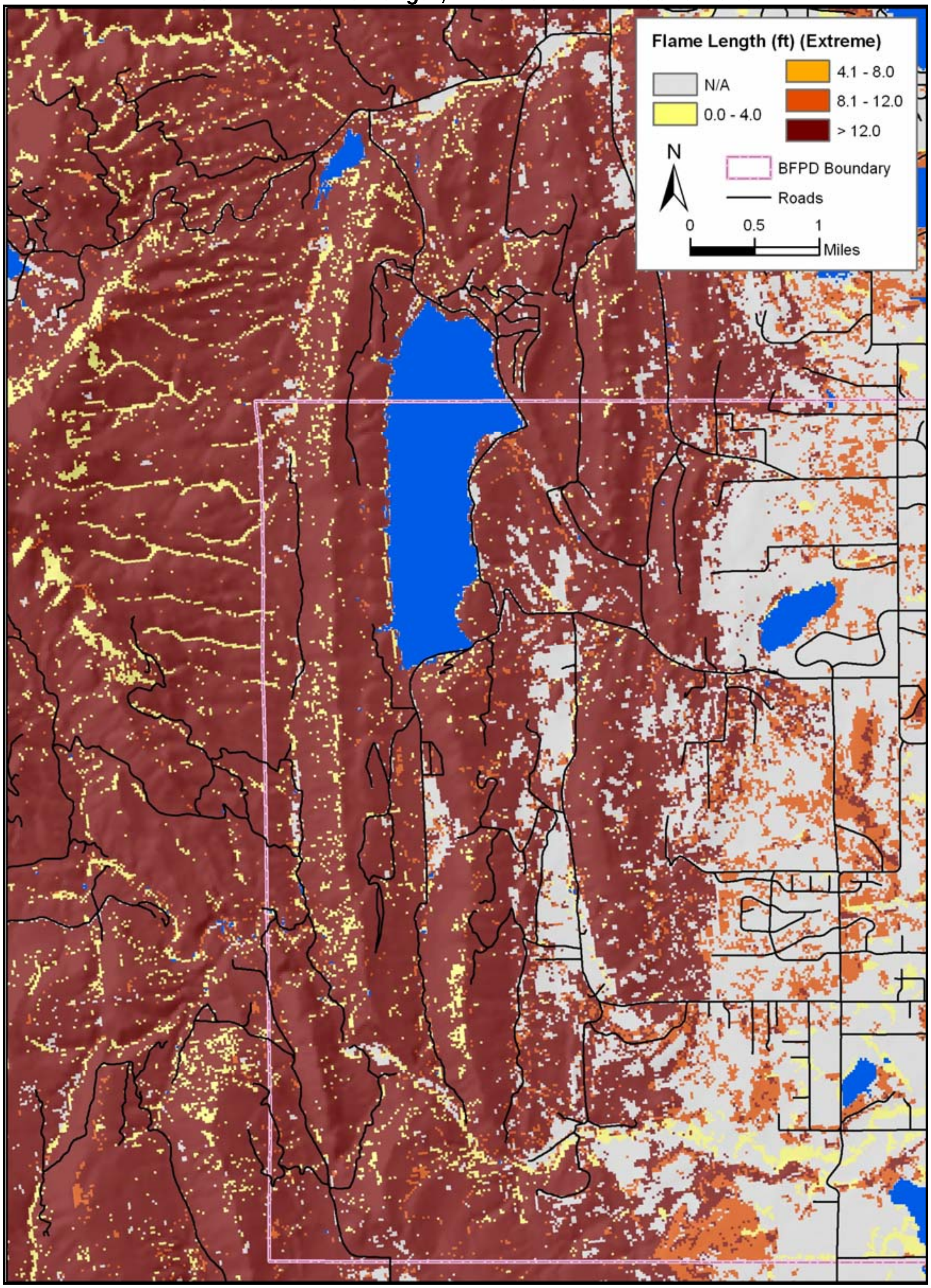


FIGURE 10. Rate of Spread, Extreme Conditions

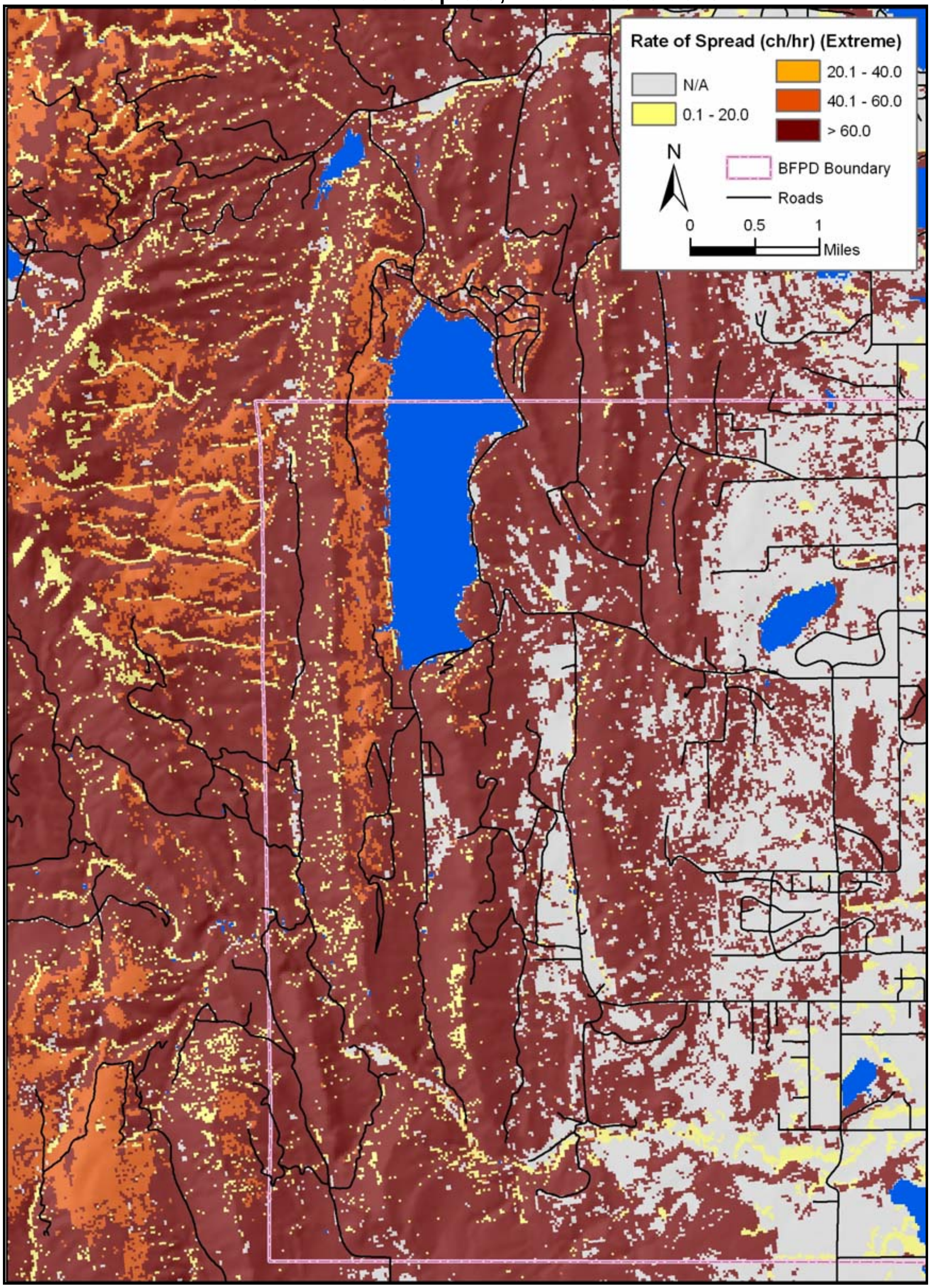
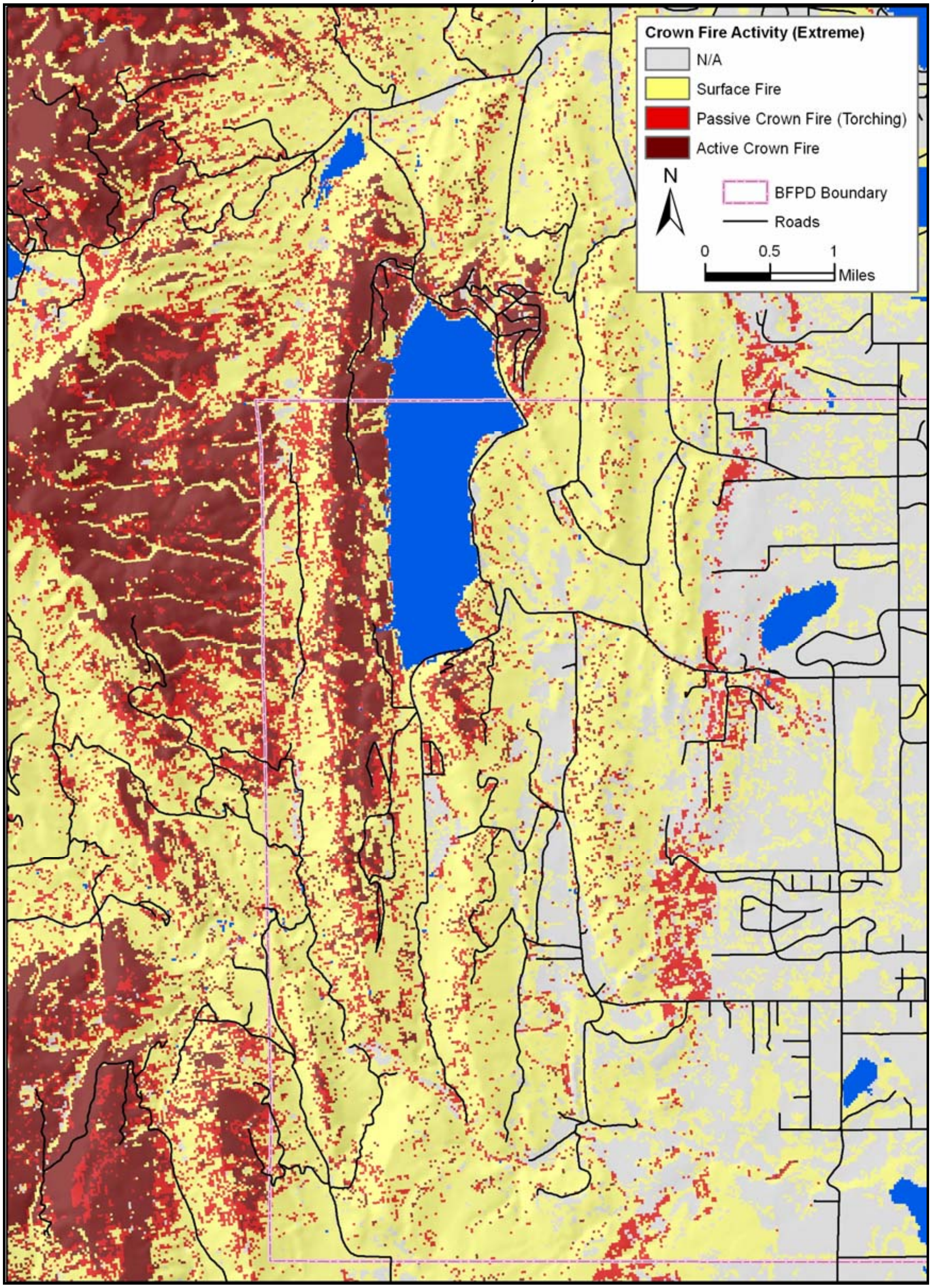


FIGURE 11. Crown Fire Potential, Extreme Conditions



SOLUTIONS AND MITIGATIONS

Establishing and Prioritizing Fire Management Units (FMUs)

An efficient method for prioritizing work efforts is to create FMUs. These units reflect a particular function, like developing an effective public outreach program, or a geographic treatment area, such as an area with related fuel reduction projects. FMUs are created prior to initiating management projects and mitigation activities. Unique activities and objectives are recommended for each unit. These solutions are designed to serve as proposed outlines for projects. They are presented as a starting point for communities to determine the priority and scope of the final project implementation. Local land and fire management agencies, with the input of the citizen's advisory council or fire safe council, must determine the final solutions.

The following FMUs have been identified for the BFPD, and recommendations are provided for each. FMUs are **not** ranked by priority, but priority recommendations have been provided for specific tactical mitigation actions where appropriate within FMUs.

- Safety Zones, Addressing, and Emergency Access Route FMU
- Public Education FMU
- Local Preparedness and Firefighting Capabilities FMU
- Home Mitigation FMU
- Plains Communities FMU
- Fuels Modifications FMU
- Water Supply FMU

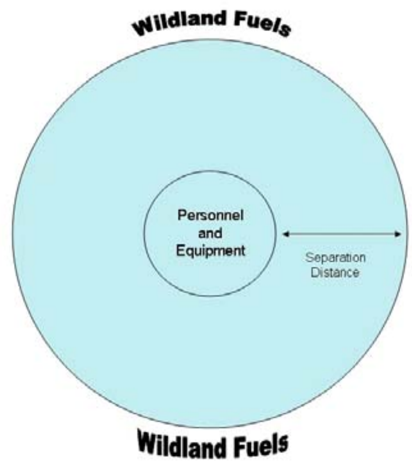
SAFETY ZONES, ADDRESSING, AND EMERGENCY ACCESS ROUTES FMU

Safety Zones

When pre-planning for a wildfire incident, designating safety zones for use by the responding firefighters should be a top priority. More than one safety zone is advised, because 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 14)**

FIGURE 12. Safety Zone Guidelines

Flame Height	Distance Separation (firefighter to flame)	Area in Acres
10 feet	40 feet	1/10 acre
20 feet	80 feet	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 (minimum) is the radius from the center of the safety zone to the nearest fuels.[4]

RECOMMENDATIONS

There appear to be at least a few safety zone options located in or near the communities of Sprague, Dakota Ridge and Hertha Ridge. These areas should be evaluated by BFPD personnel, and if viable, inserted in the district's run books.

1. Agricultural fields east of the Sprague community.
2. Rabbit Mountain Open Space trailhead south of the community of Dakota Ridge.
3. South end of Carter Lake outside of the entrance to the community of Hertha Ridge.

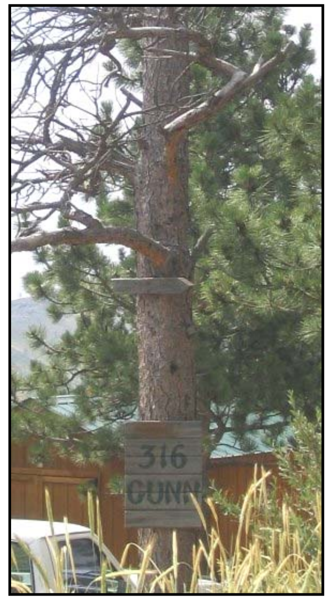
4 http://www.nwcg.gov/pms/pubs/410-1/chapter01.pdf referenced March 20, 2007

Addressing

A number of areas in the BFPD have poor and/or inconsistent street signage and addressing of properties. In the worst cases, addressing was found to be missing altogether or attached to combustible objects. (See **Figure 15**.) In the foothill areas of the BFPD, there are many intricate mountain roads and driveways. In these areas, proper, standardized, reflective signage is critical to effective response. Response times are substantially reduced, especially at night and in difficult conditions, by standardized addressing. 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 city employees who have not had the opportunity to train on access issues as often as career emergency responders. Standardized reflective signage mounted on a non-combustible pole is highly recommended. These signs can be used in addition to the current markers.

Recommendations for address markers can be found in **Appendix D**.

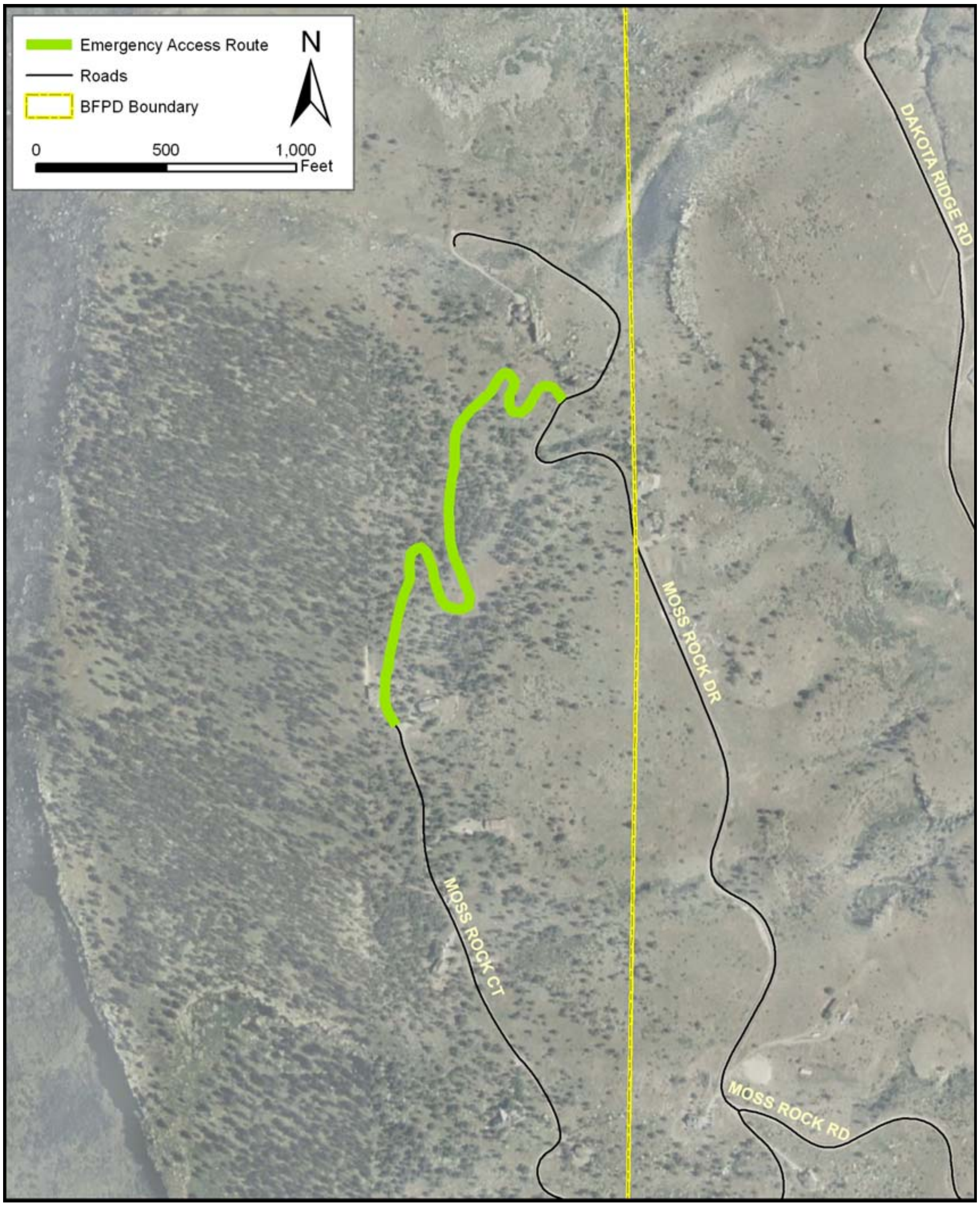
FIGURE 13.



Emergency Access Route

One road has been identified as an emergency access route alternative to the primary access. This route will help to enhance firefighter and public safety by connecting the road into a loop thus discarding the hazards of one-way in / out type of roads. The route is highlighted in **Figure 16**.

FIGURE 14.



EMERGENCY ACCESS ROUTE RECOMMENDATION:

The route is represented graphically by **Figure 16**.

Moss Rock Ct. to Moss Rock Dr. Priority Level High. This project focuses on connecting Moss Rock Court to Moss Rock Drive by using an existing roadway/two-track. This emergency usage would be both for citizens and emergency responders. The road surface should be evaluated to determine the feasibility of allowing larger fire apparatus. 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 BFPD and the private landowners. It is recommended that the route be well marked.

A significant amount of effort should be devoted to educating the homeowners in this area about the importance of this project.

GENERAL RECOMMENDATIONS

1. 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.

2. Identify and pre-plan alternate escape routes and staging areas.

3. Perform response drills to determine the timing and effectiveness of fire resource staging areas.

4. Educate citizens on the proper escape routes and evacuation centers to use in the event of an evacuation.

5. 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.

6. Emergency management personnel should be included in the development of preplans for citizen evacuation.

7. 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.

Public Education FMU

The wildland urban interface area of the Berthoud Fire Protection District is experiencing continuing development. Rising 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 regard 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 the BFPD and throughout the front-range interface.

RECOMMENDATIONS

- Visit these web sites for a list of public education materials, and for general homeowner education:
  - http://www.nwcg.gov/pms/pubs/pubs.htm
  - http://www.firewise.org
  - http://csfs.colostate.edu/protecthomeandforest.htm
  - http://www.brfd.org

- 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 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 the residents to the prioritization of mitigation actions
  - Select demonstration sites
  - Assist with grant applications and awards

- Carter Lake is a popular public recreation area within the Berthoud FPD, (see *Areas of Special Interest* below). One recommendation for this area is to provide wildfire education to the public via verbal contact, published literature, and signage.

Local Preparedness and Firefighting Capabilities FMU

The Berthoud Fire Protection District (BFPD) provides suppression services for the study area. The District has two fire stations: Station 1 (includes the administrative offices), located at 275 Mountain Avenue, and Station 2, located at 4014 W. County Road 8. Mutual aid is available from the Larimer County Emergency Services Unit, Loveland Fire Rescue, Johnstown Fire Protection District, Mountain View Fire Protection District, Hygiene Fire Protection District, Longmont Fire Department, Poudre Fire Authority, and the Lyons Fire Protection District.

BFPD maintains three type-1 engines, one type-6 brush truck, one type-3 engine, two water tenders, two utility/hose tenders, two aerials, and five support vehicles.

BFPD adheres to the National Wildfire Coordinating Group (NWCG) curriculum for training. Of BFPD's 35 combination members, 25 are firefighters with NWCG S-130/190 training (basic wildland fire fighting and weather). Approximately 7 firefighters are qualified at the Engine Boss level or higher.

Berthoud FPD currently makes available personnel and equipment which respond to out of area wildfire incidents across the country. The experience they gain while assigned to a large on-going wildfire incident provides numerous and important benefits. These benefits will greatly enhance the effectiveness of the District when confronted with larger type incidents.

RECOMMENDATIONS:

Firefighter Training (**Priority Level High**): Provide education and experience for all firefighters including:

- NWCG S-130/190 for all department members
- Annual wildland fire refresher and "pack testing" (physical standards test)
- Organize and facilitate an annual wildfire interface training exercise within the communities outlined in this CWPP.
- S-131 Advanced Wildland Firefighter
- S-215 Fire Operations in the Urban Interface
- S-290 Intermediate Fire Behavior
- I-200 and I-300 – Basic and Intermediate ICS
- Encourage personnel to seek higher wildfire qualifications
- Encourage personnel to participate in out of district wildfire assignments
- Encourage prescribed burn participation
- Encourage Type 3 Incident Management Group participation and utilization

Equipment:

- **Priority Level High.** Provide minimum wildland Personal Protective Equipment (PPE) for all career and volunteer firefighters. (See NFPA Standard 1977 for requirements).

- **Priority Level High.** Provide gear bags for both wildland 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.

- **Priority Level High.** Purchase and equip an additional type-6 engine. Type-6 engines are a versatile piece of firefighting equipment. Run in tandem with a standard structure engine, the type-6 allows for the ability to accomplish many different tasks.

- **Priority Level High.** Purchase an additional porta-tank (2500 gallon).

- **Priority Level High.** Purchase and equip an additional type-3 engine. This engine should be equipped with a “light” structural complement (SCBA, TIC, etc.) so it can function (in a limited capacity) as a piece of structure apparatus.

- **Priority Level Moderate.** Provide and maintain a 10-person wildland fire cache, in addition to the tools on the apparatus. This cache will also be used for mitigation work. The contents of the cache should be sufficient to outfit two squads for hand line construction and direct fire attack. Recommended equipment would include:

    - Four cutting tools such as pulaskis or super pulaskis
    - Six scraping tools such as shovels or combis
    - Four smothering tools such as flappers
    - Four backpack pumps with spare parts
    - Two complete sawyer’s kits including chainsaw, gas, oil, sigs, chaps, sawyer’s hard hat, ear protection, files, file guides, spare chains and a spare parts kit
    - MREs and water cubies sufficient for 48 hours

Communications

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 regards to firefighter safety.

- **Priority Level High.** Research the feasibility of locating an additional 800 MHZ repeater site above the west side of Carter Lake. This could possibly be a cooperative effort with Loveland Fire Rescue.

- **Priority Level High.** Purchase additional VHF portable radios and batteries. These must be programmable. Training with these radios should be provided quarterly.

- **Priority Level High.** A complement to any communications system is the acquisition of an 800 MHz / VHF interoperability “black box” device. This device quickly permits the user to patch together multiple radio frequencies into one common channel. This could possibly be a cooperative effort with Loveland Fire Rescue.

Access issues

Numerous areas are present within BFPD that require a gate code or keys so as to gain access. Most emergency apparatus carry some form of forcible entry tool which can be used to cut fence wire or pad locks. But there are additional command and support personnel who may not have tools to force entry.

- **Priority Level High.** A member of BFPD should be tasked with locating all secured areas within the District. These areas maybe entrances to subdivisions, private industry (mine), and both public and private landowners. The current key, combination, or other means of gaining entry could then be verified. This information would then be added to the districts run maps.

Home Mitigation FMU

Community responsibility for self-protection from wildfire is essential. Educating homeowners is the first step in promoting a shared responsibility. Part of the educational process is defining the hazard and risks at both the community- and parcel-level.

Of the ten communities in the study area, the community-level assessment identified three that are at very high risk. Construction type, condition, age, fuel loading of the structure/contents, and position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. There is also a likelihood of rapid fire growth 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.

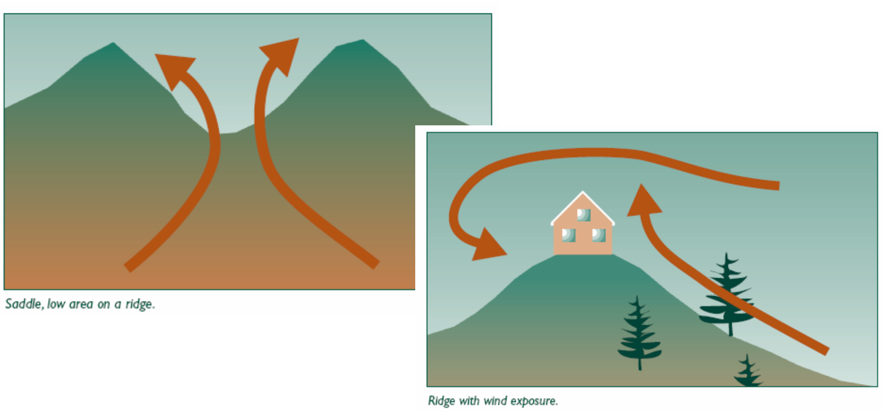
Table 3 illustrates the relative hazard rankings for communities in the study area.

- A rating of nine or less indicates an area of extreme hazard.
- A rating of 10 to 19 indicates a very high hazard.
- A rating of 20 to 29 indicates high hazard.
- A rating of 30 to 34 indicates moderate hazard.
- A rating of 35 or greater indicates a low hazard.

The communities with very high hazard ratings should be considered an FMU where a parcel level analysis should be implemented as soon as possible. Please see **Appendix B** for more detailed information.

The single most important element for the improvement of life safety and property preservation for every home in the study area is *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.

FIGURE 15. Saddle & Ridge Top Development[5]



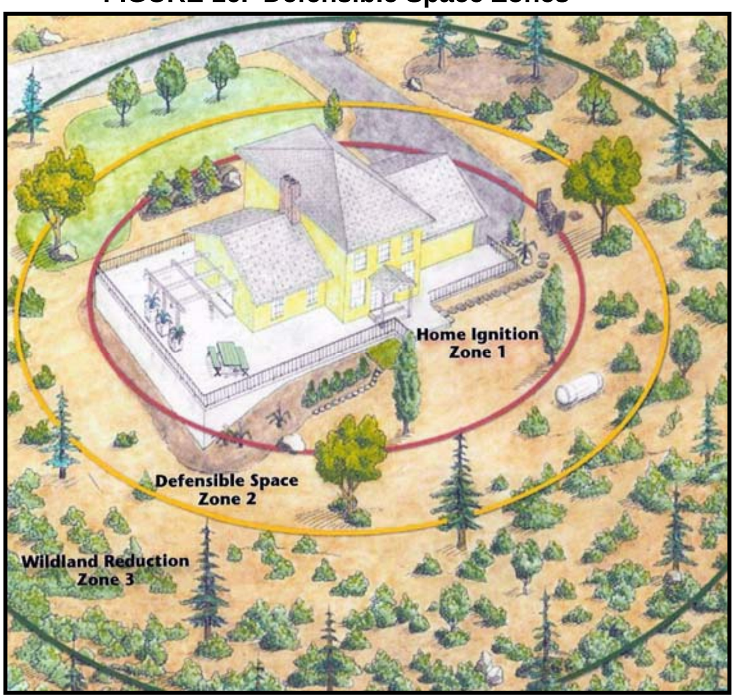
5 *FireWise Construction*, Peter Slack, Boulder Colorado

An aggressive program of *evaluating and implementing defensible space* for homes will do more to limit fire-related property damage than any other single recommendation in this report.

There is no question that any type of dense/flammable vegetation should be removed from around a home in order to reduce the risk of structural ignition during a wildfire. The question is how much should be removed? The basic rule is to eliminate all flammable materials (fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.) from within 30 feet of the home. For structures near wildland open space, an additional 70 feet should be modified in such a way as to remove all dead wood from shrubbery, thin and trim trees and shrubs into "umbrella" like forms (lower limbs removed), and prevent the growth of weedy grasses (see **Figure 18**). Steep slopes and/or the presence of dangerous topographic features as described above may require the defensible space distances to be increased.

The term "clearance" leads some people to believe that all vegetation must be removed down to bare soil. This is not the case. Removing all vegetation unnecessarily compromises large amounts of forested terrain, increases erosion, and will encourage the growth of weeds in the newly disturbed soil. These weeds are considered "flashy fuels," which actually increase fire risk because they ignite so easily. Defensible space must be ecologically sound, aesthetically pleasing, and relatively easy to maintain. Only then will the non-prescriptive use of fuels reduction around homes become commonplace.

FIGURE 16. Defensible Space Zones[6]



6 *A Homeowner's Guide to Fire Safe Landscaping*(2005) www.FireSafeCouncil.org

Maintaining Your Defensible Space[7]

Your home is located in a forest that is dynamic, and always changing. Trees and shrubs continue to grow, plants die or are damaged, new plants begin to grow, and plants drop their leaves and needles. Like other parts of your home, defensible space requires maintenance. Use the following checklist each year to determine if additional work or maintenance is necessary.

Defensible Space and FireWise Annual Checklist

- 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.
- Grass and weeds are mowed to a low height.
- 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 name and house number are posted and easily visible.
- There is an easily accessible tool storage area with rakes, hoes, axes, and shovels for use in case of fire.
- You have practiced family fire drills and your fire evacuation plan.
- Your escape routes, meeting points and other details are known and understood by all family members.
- 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.

7 http://www.ext.colostate.edu/PUBS/natres/06302.html referenced 7-2007

RECOMMENDATIONS

- **Priority level-High.** A parcel-level wildfire hazard analysis for the homes located in the Sprague, Dakota Ridge, Hertha Ridge, and 27E (upper areas) communities should be conducted as soon as possible. This data should facilitate the following important fire management practices:

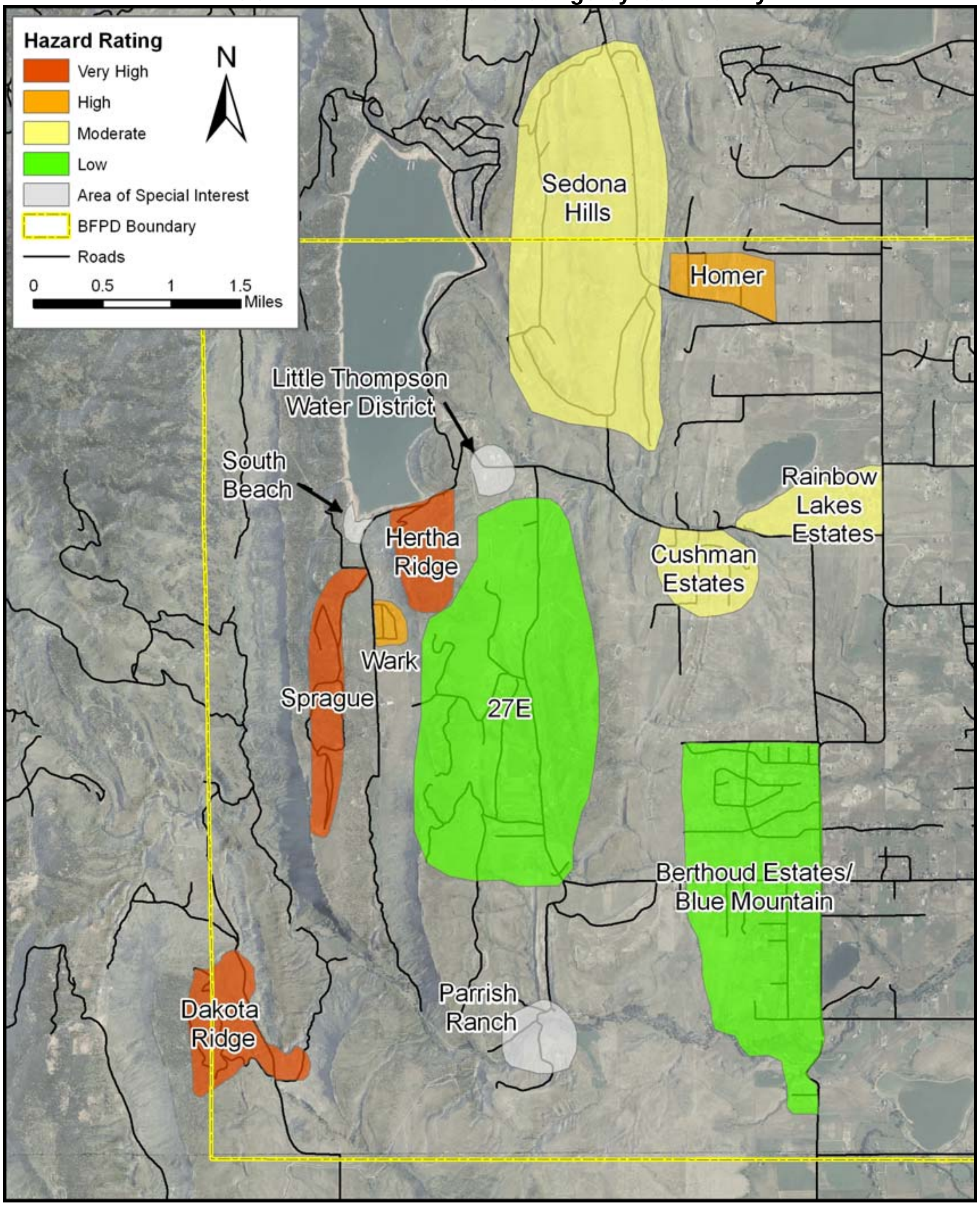
    - Establishing a baseline hazard assessment for homes in these communities
    - Education of the community through the presentation of the parcel level Hazard-Risk Analysis at neighborhood public meetings
    - Identification of defensible space needs and other effective mitigation techniques
    - Identification and facilitation of "cross-boundary" projects
    - Community achievement of national FIREWISE status
    - Development of a Pre-Attack/Operational Plan for the FMU, and eventually the entire study area. A pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate incidents that occur.

- **Priority level-High.** Add reflective address signs at each driveway entrance and all homes (see **Appendix D** for recommendations).

- **Priority level-High**. Use the structure triage methodology provided in **Appendix C** to identify homes not likely to be defendable.

- **Priority level-High**. Improve access roads and turnarounds to create safe access for firefighting resources. See *Berthoud FPD Access and Water Supply* (**Appendix D**).

FIGURE 17. BFPD Hazard Ratings by Community



1. Sprague	6. Homer
2. Dakota Ridge	7. Cushman Estates
3. Hertha Ridge	8. Sedona Hills
4. Wark	9. Rainbow Lake Estates
5. 27E	10. Berthoud Estates / Blue Mountain

Plains Communities FMU

There are some communities in the study area that are not representative of a true Wildland Urban Interface, but are adjacent to, or in close proximity to, significant wildland fuel beds. These fuel beds consist of primarily tall grass prairie remnants and short grasses. Shrubs and hardwoods are also found growing in stringers and patches in drainages and riparian areas. There are some areas with jackpots of heavier fuels, most of which are smaller than the minimum mapping unit of the fire behavior model. Most of these fuels are located on open space parcels, and while some are grazed on a rotating basis, they represent a potential threat to some or most of the homes in these communities, especially those directly adjacent to them. These communities generally have rolling to flat topography, but ravines exist in some areas. Agricultural properties and larger rural lots are mixed in with suburban style subdivisions throughout this area. Construction type and structure age varies widely with both ignition resistant construction and homes with flammable roofs and sidings often existing in the same neighborhood. Although these communities have been given a moderate or low hazard rating, there are general mitigation measures which should be considered to reduce the possibility of loss resulting from fires occurring in the neighboring natural fuels. Homes located on the perimeter of these communities, or otherwise adjacent to continuous areas of natural fuels, are the highest priority for mitigation. The following recommendations should be considered for the communities of Homer, Cushman Estates, Rainbow Lake Estates, and Berthoud Estates/Blue Mountain.

RECOMMENDATIONS

- Defensible space is recommended for all homes. Maintain defensible space throughout the year.

    - ✓ Mow grass and weeds to a low height.
    - ✓ Clean needle litter from roofs and gutters and away from foundations.
    - ✓ Do not dispose of yard waste into open space areas.
    - ✓ Discourage the planting of flammable vegetation such as juniper within 30 feet of homes.
    - ✓ Encourage the use of xeriscaping, and use fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see **Home Mitigation FMU**).
    - ✓ Water ornamental vegetation during times of drought.
    - ✓ When possible, maintain an irrigated green belt around the home.

- Extended defensible space is recommended for all homes located on the perimeter of native fuel beds, especially those located near ravines, steep slopes, or other dangerous topographic features. These areas are also noted in **Appendix B**

- Wood shake and other flammable roofing types should be replaced with ignition resistant roofing such as asphalt or metal (see the **Home Mitigation FMU** section of this report).

- Encourage the use of low-combustibility materials for decks and projections on new construction and renovations, especially where homes are upslope from heavy fuels.

- Do not store combustibles or firewood under decks. Open areas below decks, outdoor stairways, and homes should be enclosed or screened to prevent the ingress of embers, especially where such openings are located on slopes above natural (non-irrigated, non-maintained) vegetation.

- Trees along driveways should be limbed and thinned as necessary to maintain clearance for emergency vehicle access (13’ 6” vertically and 16’ horizontally).

- 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.

- Power pole bases should be surrounded by an area at least 5’ in diameter that is completely free of flammable vegetation.

FUELS MODIFICATION PROJECTS FMU

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. Nonetheless, fuelbreaks have proven to be effective in limiting the spread of crown fires in Colorado.[8] 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 conditions) 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 Berthoud FPD 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 between the defensible space of homes and the fuelbreak is less than ten acres. Another common 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

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

mentioned above, even though this position is considered the least desirable from a fire suppression point of view.

Fuelbreaks are often easiest to construct along existing roadbeds (see the description of the fuels modification project for access routes on page 42 of this report). 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 x slope %), above road distance = 100’ – slope % (see **Table 4**). Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%.[9] 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.

In **Appendix B** we noted that some communities have done mitigation work and not removed the resulting debris. 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 properly, by piling and burning, chipping, physical removal from the area, or lopping and scattering. 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.

9 Frank C. Dennis, “Fuelbreak Guidelines for Forested Subdivisions” (Colorado State Forest Service, Colorado State University, 1983), p. 11.

ACCESS ROUTE FUELS MODIFICATION RECOMMENDATIONS

Roadside thinning should include an area of at least 100' on either side of the centerline of the route, where practical. This distance should be modified to account for increased slope and other topographic features that increase fire intensity (see **Table 5**). This is especially important in communities with steep, narrow roads and few turnouts. In these areas, safer access for firefighters would have 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.

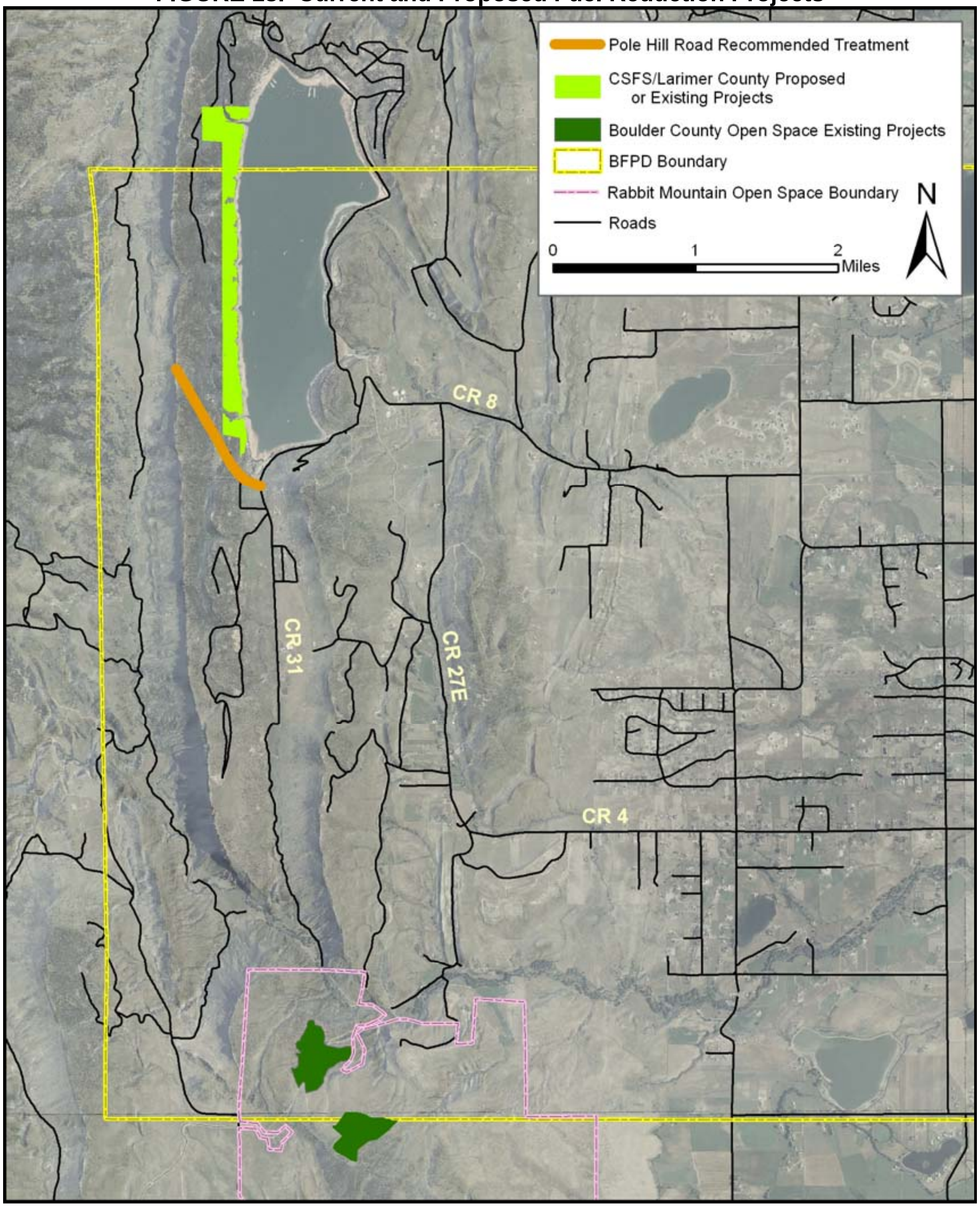
TABLE 5. Recommended Treatment Distances For Mid-Slope Roads

% 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 Fuels Reduction Projects for BFPD

The following recommendations are in addition to, not in place of, the fuels reductions mentioned in the **Safety Zones, Addressing, and Emergency Access Route, FMUs**. 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 18. Current and Proposed Fuel Reduction Projects



Current and Proposed Cross-Boundary Projects

One purpose of this CWPP is to make known other agencies' fuel reduction projects adjacent to the BFPD. The CSFS and Larimer County Parks and Open Lands are currently implementing the Carter Lake Forest Management Plan. This project will benefit the BFPD and will be a natural starting point for the Sprague Community fuel reduction project. Boulder County Parks and Open Space have several ongoing projects. These projects are shown in **FIGURE 20**.

RECOMMENDATIONS

A. **Pole Hill Road Treatment (Approximately 26 Acres). Priority level – High (see Figure 20).** This project focuses on limbing and thinning along the Pole Hill Road west of the Carter Lake South Beach area. The project begins near the South Beach area and makes use of the road/two-track which diagonals in a northwestern direction uphill past several home sites to the top of the ridge where the fuels become patchy. 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 if there is a desire to incorporate the home sites' extended defensible space into this treatment project. This project will help to protect the Sprague community (rated Very High hazard) from northern fuel driven fires.

B. **Moss Rock Ct. to Moss Rock Dr. Priority Level High. (shown on figure 14, Emergency Access Route)** This project focuses on connecting Moss Rock Court to Moss Rock Drive by using an existing roadway/two-track. This emergency usage would be both for citizens and emergency responders. The road surface should be evaluated to determine the feasibility of allowing larger fire apparatus. 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 BFPD and the private landowners. It is recommended that the route be well marked.

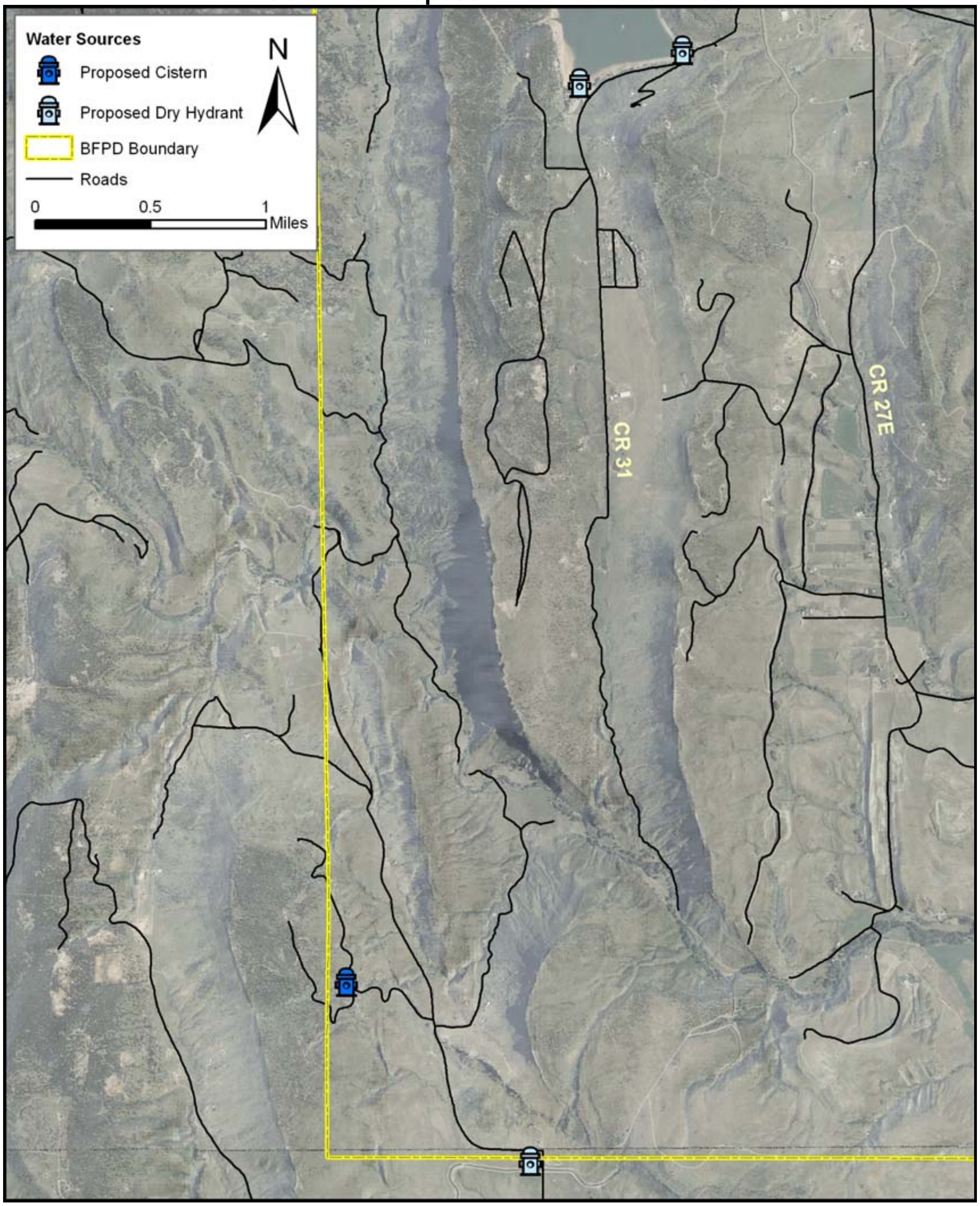
Water Supply FMU

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

- Sprague
- Dakota Ridge
- Hertha Ridge
- Wark Road

Two additional (non-municipal hydrants) water supplies are currently available to BFPD. A swimming pool (approximate capacity: 20,000 gallons) located on Bennett Road and a cistern located at the entrance to the Rabbit Mountain Trailhead which is owned by Boulder County Parks and Open Space. This cistern has a capacity of 2000 gallons and is serviced by a 2 ½" fitting. The community of Dakota Ridge is located 1 mile north of this location.

FIGURE 19. Proposed BFPD Water Sources



The mid-level assessment revealed an adequate water supply for the majority of the study area. In certain areas there is a considerable distance from reliable water sources for fire suppression. Immediately accessible secondary water sources must always be considered to fully support fire operations.

Carter Lake supports a number of water draft sites. BFPD is equipped with two 2000-gallon water tenders equipped with a 2500-gallon port-tank each. The District also runs two utility/hose tenders specifically for rural water operations. These are equipped with a 2250 GPM pump and 8000 feet of 5" supply hose. One portable volume pump (300 GPM) is also available to staff a water fill site.

Firefighting efforts in a few communities could be enhanced by improving water supplies in the FMU.

RECOMMENDATIONS

- **Priority Level High.** A medium sized (10,000+ gal.) cistern is recommended for the area of Dakota Ridge. The intersection of Moss Rock Court and Moss Rock Drive would be a suitable location. This is the most critical water supply need in the entire study area. **See FIGURE 21.**
- **Priority Level High.** A dry hydrant is recommended to access the water canal that runs just south of the Rabbit Mountain Trailhead parking area. **See FIGURE 21.**
- **Priority Level Moderate.** A dry hydrant is recommended to access water from Carter Lake. Two locations have been selected and are possibly currently used as draft sites. **See FIGURE 21.**

Area of Special Interest

Introduction

In addition to residential communities, certain other properties have been identified by stakeholders as areas 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.

Carter Lake – Recreation Managed by the Larimer County Parks and Open Lands

Carter Lake is located in the foothills west of Loveland at an elevation of 5,760 feet. It is a part of the Big Thompson Project operated by the Bureau of Reclamation and the Northern Colorado Water Conservancy District. The purpose of this water project is to divert water from the west slope to the east slope for drinking water, irrigation, and hydropower generation. The Bureau of Reclamation is solely responsible for power generation. The agencies jointly manage water levels for irrigation, municipal and industry use. Recreation is managed by Larimer County Parks and Open Lands. The lake is three miles long and about one mile wide. Carter Lake is a 1,100-acre reservoir surrounded by 1,000 acres of public lands and is popular for fishing, sailing, camping, swimming, scuba diving, rock climbing, and water skiing. It is open year round. Park Entrance Permits and Camping Fees are required.[10]

RECOMMENDATIONS

- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined within the Home Mitigation FMU and Appendix B.
- All Larimer County parks and Open Lands employees should attend wildland firefighting training.
- South Shore fuel reduction projects should be coordinated with BFPD. This will help to tie cross boundary projects together. Completed projects will need to be maintained.
- The public should be provided with wildfire educational materials available at all the information kiosks located on Parks and Open Lands 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.

10 http://www.co.larimer.co.us/parks/carter.htm; referenced 08-21-07

Boulder County Parks and Open Space – Rabbit Mountain

Rabbit Mountain is part of the uplift that divides the Saint Vrain drainage basin from the Big Thompson drainage basin. It provides a remarkable view of the Continental Divide to the west, as well as great views of the Big Thompson valley to the north and the Saint Vrain valley to the south. Rabbit Mountain contains over 2,888 acres of backcountry. There are over 5 miles of multiuse trails.[11]

RECOMMENDATIONS

- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined within the Home Mitigation FMU and Appendix B.
- All Open Space employees should attend wildland firefighting training.
- Fuel reduction projects should be continued and maintained.
- 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.

Little Thompson Water District

The Little Thompson Water District is a not-for-profit, user-owned utility overseen by an elected Board of Directors. It was formed as a Special District of Colorado in 1960 to provide high-quality drinking water to rural residents. It began serving domestic water to a 300-square-mile area in Larimer, Weld and Boulder counties in 1962. At the beginning of 2005, it served approximately 7,400 tapholders. Its service area is generally bounded by the City of Loveland on the north, Longs Peak Water District on the south, the city of Greeley, the South Platte River and the St. Vrain River on the east, and the foothills on the west. It expanded to include the former Arkins Water Association in 1999 and the Town of Mead in 2002.[12]

RECOMMENDATIONS

- All buildings and improvements adjacent to wildland fuels should follow the recommendations as outlined within the Home Mitigation FMU and Appendix B.
- All Open Space employees should attend wildland firefighting training.
- Fuel reduction projects should be continued and maintained.
- 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.

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11 http://www.co.boulder.co.us/openspace/recreating/public_parks/rabbit_mtn.htm; referenced 08-21-07

12 http://www.ltwd.org/aboutus.html; referenced 08-21-07

Parrish Ranch

J. Parrish Ranch, *Larimer County, 428 acres*
Partners: Jesse and Donna Parrish, Curt and Jennifer Heckrodt, the Berthoud Land Conservation Fund, and Larimer Land Trust with funding from Larimer County, the Town of Berthoud, and Great Outdoors Colorado

Conservation Values: This unique and committed partnership resulted in the protection of 390 acres of remarkable land. Larimer County purchased the westernmost 320 acres of the property with help from a generous donation from the Heckrodts and an open space grant from Great Outdoors Colorado. In addition, the Parrishes donated a conservation easement to the Larimer Land Trust on the eastern 70 acres of the property.

The Parrish Ranch supports a rich variety of vegetation, and subsequently serves as excellent wildlife habitat for large and small mammals, songbirds, raptors, butterflies and fish. The Ranch includes a mile of ridgeline that is prominent in the mountain backdrop west of Berthoud and serves as the foreground for the view of Longs Peak and Mount Meeker from the Town of Berthoud, US Highway 287, and Interstate 25. Preventing the development of ridgeline homes on this land has preserved this trademark view.

The western portion of the ranch also supports a high-quality occurrence of Bell's Twinpod, a plant found only in Colorado. Finally, with development already encroaching from the north, the protection of the J. Parrish Ranch provides an additional buffer to Boulder County's existing Rabbit Mountain Open Space from further development.[13]

The caretaker of the ranch was contacted during the field work for this report. As of this writing we have not been able to secure factual information regarding the workings of the ranch.

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13 http://www.coloradoopenlands.org/site/ourWork/landProtection/northFrontRange/projects.php#parrish; referenced 08-21-07

GLOSSARY

The following definitions apply to terms used in the Berthoud Fire Protection District 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.

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.

Appendix E

Berthoud Fire Protection District 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 Berthoud Fire Protection District (BFPD), 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

The Berthoud Fire Protection District used internal budgets in combination with a CSFS grant 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 BFPD. The BFPD 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 BFPD 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 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 BFPD, will have the greatest responsibility for implementing the recommended mitigation projects. The CSFS, Boulder and Larimer Counties 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. The Berthoud Fire Protection District 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 BFPD, 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 BFPD web site is http://www.berthoudfire.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.[1]"

State, local, and private agencies (stakeholders) participated in the Berthoud Fire Protection District CWPP. These stakeholders are:

- The Berthoud Fire District
- Loveland Fire District
- Larimer County Parks and Open Lands
- Boulder County Parks and Open Space
- Little Thompson Water District
- The Colorado State Forest Service
- Anchor Point Group

The true collaborative process was initiated thru a number of stakeholder meetings held within Larimer 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 Berthoud Fire Protection District ten communities were delineated and analyzed for hazard and risk.

Two meetings were held. The BFPD stakeholder meeting was held at the Northern Colorado Water Conservancy District. The public meeting was held at the Berthoud Fire District Station 2. The public meeting was very successful with over twenty citizens present stimulating a large exchange of information. The attendance was largely due to the aggressive advertising on behalf of the Berthoud FPD. Door hung flyers were distributed to most homes within the 10 defined wildfire hazard communities.

The purpose of these meetings was to discuss the findings 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.

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/federalfunding.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

BERTHOUD FIRE PROTECTION DISTRICT CWPP

APPENDIX D

ACCESS AND WATER SUPPLY RECOMMENDED 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.

Emergency response personnel do their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for residents and their families, as well as that of the firefighters and emergency medical technicians that will arrive on scene. This is especially important in rural areas, where response times may be considerably longer than in cities.

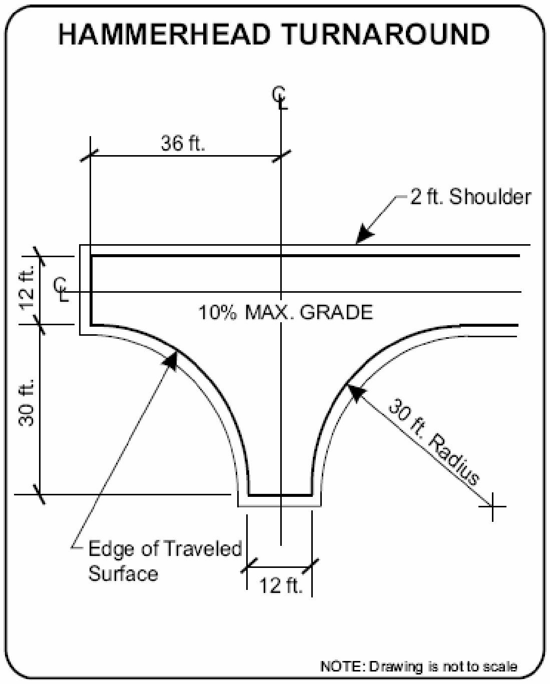
Access Guidelines

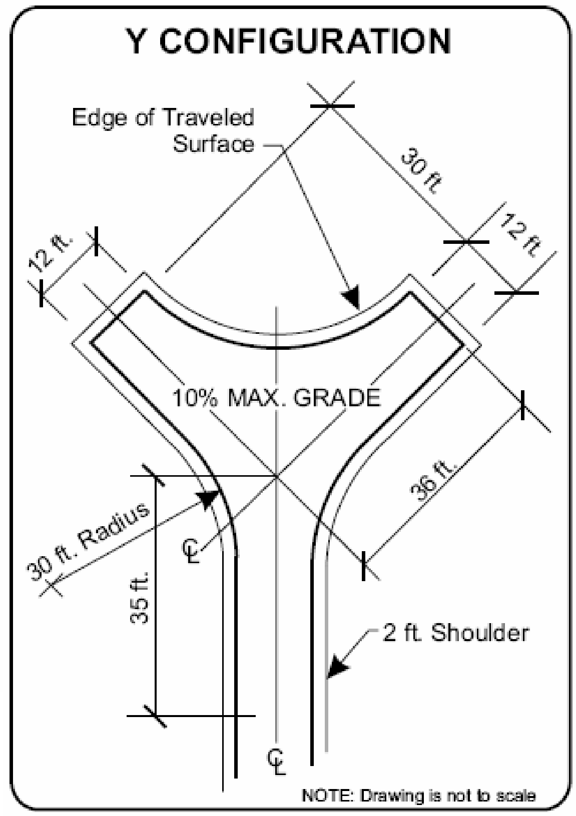
Driveway Turnarounds

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

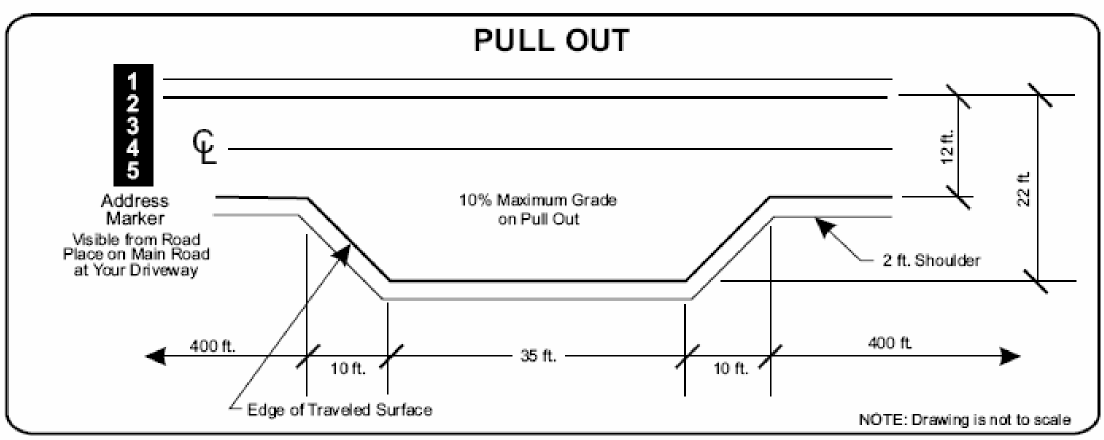
Driveways should have an unobstructed vertical clearance of 13’ 6”. Trees may need to be limbed and utility lines relocated to provide the necessary clearance. The BFPD suggests that driveways have a 14’ wide drivable surface and 16’ of horizontal clearance. On turns the outside radius should be a minimum of 42’ with the inside a minimum of 24’. The surface should be able to support a 60,000 pound fire apparatus.





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.



Address Markers

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 the residences that are accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate simply to 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.

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

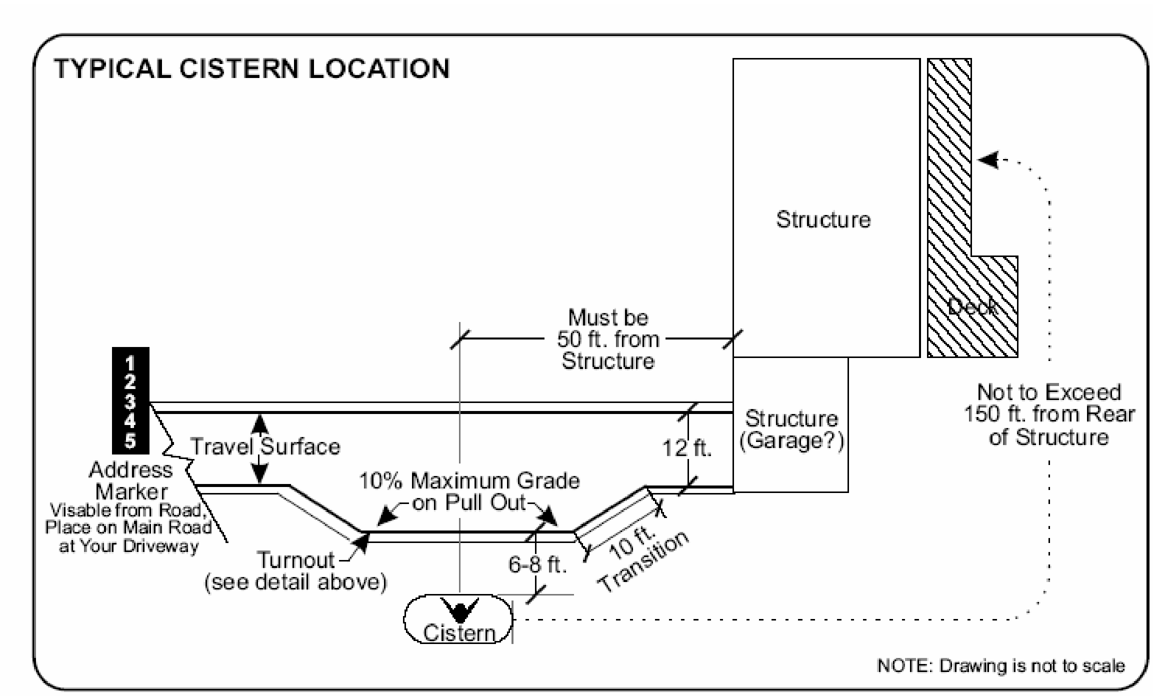
In the study area, like many of the mountainous areas of Colorado, water is a critical fire suppression issue. Although the Berthoud Fire Protection District (BFPD) has a good network of pressurized hydrants, the hazard assessment revealed several communities in the study area which are a considerable 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 FMU** section of the main report.

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 the BFPD.



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 FMU** section of the main report. 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 District. BFPD 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, the BFPD is in the best position to offer site-specific information.

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 eves 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.

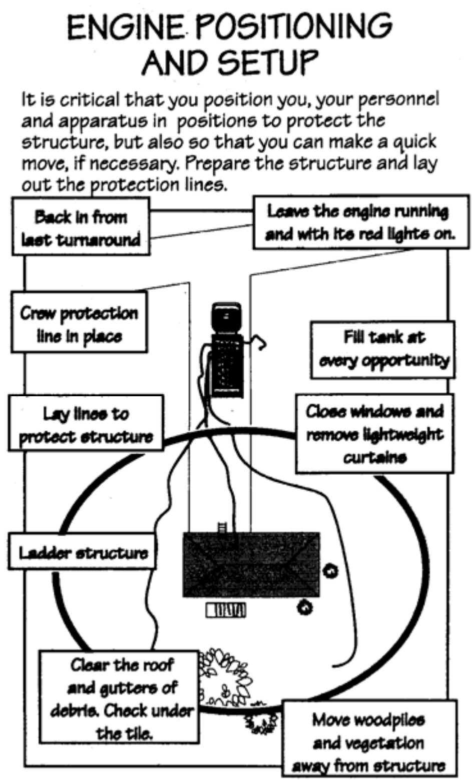
- Factors that may make an attempt to save a structure too dangerous or hopeless:

- 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



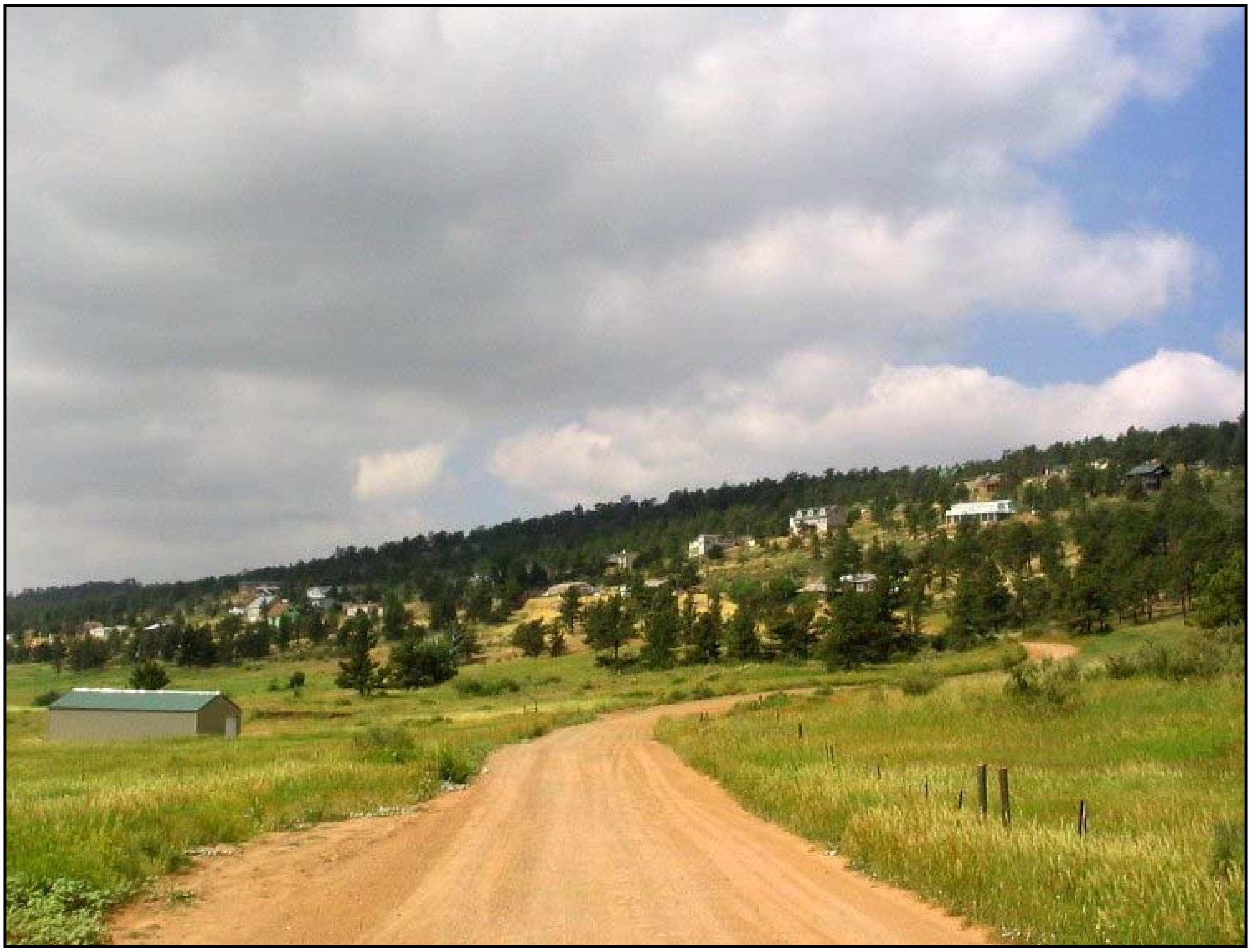
[1]

1 Teie,William C.,1995, Firesighter's Guide, Urban/Wildland Situations. Deer Valley Press

BERTHOUD FIRE PROTECTION DISTRICT CWPP

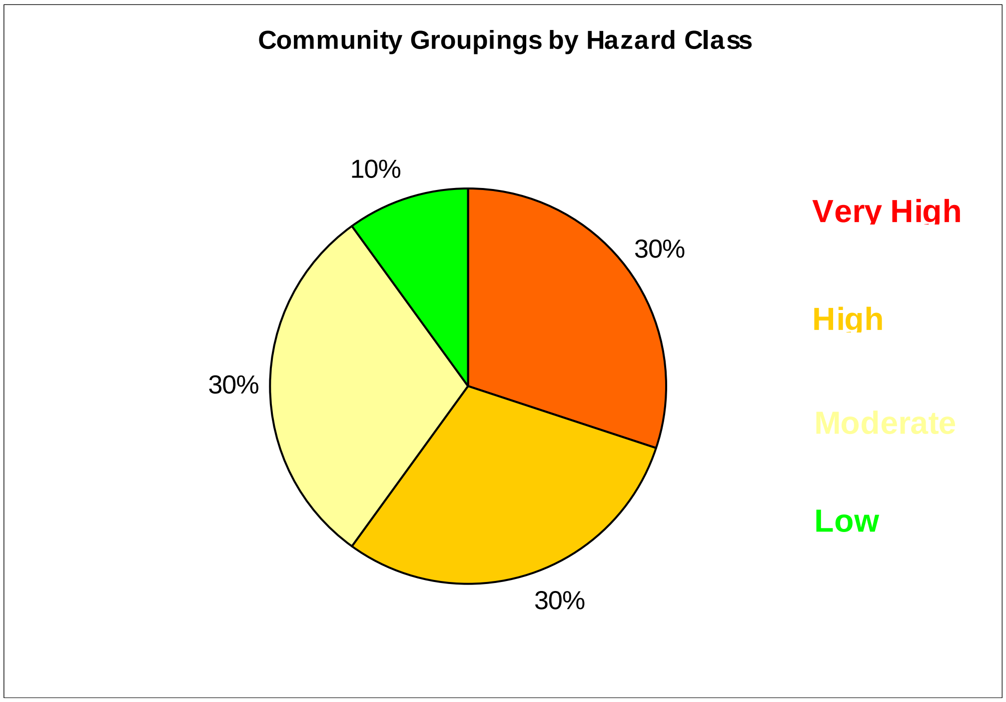
APPENDIX B

COMMUNITIES



The purpose of this appendix is to examine in greater detail the communities in the study area. Of the ten communities in the Berthoud Fire Protection District, three were found to represent a very high hazard; three were rated as high hazard, three as moderate hazard and one as low hazard (see **Figure 1**). For easy reference, the map of communities presented in the main text has been reproduced here as **Figure 2**. **Figure 3** displays this grouping graphically. **Table 1** has been included for quick identification.

FIGURE 1.



Community Groupings by Hazard Class
10%
30%
30%
30%
Very High
High
Moderate
Low

FIGURE 2.

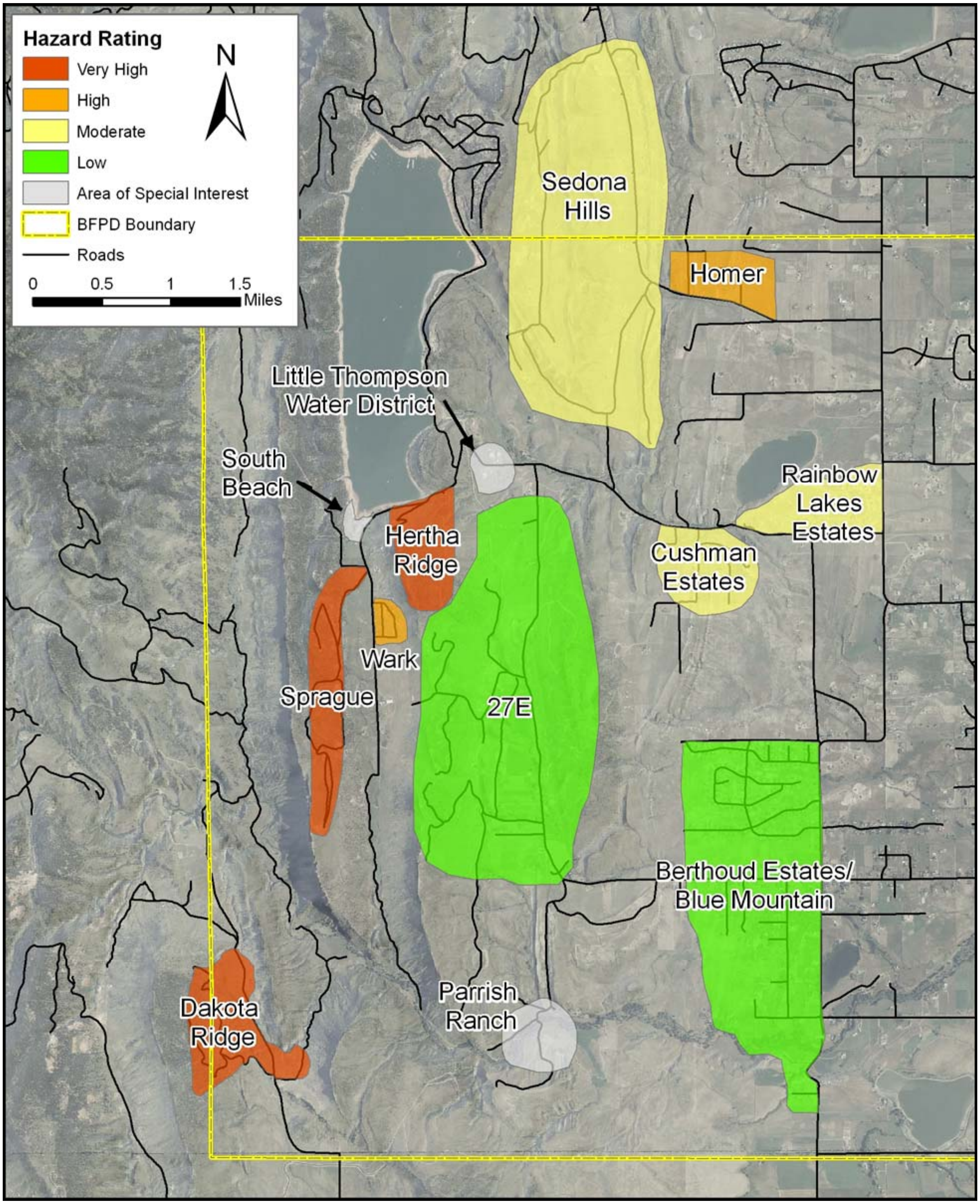

Hazard Rating
Very High
High
Moderate
Low
Area of Special Interest
BFPD Boundary
Roads
N
0
0.5
1
1.5
Miles
Sedona Hills
Homer
Little Thompson Water District
South Beach
Hertha Ridge
Rainbow Lakes Estates
Cushman Estates
Wark
Sprague
27E
Berthoud Estates/ Blue Mountain
Parrish Ranch
Dakota Ridge

FIGURE 3.

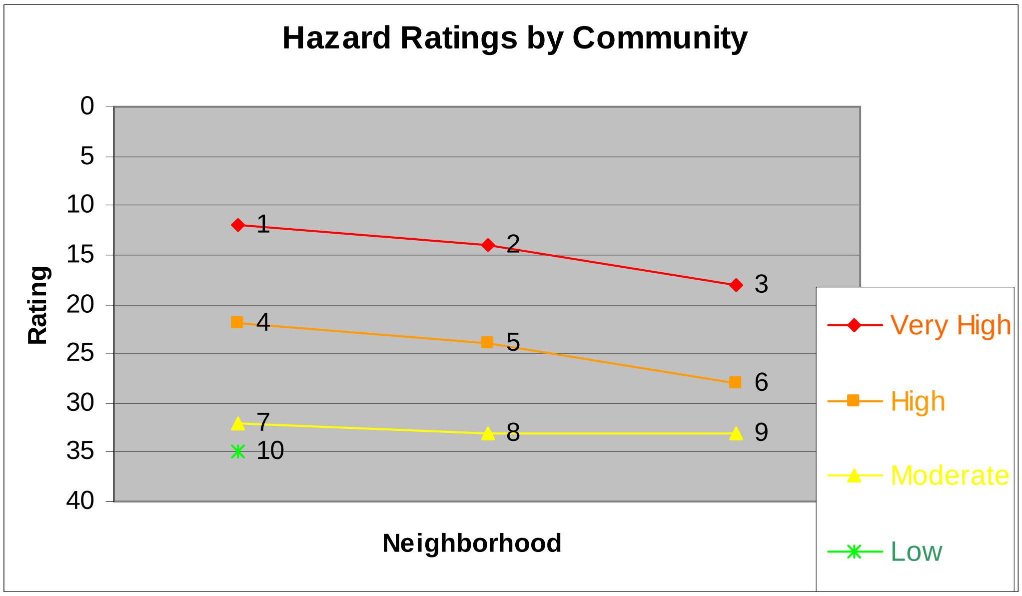


TABLE 1. Communities by Hazard Rating

Hazard Ratings for Berthoud Fire Protection District Communities				
Number	**Community**	**Map Ref.**	**Rank**	**Score**
1	Sprague	B1	**Very High**	12
2	Dakota Ridge	C1	**Very High**	14
3	Hertha Ridge	B1	**Very High**	18
4	Wark	B1	**High**	22
5	27E	B1	**High**	24
6	Homer	A1	**High**	28
7	Cushman Estates	B1	**Moderate**	32
8	Sedona Hills	A1	**Moderate**	33
9	Rainbow Lake Estates	B1	**Moderate**	33
10	Berthoud Estates / Blue Mountain	C1 & B1	**Low**	35

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 uphill or 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 very high hazard level were recommended for a parcel-level analysis. In the high, moderate, and low-level communities, a parcel-level analysis is only recommended if the evaluator found a significant number of homes that had no or ineffective defensible space, or a if 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. Sprague

FIGURE 4.

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 acre
Fuel models found in the neighborhood:	2, 9
Water supply:	None
Hazards:	Steep slopes, inadequate roads, man-made hazards

Description:

- Small to medium sized homes on small to medium sized lots.
- Dominant construction is older wood siding with composite roofs.
- 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.
  - Standing dead timber is abundant in places.
- Access is poor due to the primary access road being one-way in/out. The road condition is narrow, steep, and rocky dirt. Driveways are similar in description.

- Very poor addressing overall – markers are missing or are inconsistent in placement, and have low visibility.

- Manmade hazards such as propane tanks and overhead power lines exist in many places.

- No water supply exists.

- Fuels are mostly shrub and timber with a grass understory (FM 2):
    - Small stands of dense timber exist (FM 9).
    - Moderate amounts of ladder fuels and slash exist.

- The community sits on a east aspect:
    - The majority of the community sits mid to upper slope.

- Carter Lake recreation area is located north of the community.

Sprague Recommendations

- ☐ A parcel-level analysis is recommended.

- ☐ Sprague and Gunn roads' surfaces should be graded smooth and an all weather surface applied to allow fire equipment better access into the subdivision.

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.

- ☐ Extended defensible space (beyond zone 3) 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. For details, 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.

- ☐ Discourage the use of combustible materials for decks and siding, especially where homes are upslope from heavy fuels.

- ☐ Flammable yard clutter (pallets, tires, disabled vehicles) should be removed. If unable to remove, the items can be grouped together and "defensible" space surrounding them created.

- ☐ 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.

- ☐ Ensure that all road signs are made of non-combustible materials.

- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.

- ☐ Make certain all water sources are adequately signed (top of Gunn Road).

2. Dakota Ridge

FIGURE 5.

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:	> 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	None
Hazards:	Steep slopes, ravines, inadequate roads, power lines, propane tanks, limited water supply, wood roofs

Description:

- Small to medium sized homes on large lots
- Mix of old and new construction.
- Dominant construction is wood siding with composite roofs; some wood roofs are present.
  - Decks and 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 due to the primary access road being one-way in/out. The road condition is okay but steep dirt. Driveways are mostly short in length.
- Poor addressing overall – markers are missing or are inconsistent in placement, and have low visibility.

- Manmade hazards such as propane tanks and overhead power lines exist in many places. At least one above-ground fuel tank exists.

- No water supply exists within the community itself. A small cistern and medium sized aqueduct are located at the Rabbit Mountain Open Space trailhead, south of the community.

- This community is a very long travel distance from a Berthoud Fire station.

- Fuels are mostly shrub and timber with a grass understory (FM 2):
    - Moderate amounts of ladder fuels and high amounts of slash exist.

- The community sits on an east aspect:
    - The majority of the community sits mid- to upper-slope.
    - Very complex topography overall.

- The community is bordered by Open Space lands on the south side.

Dakota Ridge 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 (beyond zone 3) 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. For details, 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.
- ☐ 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.
- ☐ Consider installing a community cistern of medium size at the intersection of Moss Rock Drive and Moss Rock Court.
- ☐ Make certain all water sources are adequately signed.
- ☐ A large-animal evacuation plan should be developed where applicable.

3. Hertha Ridge

FIGURE 6.

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:	**>** 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	None
Hazards:	Steep slopes, ravines, long driveways, power lines, propane tanks

Description:

- Medium-sized to large 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 minimal in most cases.
    - Flammable outbuildings are present.
- Access is poor due to the primary road being one-way in/out. Some driveways are very long, narrow, and steep dirt.
- Addressing is inconsistent and non-reflective.
- Manmade hazards such as propane tanks and overhead power lines exist.
- No water supply within the community. Carter Lake is very close.

- Fuels are primarily scattered brush and timber with a grass understory. Jackpots of mature brush exist.
- Topography overall is steep and is on an east aspect. Most homes sit mid-slope.
- Carter Lake recreation area is located north of the community.

Hertha Ridge 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 (beyond zone 3) 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. For details, 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.
- ☐ Discourage the use of combustible materials for decks and siding, 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.
- ☐ A proper road sign made of non-combustible and reflective material should be installed at the entrance.
- ☐ Ensure that all responding agencies have the entrance gate code.
- ☐ A large-animal evacuation plan should be developed if applicable.

4. Wark

FIGURE 7.

Hazard Rating:	High
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 Acre
Fuel models found in the neighborhood:	1
Water supply:	None
Hazards:	Very poor addressing, inadequate roads, manmade hazards, yard clutter

Description:

- Small to medium sized homes on small lots.
- Older construction is dominant with wood siding and composite roofs, one wood shake roofs exists.
  - Decks and other structural projections built over flammable vegetation.
- Some homes have adequate defensible space.
  - Dangerous yard clutter and flammable outbuildings exist.
- Road conditions are dirt and poor. Driveways are short.
- Addressing is generally poor. The markers that do exist are not consistent or reflective.
- Manmade hazards such as propane tanks and overhead power lines exist.
- No water supply. Carter Lake is within one mile.
- Continuous grass.

- The community sits at the base of a west slope.
- Carter Lake recreation area is located north of the community.

Wark Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ Discourage the use of combustible materials for decks, siding, and roofs. Replace 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 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.
- ☐ A large-animal evacuation plan should be developed where applicable.

5. 27 E Road

FIGURE 8.

Hazard Rating:	High
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:	> 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	Hydrants
Hazards:	Propane tanks, overhead power lines

Description:

- Medium sized homes on large lots.
- Construction is mainly wood siding with composite roofs, a couple wood roofs.
  - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
- Main access road is dirt, but good condition. Some very long driveways exist.
- Addressing is generally poor. The markers that do exist are inconsistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a fire hydrant system.
- The primary fuel is grass. Brush in moderate loads with some timber also exists.

- The community sits primarily in a North/South valley. Some homes are located on the upper slopes (east aspect) and some are ridge top. The slope is approximately 30%.

27 E Road Recommendations

- ☐ A parcel-level analysis is recommended for the homes on the upper east slope and ridge tops.
- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- ☐ Extended defensible space (beyond zone 3) 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. For details, 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.
- ☐ 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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

6. Homer

FIGURE 9.

Hazard Rating:	High
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
Water supply:	One hydrant
Hazards:	Propane tanks, overhead power lines

Description:

- Small to medium sized homes on medium sized lots.
- Construction is mainly wood siding with composite roofs.
  - Decks and other structural projections built over flammable vegetation exist.
- Many homes do not have adequate defensible space.
- Main access road is dirt, but steep and rocky in places.
- Addressing is generally poor. The markers that do exist are inconsistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a single fire hydrant.
- Fuels are primarily grass (FM 1).
- The community sits on an east aspect. Most homes sit at the base.

Homer Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ 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 and siding.
- ☐ 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 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.
- ☐ Consider installing additional hydrants.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

7. Cushman Estates

FIGURE 10.

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
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
Water supply:	Hydrants
Hazards:	Short, steep slopes

Description:

- Medium sized homes on medium sized lots.
- Construction is mainly wood siding with composite roofs, a couple wood roofs.
  - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
- Main access road is dirt, but steep in places. One way in / out.
- Addressing is generally poor. The markers that do exist are not consistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a fire hydrant system.
- The primary fuel is short grass. A riparian area is near the entrance.

- Topography is rolling but is mostly on an east aspect. Short and steep hills exist in some places.

Cushman Estates Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ 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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

8. Sedona Hills

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:	> 5 acres
Fuel models found in the neighborhood:	1, 2, 5
Water supply:	Hydrants
Hazards:	Steep slopes, power lines

Description:

- Medium sized to large homes on large lots.
- Homes are mostly new construction. Some wood siding with composite roofs.
  - Decks and projections over flammable vegetation.
- Defensible space is generally good.
- Most access roads are paved. Kiva Ridge Drive, however, is dirt, steep, and one-way in/out.
- Addressing is present, but not reflective.
- Overhead power lines exist on Kiva Ridge Drive.
- Water supply is via fire hydrants.
- Fuels are grass with brush. Some heavy jackpots of mature brush (FM 5).

- The community is very large (50% resides in the Loveland Fire District). The topography runs along two North/South ridges with the valleys having most of the homes in them.

- A community (within the Loveland Fire District) which sits at the NE corner of Carter Lake borders the community on the west side.

Sedona Hills Recommendations

- ☐ Adequate defensible space is recommended for all homes. 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 and siding.
- ☐ 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 **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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

9. Rainbow Lake Estates

FIGURE 12.

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
Water supply:	Hydrants
Hazards:	None

Description:

- Large homes on medium sized lots.
- Homes are newer construction. Wood siding with composite roofs.
- Defensible space is generally good.
- Access roads are paved.
- Addressing is present for most residences, but is not reflective.
- Water supply is via a fire hydrant system.
- Fuels are mostly short grass.
- Topography is mostly flat.

Rainbow Lake Estates Recommendations

- ☐ Adequate defensible space is recommended for all homes. 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 and siding.

- ☐ 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 **Home Mitigation FMU** section in the main report.

- ☐ Ensure that all road signs and attachments are made of non-combustible materials.

- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.

- ☐ Keep vegetation mowed around fire hydrants.

- ☐ A large-animal evacuation plan should be developed where applicable.
- ☐
- ☐ 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.

10. Berthoud Estates / Blue Mountain

FIGURE 13.

Hazard Rating:	Low
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
Water supply:	Hydrants
Hazards:	Propane tanks, overhead power lines

Description:

- Medium sized homes on medium sized lots.
- Wood siding with composite roofs.
- Defensible space is generally good.
- Access roads are paved.
- Addressing is present for most residences, but is not reflective.
- Water supply is via a fire hydrant system.
- Fuels are mostly grass.
- Topography is mostly flat.

Berthoud Estates / Blue Mountain 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 and siding.

- □ 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 **Home Mitigation FMU** section in the main report.

- □ Ensure that all road signs and attachments are made of non-combustible materials.

- □ Add reflective addressing made of non-combustible materials to all driveways and homes.

- □ Keep vegetation mowed around fire hydrants.

- □ A large-animal evacuation plan should be developed where applicable.

BERTHOUD FIRE PROTECTION DISTRICT CWPP

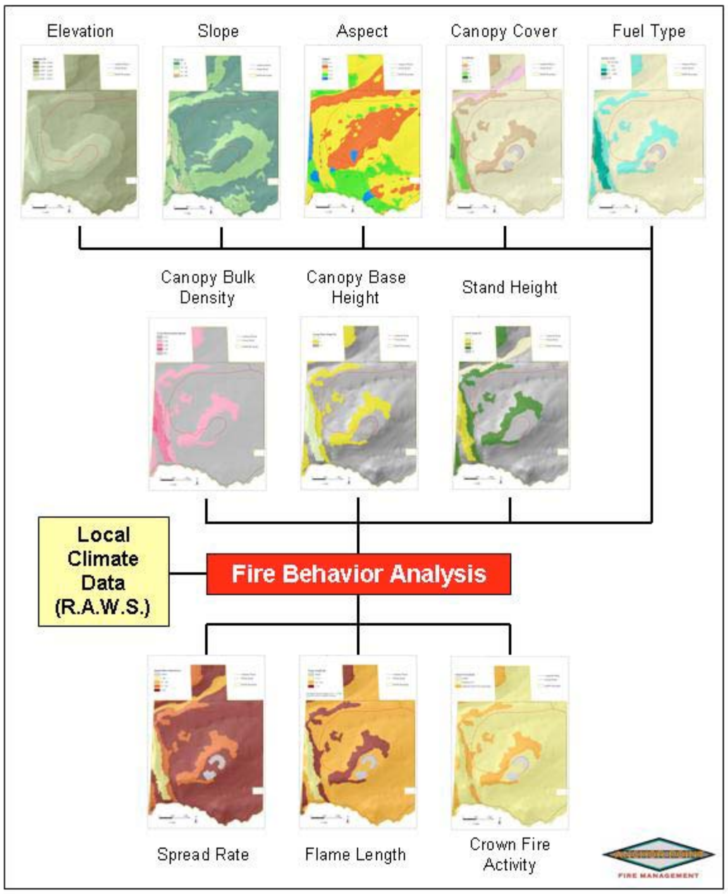
APPENDIX A

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 FlamMap[1], 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 BEHAVE[2] 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
- Fuels are continuous and uniform
- Fires are surface fires

FlamMap

Anchor Point uses FlamMap to evaluate the potential fire conditions in the fire behavior study area. Berthoud Fire Protection District (BFPD) encompasses 63,150 acres (99 square miles). The study area for the fire behavior analysis covers approximately 29,488 acres (46 square miles). This area includes the study area of the Fire District 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 calculated from the Redstone 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.

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[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).

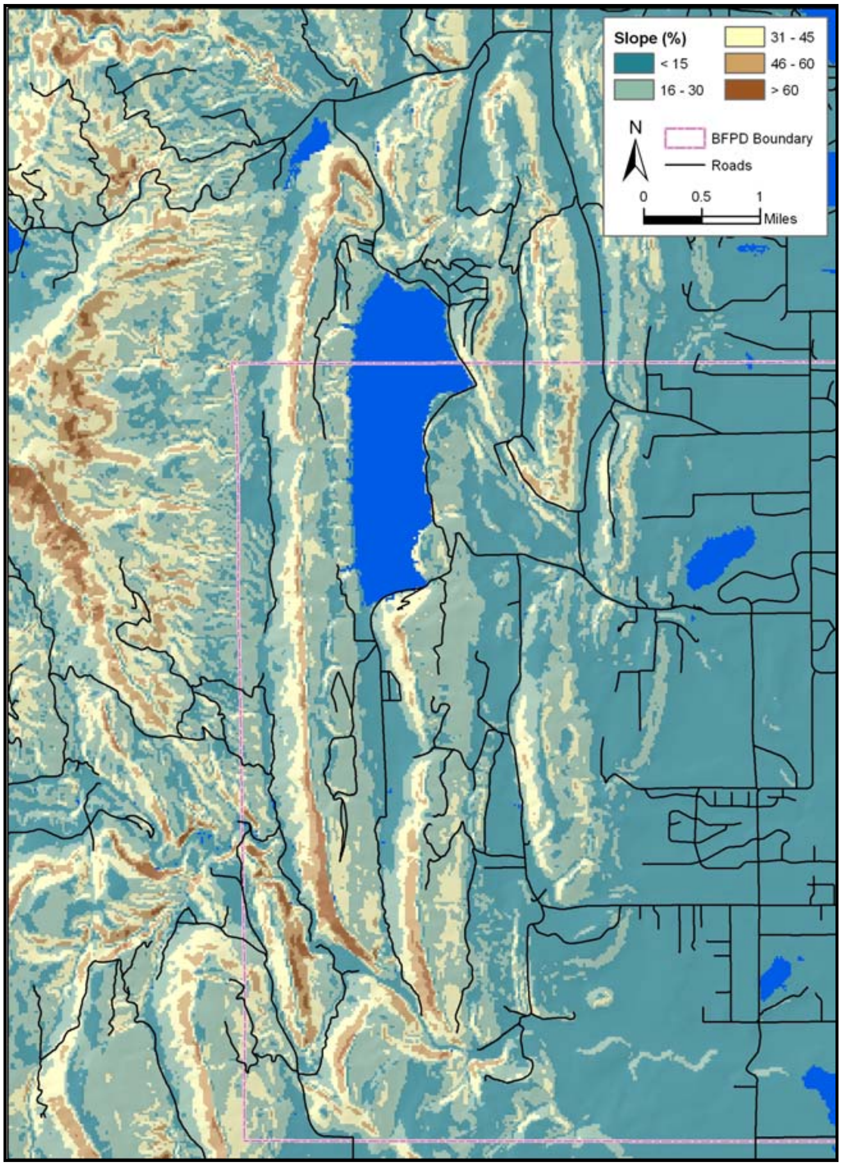
[2] Patricia L. Andrews, producer and designer, Collin D. Bevins, programmer and designer, The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) and Systems for Environmental Management (Missoula, Montana).

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

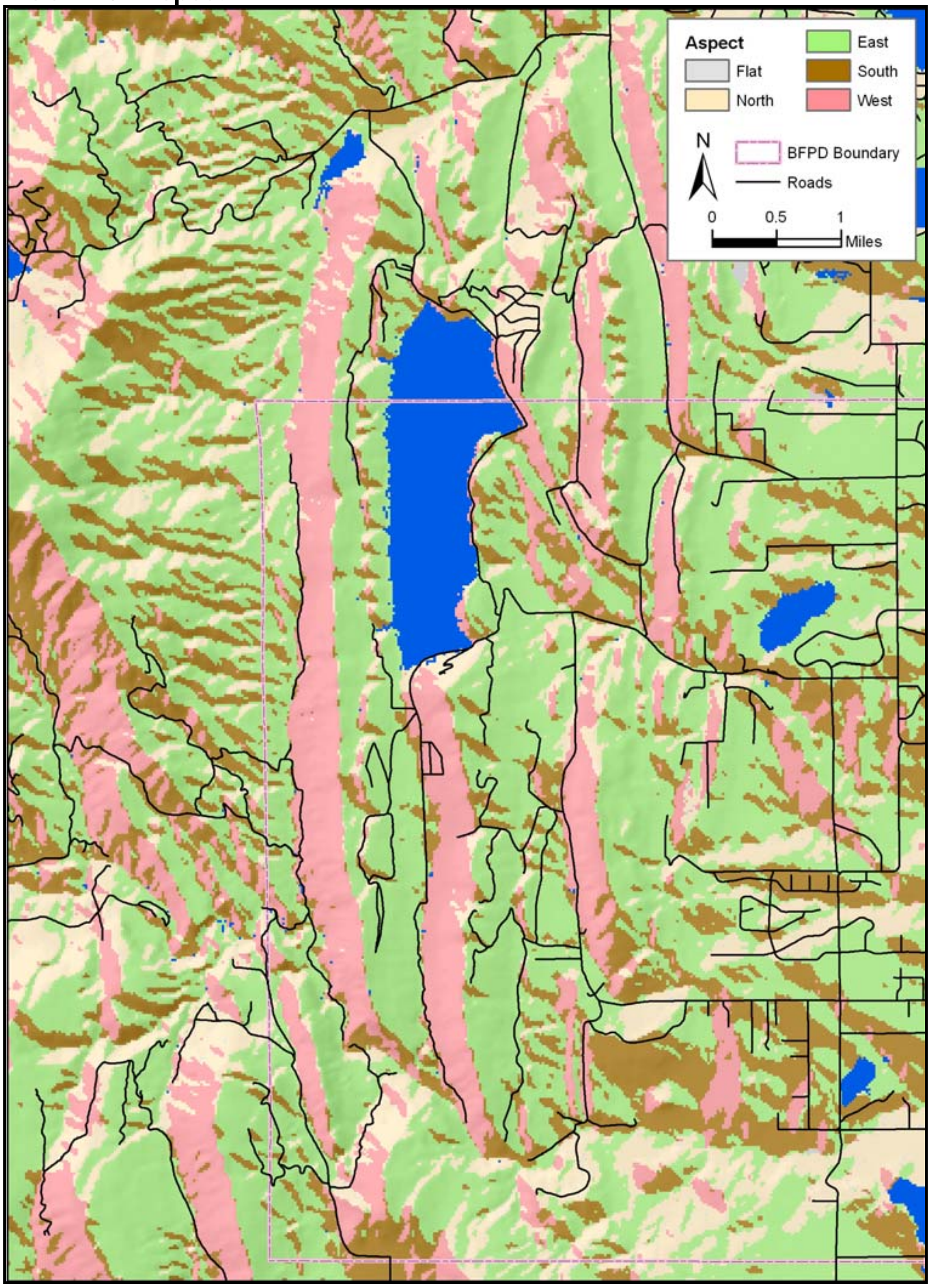
The major factors influencing fire behavior are fuels (type and coverage), weather, and topography (aspect, slope, and elevation). The following pages contain a brief explanation of each.

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.

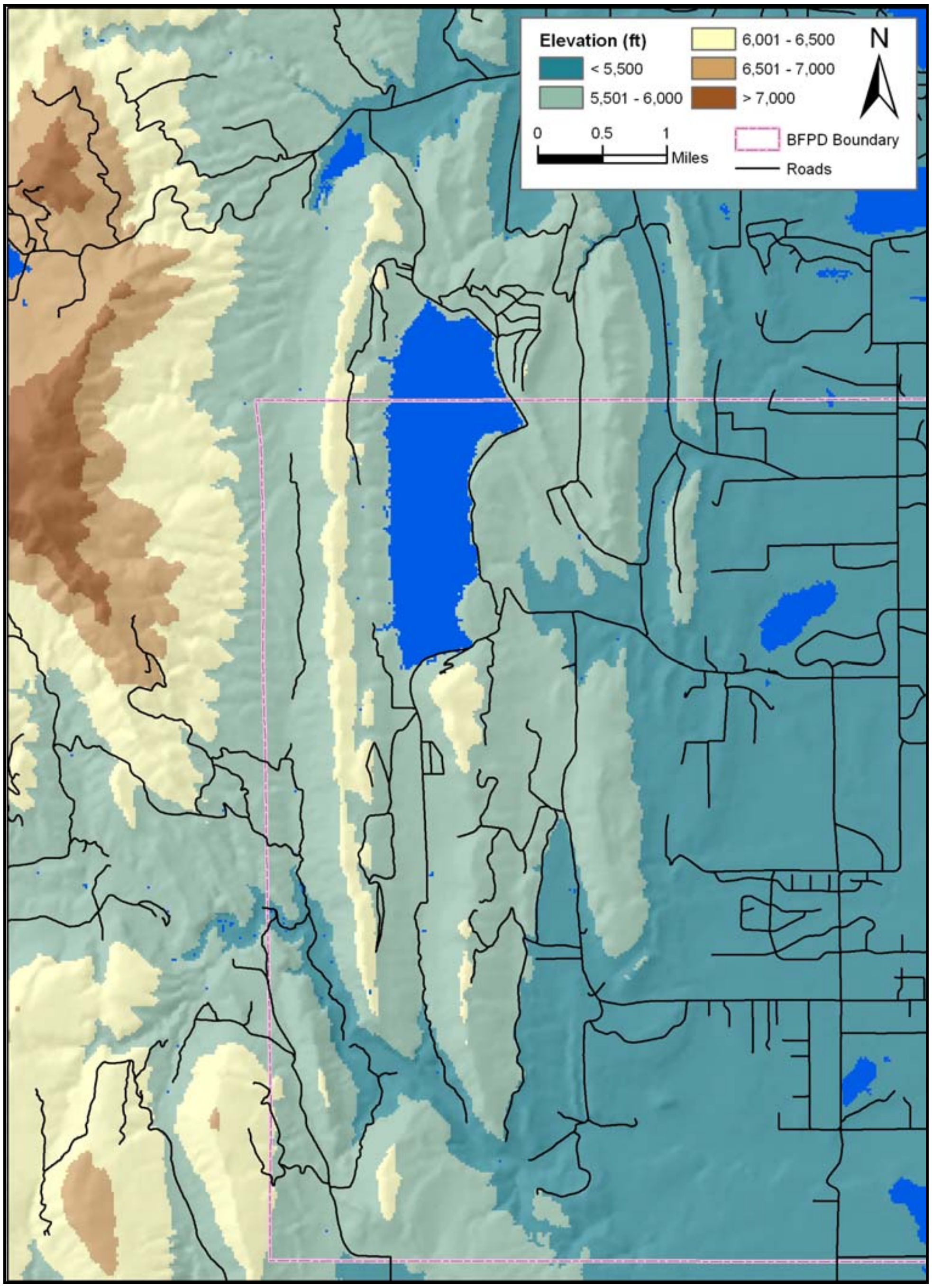
FIGURE 3. Aspect



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 7,000′. 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. Unless otherwise noted, 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.

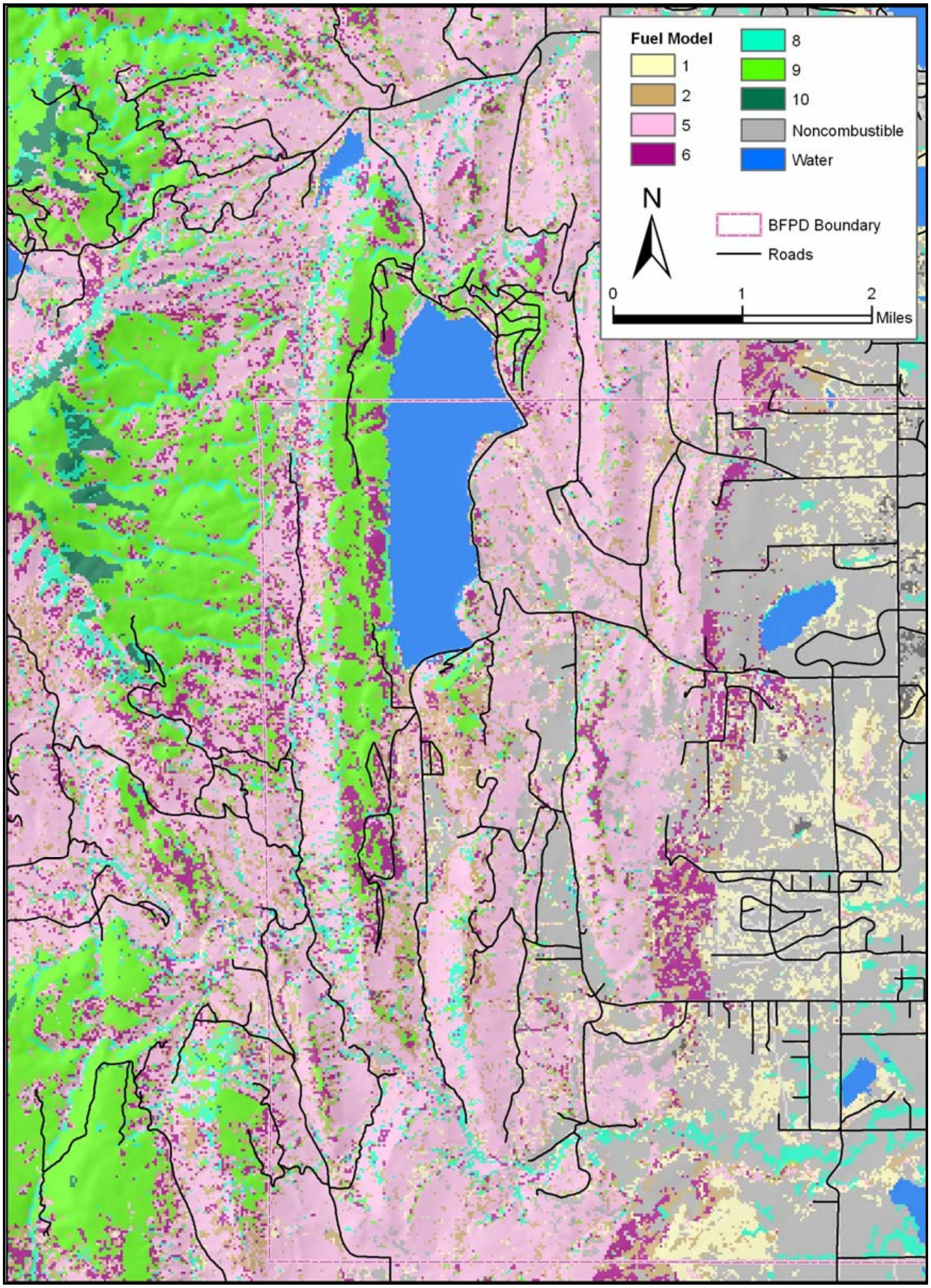
Vegetation for the project area may or may not be specifically listed in the description*.*

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.

[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. Berthoud Fire Protection District Fuel Models



FUEL MODEL 1[4]

FIGURE 6. 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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	28.8	92.9	203.6	362.4	570.1	665.6
4.0	22	71.1	155.7	277	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	35.6	64.8	64.8	64.8	64.8

10-hr fuel = 6%, 100-hr fuel = 10%, herbaceous fuel moisture = 39%, slope = 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3	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	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 2[5]

FIGURE 7. Open canopy shrubs with grass understory

Characteristics

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

Common Types/Species

Generally, open shrub lands and pine stands, or scrub oak stands that cover one third to two thirds of the area, 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—as well as 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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	15.5	42.8	84.6	139.9	208.1	288.6
4.0	12.7	35	69.1	114.3	170	235.7
6.0	11.3	31	61.3	101.3	150.7	209
8.0	10.4	28.5	56.4	93.2	138.6	192.2
10.0	9.3	25.6	50.5	83.6	124.3	172.3
12.0	7.5	20.5	40.6	67.1	99.7	138.3

10-hr fuel 6%, 100= 10%, herbaceous fuel moisture = 39%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.8	7.7	10.5	13.2	15.9	18.5
4.0	4.1	6.6	9	11.3	13.6	15.8
6.0	3.8	6	8.2	10.4	12.5	14.5
8.0	3.6	5.7	7.8	9.9	11.8	13.8
10.0	3.3	5.3	7.2	9.1	11	12.7
12.0	2.8	4.4	6.1	7.6	9.2	10.6

FUEL MODEL 3[3]

FIGURE 8. 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.

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[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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
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 6%, 100= 10%, herbaceous fuel moisture = 39%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
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 5[6]

FIGURE 9. 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.

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[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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	11	25.6	43.5	63.9	86.5	110.9
4.0	10	23.3	39.7	58.3	79	101.3
6.0	9.3	21.5	36.6	53.7	72.7	93.3
8.0	8.1	18.8	32	47.1	63.7	81.7
10.0	5.2	12.1	20.5	30.2	40.8	52.4
12.0	2.9	6.8	11.6	17	22.4	22.4

10-hr fuel 6%, 100 = 10%, herbaceous fuel moisture = 39%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.6	6.8	8.7	10.4	11.9	13.4
4.0	4.3	6.3	8	9.6	11	12.4
6.0	4	5.9	7.5	8.9	10.3	11.5
8.0	3.5	5.2	6.7	7.9	9.1	10.2
10.0	2.4	3.5	4.4	5.3	6.1	6.8
12.0	1.4	2.1	2.6	3.1	3.6	3.6

FUEL MODEL 8[3]

FIGURE 10. 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					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	1.1	2.3	3.8	5.7	7.8	10
	4.0	0.9	1.9	3.1	4.6	6.3	6.7
	6.0	0.7	1.6	2.6	3.9	4.9	4.9
	8.0	0.6	1.3	2.3	3.3	3.8	3.8
	10.0	0.6	1.2	2	3	3.1	3.1
	12.0	0.5	1.1	1.8	2.7	2.7	2.7

10 hr fuel=6, 100 hr fuel=10 herbaceous fuel moisture=39 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	0.9	1.3	1.6	2	2.3	2.6
	4.0	0.8	1.1	1.4	1.7	1.9	2
	6.0	0.7	1	1.2	1.5	1.6	1.6
	8.0	0.6	0.9	1.1	1.3	1.4	1.4
	10.0	0.6	0.8	1	1.2	1.3	1.3
	12.0	0.5	0.8	1	1.2	1.2	1.2

FUEL MODEL 9[4]

FIGURE 11. 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.

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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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	4	9.7	18.1	28.7	41.5	56.2
4.0	3.1	7.7	14.3	22.7	32.7	44.3
6.0	2.6	6.4	11.8	18.7	27.1	36.7
8.0	2.3	5.5	10.2	16.3	23.5	31.8
10.0	2	5	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=6, 100 hr fuel=10%, herbaceous fuel moisture=39%, slope=10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed 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	6.6
6.0	1.7	2.5	3.4	4.2	5	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	4.6

Fuel Model 10[5]

FIGURE 12. 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.

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[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)

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.2	9.1	15.2	22.2	30.1	38.7
4.0	3.7	8	13.4	19.7	26.6	34.2
6.0	3.3	7.3	12.2	17.8	24.1	31
8.0	3.1	6.7	11.3	16.5	22.4	28.8
10.0	2.9	6.3	10.6	15.6	21.1	27.1
12.0	2.8	6	10.1	14.8	20.1	25.8

10 hr fuel=6%, 100 hr fuel=10%, herbaceous fuel moisture=39%, slope=10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	4	5.8	7.3	8.7	10	11.3
4.0	3.7	5.2	6.6	7.9	9.1	10.2
6.0	3.4	4.8	6.1	7.3	8.4	9.4
8.0	3.2	4.5	5.8	6.9	7.9	8.9
10.0	3	4.4	5.5	6.6	7.6	8.5
12.0	2.9	4.2	5.3	6.4	7.3	8.2

Reference Weather Used in the Fire Behavior Potential Evaluation

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

Redstone Site Information

Latitude (dd mm ss)	40 ° 34 ' 15.6 " N
Longitude (dd mm ss)	105 ° 13 ' 37.2 " W
Elevation (ft.)	6,160

Weather observations from the Redstone RAWS were averaged for a six-year period (2001-2006) to calculate these conditions. The moderate conditions class (16^{th} to 89^{th} 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 97^{th} 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	17 mph
Herbaceous fuel moisture	39%
Woody fuel moisture	85%
100-hr fuel moisture	10%
10-hr fuel moisture	6%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	26 mph
Herbaceous fuel moisture	28%
Woody fuel moisture	75%
100-hr fuel moisture	7%
10-hr fuel moisture	4%

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 wind at 20 feet, 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.

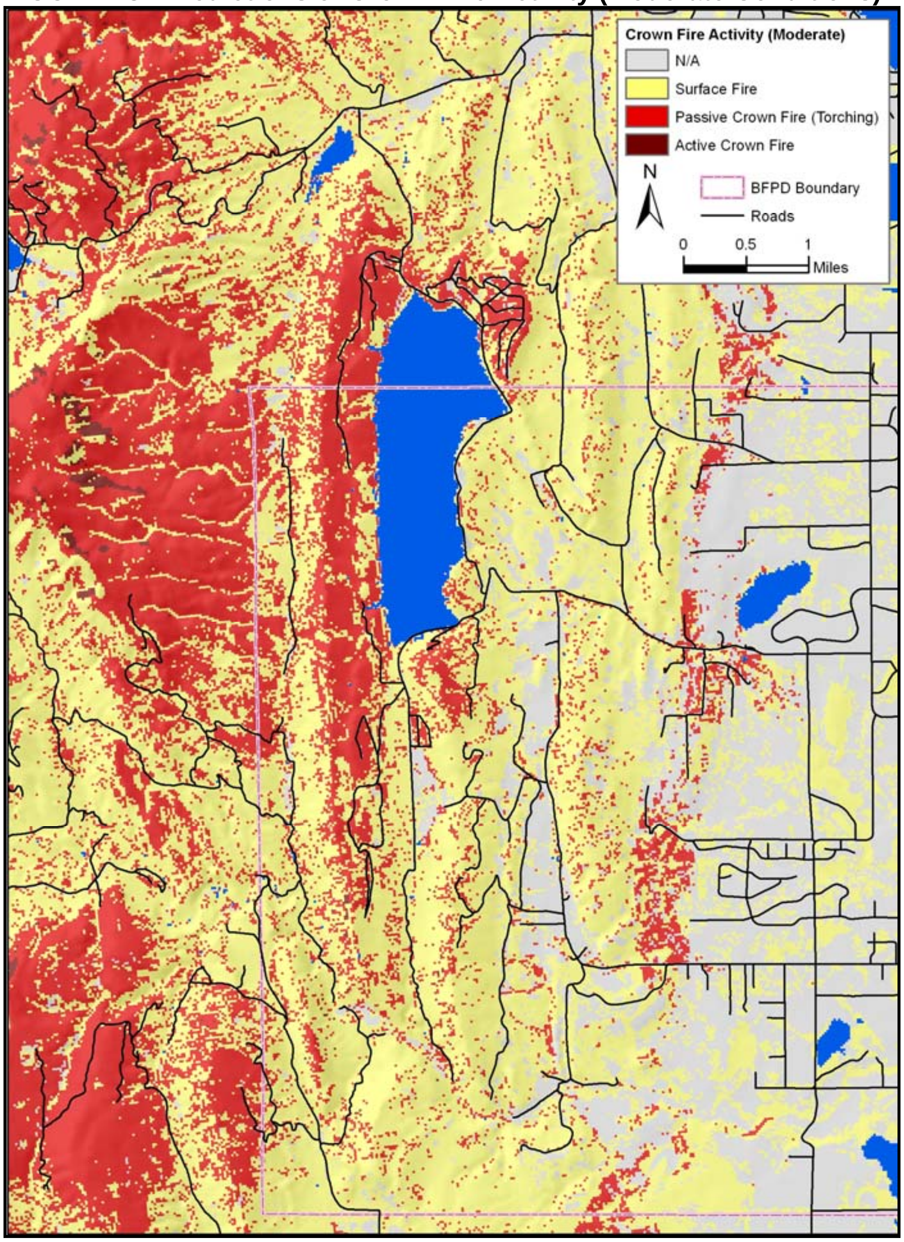
Live Fuel Moisture

Live fuel Moisture is the amount of water in a fuel, expressed as a percentage 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 13. Predictions of Crown Fire Activity (Moderate 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 14. Predictions of Crown Fire Activity (Extreme Conditions)

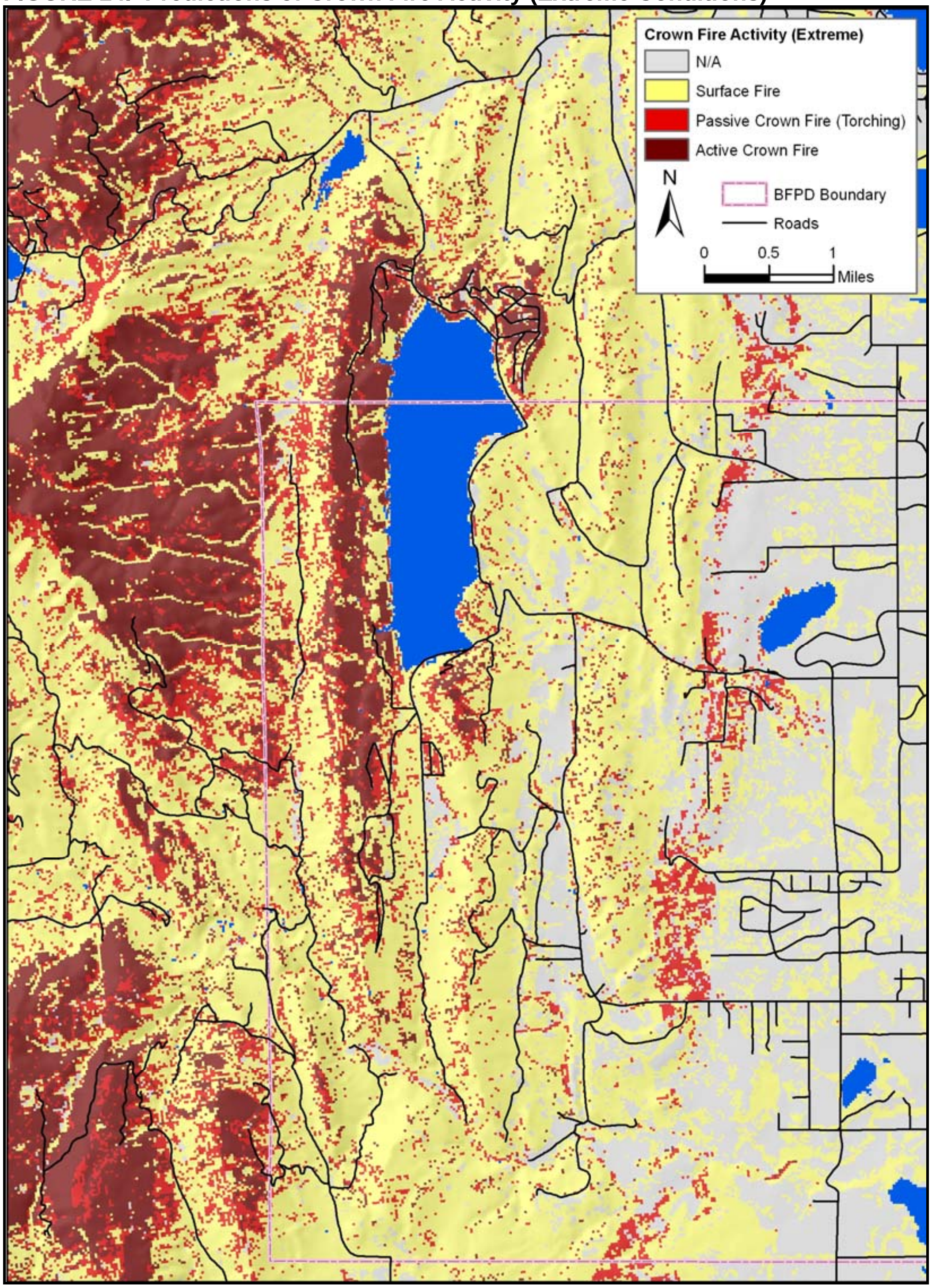
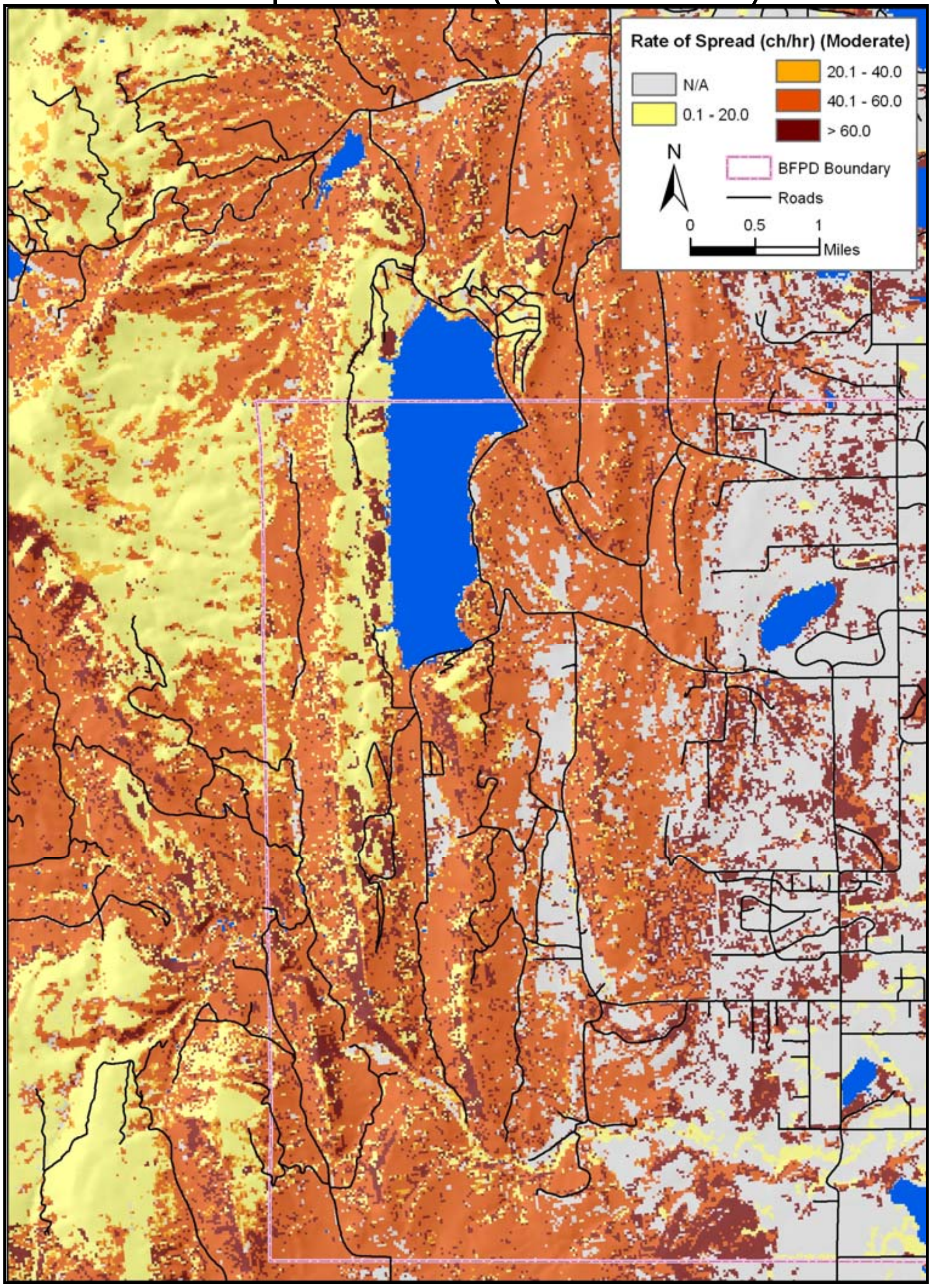


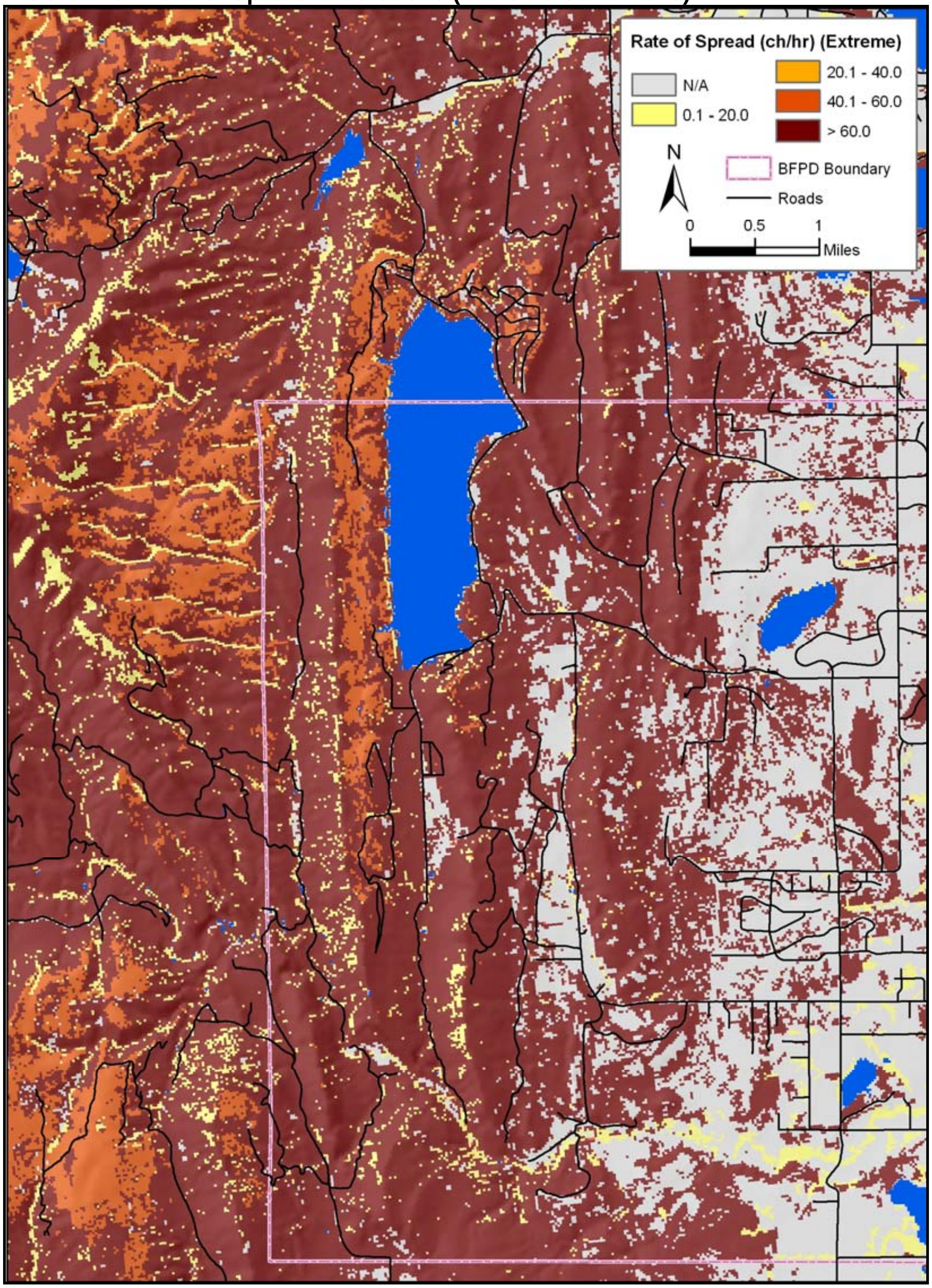
FIGURE 15. Rate of Spread Predictions (Moderate Conditions)



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

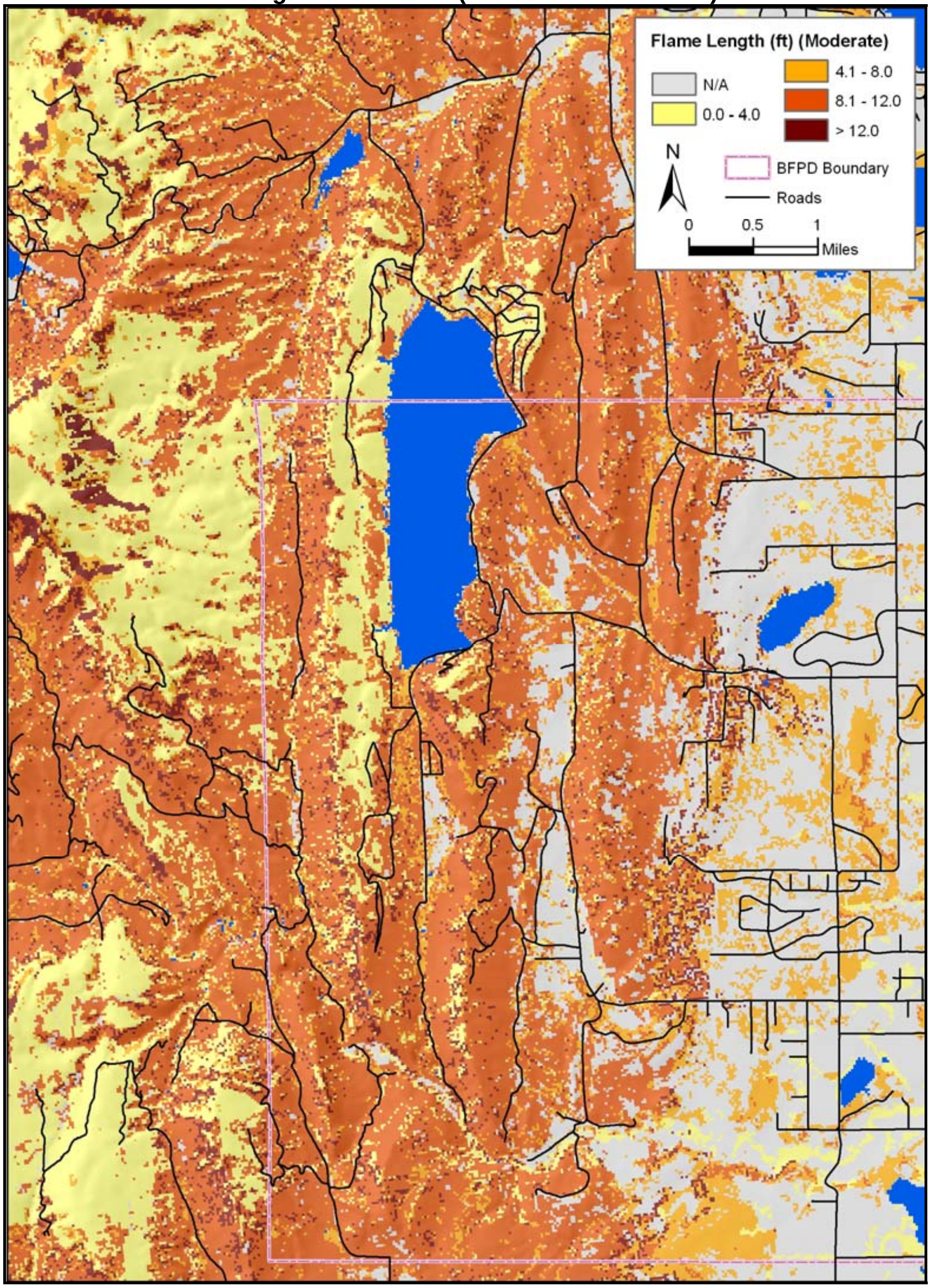
Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains. 1 ch/h equals approximately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

FIGURE 16. Rate of Spread Predictions (Extreme Conditions)



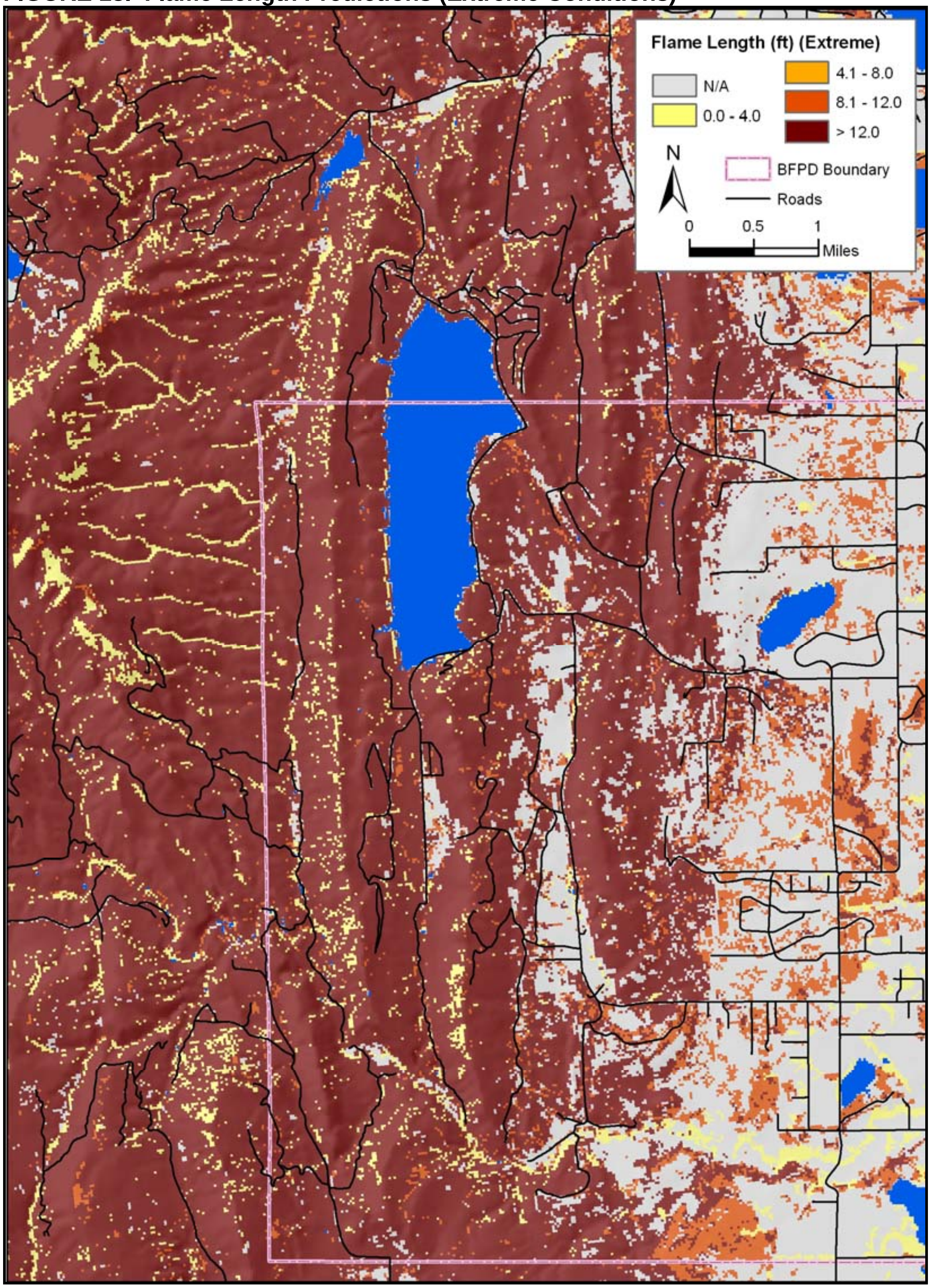
Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

FIGURE 17. Flame Length Predictions (Moderate 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 18. Flame Length Predictions (Extreme Conditions)



Fire Behavior Interpretation and Limitations

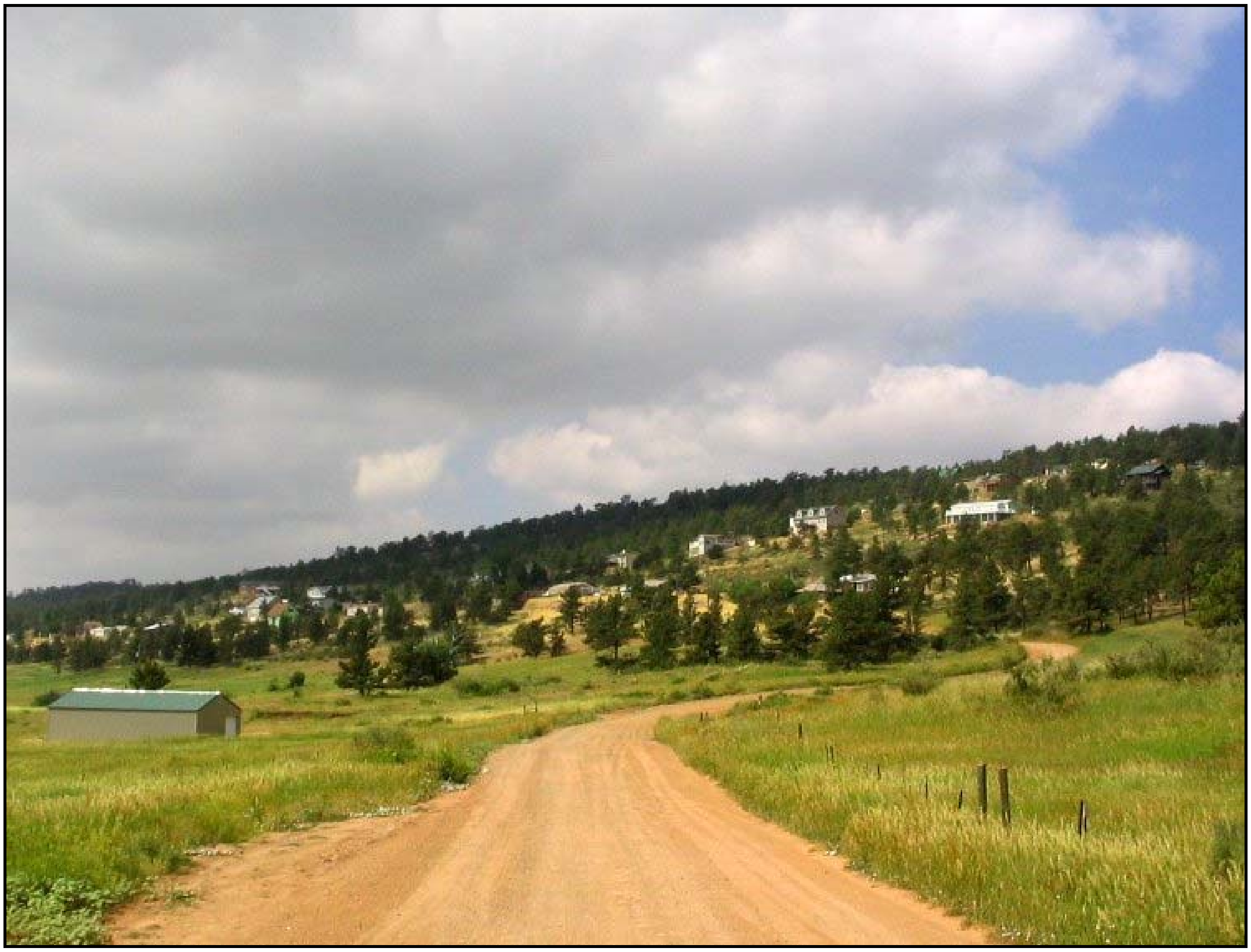
This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point source ignition at every point. It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability that a wildfire will 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.

BERTHOUD FIRE PROTECTION DISTRICT CWPP

APPENDIX B

COMMUNITIES



The purpose of this appendix is to examine in greater detail the communities in the study area. Of the ten communities in the Berthoud Fire Protection District, three were found to represent a very high hazard; three were rated as high hazard, three as moderate hazard and one as low hazard (see **Figure 1**). For easy reference, the map of communities presented in the main text has been reproduced here as **Figure 2**. **Figure 3** displays this grouping graphically. **Table 1** has been included for quick identification.

FIGURE 1.

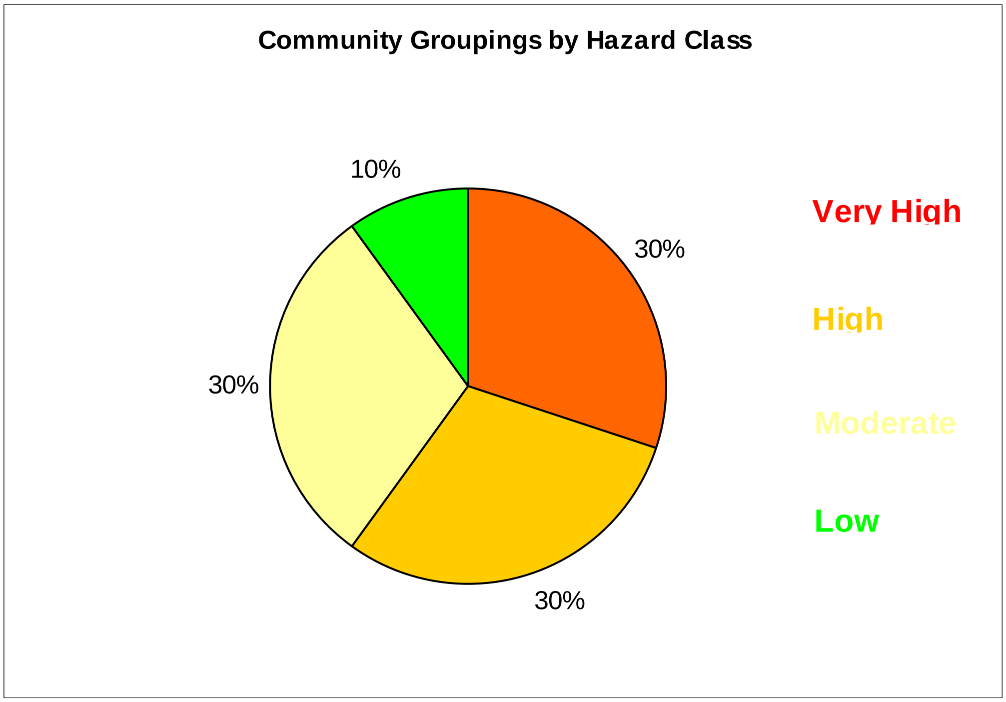

Community Groupings by Hazard Class
10%
30%
30%
30%
Very High
High
Moderate
Low

FIGURE 2.

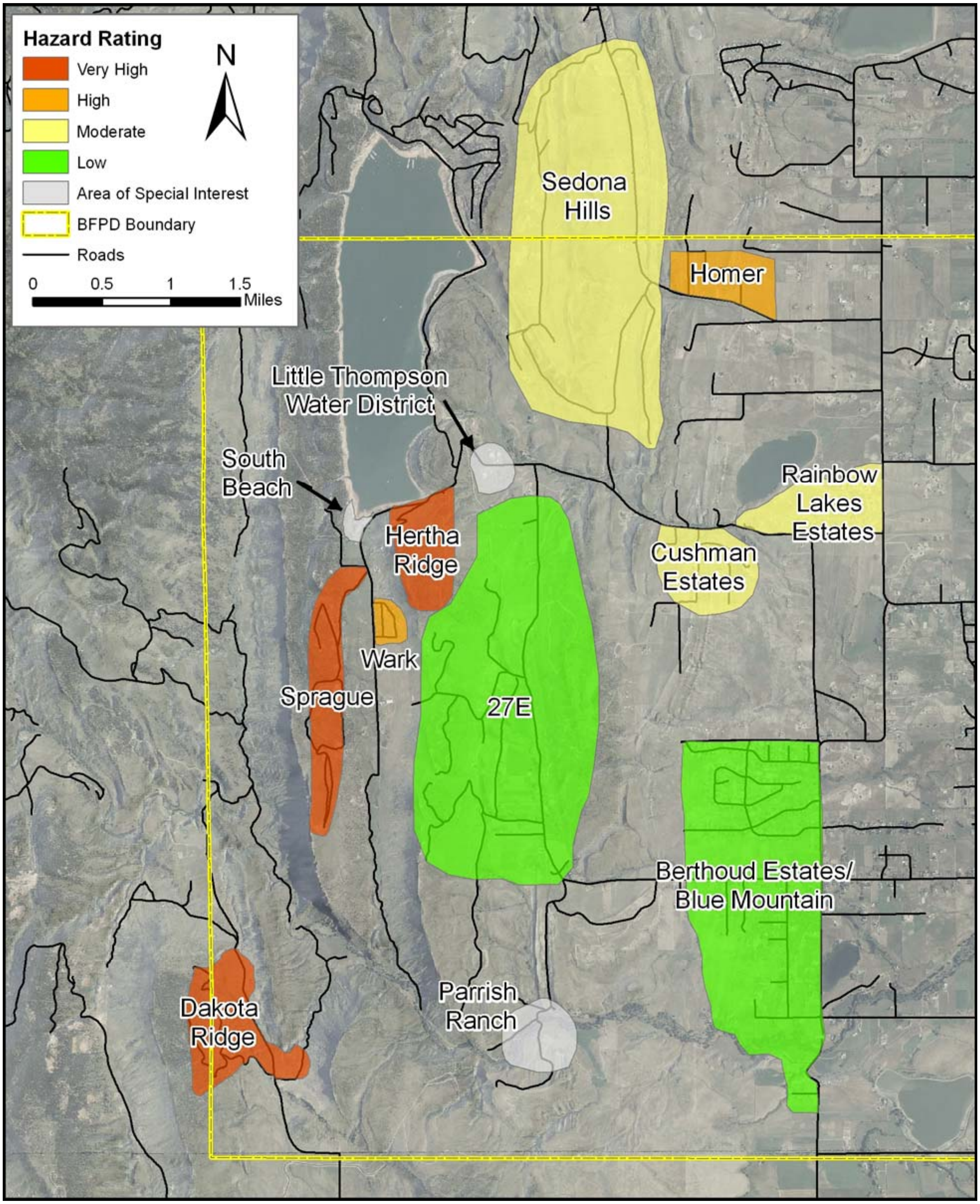

Hazard Rating
Very High
High
Moderate
Low
Area of Special Interest
BFPD Boundary
Roads
0
0.5
1
1.5
Miles
N
Sedona Hills
Homer
Little Thompson Water District
South Beach
Rainbow Lakes Estates
Hertha Ridge
Cushman Estates
Wark
Sprague
27E
Berthoud Estates/ Blue Mountain
Parrish Ranch
Dakota Ridge

FIGURE 3.

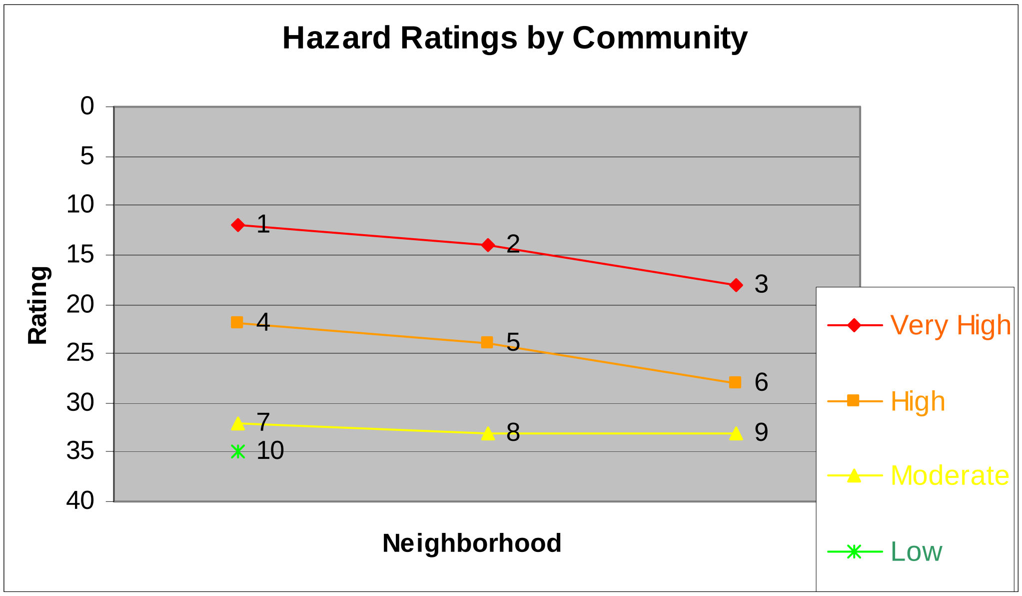


TABLE 1. Communities by Hazard Rating

Hazard Ratings for Berthoud Fire Protection District Communities				
Number	**Community**	**Map Ref.**	**Rank**	**Score**
1	Sprague	B1	**Very High**	12
2	Dakota Ridge	C1	**Very High**	14
3	Hertha Ridge	B1	**Very High**	18
4	Wark	B1	**High**	22
5	27E	B1	**High**	24
6	Homer	A1	**High**	28
7	Cushman Estates	B1	**Moderate**	32
8	Sedona Hills	A1	**Moderate**	33
9	Rainbow Lake Estates	B1	**Moderate**	33
10	Berthoud Estates / Blue Mountain	C1 & B1	**Low**	35

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 uphill or 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 very high hazard level were recommended for a parcel-level analysis. In the high, moderate, and low-level communities, a parcel-level analysis is only recommended if the evaluator found a significant number of homes that had no or ineffective defensible space, or a if 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.

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

Communities

1. Sprague

FIGURE 4.

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 acre
Fuel models found in the neighborhood:	2, 9
Water supply:	None
Hazards:	Steep slopes, inadequate roads, man-made hazards

Description:

- Small to medium sized homes on small to medium sized lots.
- Dominant construction is older wood siding with composite roofs.
- 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.
  - Standing dead timber is abundant in places.
- Access is poor due to the primary access road being one-way in/out. The road condition is narrow, steep, and rocky dirt. Driveways are similar in description.

- Very poor addressing overall – markers are missing or are inconsistent in placement, and have low visibility.

- Manmade hazards such as propane tanks and overhead power lines exist in many places.

- No water supply exists.

- Fuels are mostly shrub and timber with a grass understory (FM 2):
  - Small stands of dense timber exist (FM 9).
  - Moderate amounts of ladder fuels and slash exist.

- The community sits on a east aspect:
  - The majority of the community sits mid to upper slope.

- Carter Lake recreation area is located north of the community.

Sprague Recommendations

- ☐ A parcel-level analysis is recommended.
- ☐ Sprague and Gunn roads' surfaces should be graded smooth and an all weather surface applied to allow fire equipment better access into the subdivision.
- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- ☐ Extended defensible space (beyond zone 3) 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. For details, 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.
- ☐ Discourage the use of combustible materials for decks and siding, especially where homes are upslope from heavy fuels.
- ☐ Flammable yard clutter (pallets, tires, disabled vehicles) should be removed. If unable to remove, the items can be grouped together and "defensible" space surrounding them created.
- ☐ 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.
- ☐ Ensure that all road signs are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Make certain all water sources are adequately signed (top of Gunn Road).

2. Dakota Ridge

FIGURE 5.

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:	> 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	None
Hazards:	Steep slopes, ravines, inadequate roads, power lines, propane tanks, limited water supply, wood roofs

Description:

- Small to medium sized homes on large lots
- Mix of old and new construction.
- Dominant construction is wood siding with composite roofs; some wood roofs are present.
  - Decks and 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 due to the primary access road being one-way in/out. The road condition is okay but steep dirt. Driveways are mostly short in length.
- Poor addressing overall – markers are missing or are inconsistent in placement, and have low visibility.

- Manmade hazards such as propane tanks and overhead power lines exist in many places. At least one above-ground fuel tank exists.

- No water supply exists within the community itself. A small cistern and medium sized aqueduct are located at the Rabbit Mountain Open Space trailhead, south of the community.

- This community is a very long travel distance from a Berthoud Fire station.

- Fuels are mostly shrub and timber with a grass understory (FM 2):
    - Moderate amounts of ladder fuels and high amounts of slash exist.

- The community sits on an east aspect:
    - The majority of the community sits mid- to upper-slope.
    - Very complex topography overall.

- The community is bordered by Open Space lands on the south side.

Dakota Ridge 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 (beyond zone 3) 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. For details, 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.
- ☐ 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.
- ☐ Consider installing a community cistern of medium size at the intersection of Moss Rock Drive and Moss Rock Court.
- ☐ Make certain all water sources are adequately signed.
- ☐ A large-animal evacuation plan should be developed where applicable.

3. Hertha Ridge

FIGURE 6.

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:	**>** 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	None
Hazards:	Steep slopes, ravines, long driveways, power lines, propane tanks

Description:

- Medium-sized to large 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 minimal in most cases.
  - Flammable outbuildings are present.
- Access is poor due to the primary road being one-way in/out. Some driveways are very long, narrow, and steep dirt.
- Addressing is inconsistent and non-reflective.
- Manmade hazards such as propane tanks and overhead power lines exist.
- No water supply within the community. Carter Lake is very close.

- Fuels are primarily scattered brush and timber with a grass understory. Jackpots of mature brush exist.
- Topography overall is steep and is on an east aspect. Most homes sit mid-slope.
- Carter Lake recreation area is located north of the community.

Hertha Ridge 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 (beyond zone 3) 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. For details, 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.
- ☐ Discourage the use of combustible materials for decks and siding, 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.
- ☐ A proper road sign made of non-combustible and reflective material should be installed at the entrance.
- ☐ Ensure that all responding agencies have the entrance gate code.
- ☐ A large-animal evacuation plan should be developed if applicable.

4. Wark

FIGURE 7.

Hazard Rating:	High
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 Acre
Fuel models found in the neighborhood:	1
Water supply:	None
Hazards:	Very poor addressing, inadequate roads, manmade hazards, yard clutter

Description:

- Small to medium sized homes on small lots.
- Older construction is dominant with wood siding and composite roofs, one wood shake roofs exists.
  - Decks and other structural projections built over flammable vegetation.
- Some homes have adequate defensible space.
  - Dangerous yard clutter and flammable outbuildings exist.
- Road conditions are dirt and poor. Driveways are short.
- Addressing is generally poor. The markers that do exist are not consistent or reflective.
- Manmade hazards such as propane tanks and overhead power lines exist.
- No water supply. Carter Lake is within one mile.
- Continuous grass.

- The community sits at the base of a west slope.
- Carter Lake recreation area is located north of the community.

Wark Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ Discourage the use of combustible materials for decks, siding, and roofs. Replace 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 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.
- ☐ A large-animal evacuation plan should be developed where applicable.

5. 27 E Road

FIGURE 8.

Hazard Rating:	**High**
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:	> 5 acres
Fuel models found in the neighborhood:	1, 2
Water supply:	Hydrants
Hazards:	Propane tanks, overhead power lines

Description:

- Medium sized homes on large lots.
- Construction is mainly wood siding with composite roofs, a couple wood roofs.
    - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
- Main access road is dirt, but good condition. Some very long driveways exist.
- Addressing is generally poor. The markers that do exist are inconsistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a fire hydrant system.
- The primary fuel is grass. Brush in moderate loads with some timber also exists.

- The community sits primarily in a North/South valley. Some homes are located on the upper slopes (east aspect) and some are ridge top. The slope is approximately 30%.

27 E Road Recommendations

- ☐ A parcel-level analysis is recommended for the homes on the upper east slope and ridge tops.
- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Home Mitigation FMU** in the main report.
- ☐ Extended defensible space (beyond zone 3) 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. For details, 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.
- ☐ 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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

6. Homer

FIGURE 9.

Hazard Rating:	High
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
Water supply:	One hydrant
Hazards:	Propane tanks, overhead power lines

Description:

- Small to medium sized homes on medium sized lots.
- Construction is mainly wood siding with composite roofs.
  - Decks and other structural projections built over flammable vegetation exist.
- Many homes do not have adequate defensible space.
- Main access road is dirt, but steep and rocky in places.
- Addressing is generally poor. The markers that do exist are inconsistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a single fire hydrant.
- Fuels are primarily grass (FM 1).
- The community sits on an east aspect. Most homes sit at the base.

Homer Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ 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 and siding.
- ☐ 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 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.
- ☐ Consider installing additional hydrants.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

7. Cushman Estates

FIGURE 10.

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
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
Water supply:	Hydrants
Hazards:	Short, steep slopes

Description:

- Medium sized homes on medium sized lots.
- Construction is mainly wood siding with composite roofs, a couple wood roofs.
    - Decks and other structural projections built over flammable vegetation exist.
- Some homes have adequate defensible space.
- Main access road is dirt, but steep in places. One way in / out.
- Addressing is generally poor. The markers that do exist are not consistent, and most are not reflective.
- Manmade hazards such as outbuildings, propane tanks, and overhead power lines exist.
- Water supply is via a fire hydrant system.
- The primary fuel is short grass. A riparian area is near the entrance.

- Topography is rolling but is mostly on an east aspect. Short and steep hills exist in some places.

Cushman Estates Recommendations

- ☐ Adequate defensible space is recommended for all homes. For details, please refer to the **Plains Communities FMU** and the **Home Mitigation FMU** in the main report.
- ☐ Mow weeds around the edges of the subdivision to a width of 6 feet.
- ☐ 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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

8. Sedona Hills

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:	> 5 acres
Fuel models found in the neighborhood:	1, 2, 5
Water supply:	Hydrants
Hazards:	Steep slopes, power lines

Description:

- Medium sized to large homes on large lots.
- Homes are mostly new construction. Some wood siding with composite roofs.
  - Decks and projections over flammable vegetation.
- Defensible space is generally good.
- Most access roads are paved. Kiva Ridge Drive, however, is dirt, steep, and one-way in/out.
- Addressing is present, but not reflective.
- Overhead power lines exist on Kiva Ridge Drive.
- Water supply is via fire hydrants.
- Fuels are grass with brush. Some heavy jackpots of mature brush (FM 5).

- The community is very large (50% resides in the Loveland Fire District). The topography runs along two North/South ridges with the valleys having most of the homes in them.

- A community (within the Loveland Fire District) which sits at the NE corner of Carter Lake borders the community on the west side.

Sedona Hills Recommendations

- ☐ Adequate defensible space is recommended for all homes. 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 and siding.
- ☐ 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 **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.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.

9. Rainbow Lake Estates

FIGURE 12.

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
Water supply:	Hydrants
Hazards:	None

Description:

- Large homes on medium sized lots.
- Homes are newer construction. Wood siding with composite roofs.
- Defensible space is generally good.
- Access roads are paved.
- Addressing is present for most residences, but is not reflective.
- Water supply is via a fire hydrant system.
- Fuels are mostly short grass.
- Topography is mostly flat.

Rainbow Lake Estates Recommendations

- ☐ Adequate defensible space is recommended for all homes. 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 and siding.
- ☐ 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 **Home Mitigation FMU** section in the main report.
- ☐ Ensure that all road signs and attachments are made of non-combustible materials.
- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.
- ☐ Keep vegetation mowed around fire hydrants.
- ☐ A large-animal evacuation plan should be developed where applicable.
- ☐
- ☐ 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.

10. Berthoud Estates / Blue Mountain

FIGURE 13.

Hazard Rating:	Low
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
Water supply:	Hydrants
Hazards:	Propane tanks, overhead power lines

Description:

- Medium sized homes on medium sized lots.
- Wood siding with composite roofs.
- Defensible space is generally good.
- Access roads are paved.
- Addressing is present for most residences, but is not reflective.
- Water supply is via a fire hydrant system.
- Fuels are mostly grass.
- Topography is mostly flat.

Berthoud Estates / Blue Mountain 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 and siding.

- ☐ 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 **Home Mitigation FMU** section in the main report.

- ☐ Ensure that all road signs and attachments are made of non-combustible materials.

- ☐ Add reflective addressing made of non-combustible materials to all driveways and homes.

- ☐ Keep vegetation mowed around fire hydrants.

- ☐ A large-animal evacuation plan should be developed where applicable.

BERTHOUD FIRE PROTECTION DISTRICT 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 eves 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.

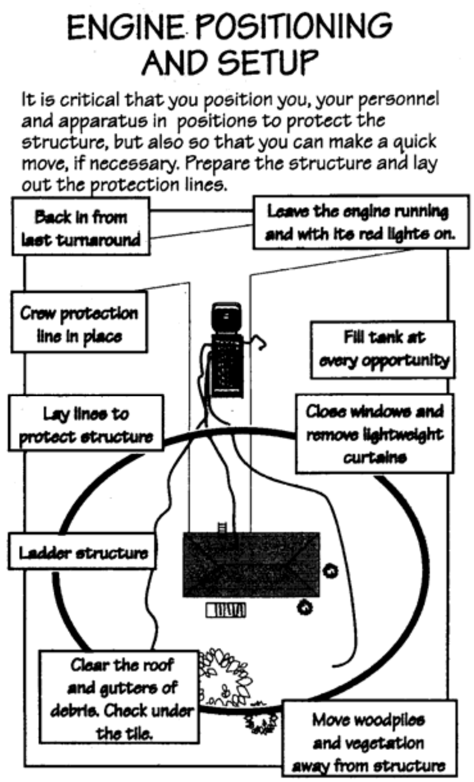
- Factors that may make an attempt to save a structure too dangerous or hopeless:

- 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]

1 Teie,William C.,1995, Firesighter's Guide, Urban/Wildland Situations. Deer Valley Press

BERTHOUD FIRE PROTECTION DISTRICT CWPP

APPENDIX D

ACCESS AND WATER SUPPLY RECOMMENDED 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.

Emergency response personnel do their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for residents and their families, as well as that of the firefighters and emergency medical technicians that will arrive on scene. This is especially important in rural areas, where response times may be considerably longer than in cities.

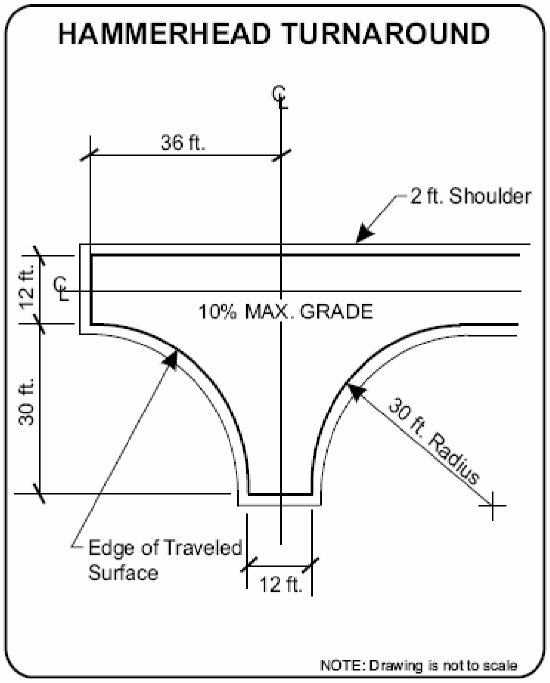
Access Guidelines

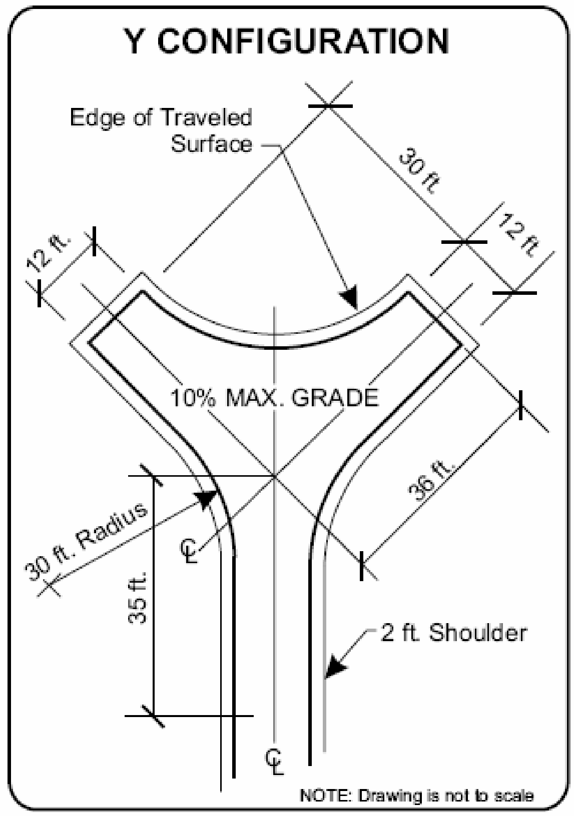
Driveway Turnarounds

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

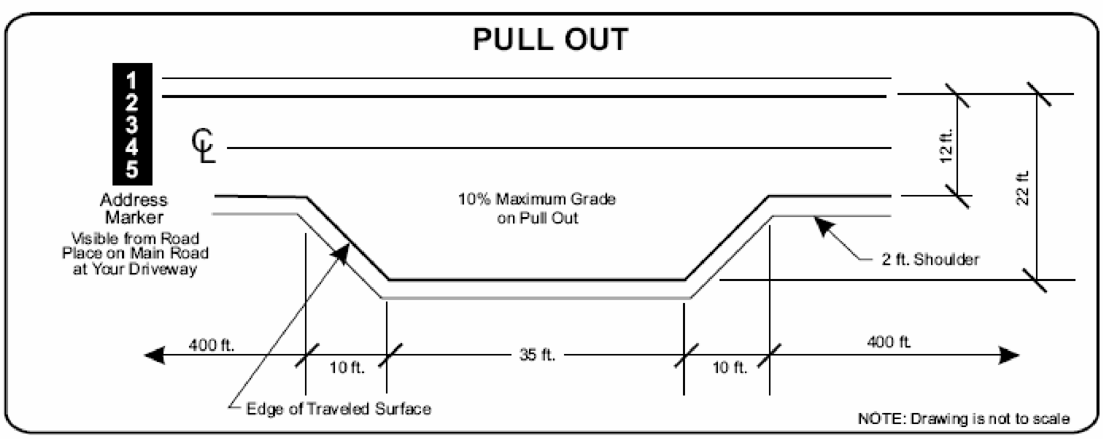
Driveways should have an unobstructed vertical clearance of 13’ 6”. Trees may need to be limbed and utility lines relocated to provide the necessary clearance. The BFPD suggests that driveways have a 14’ wide drivable surface and 16’ of horizontal clearance. On turns the outside radius should be a minimum of 42’ with the inside a minimum of 24’. The surface should be able to support a 60,000 pound fire apparatus.





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.



Address Markers

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 the residences that are accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate simply to 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.

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

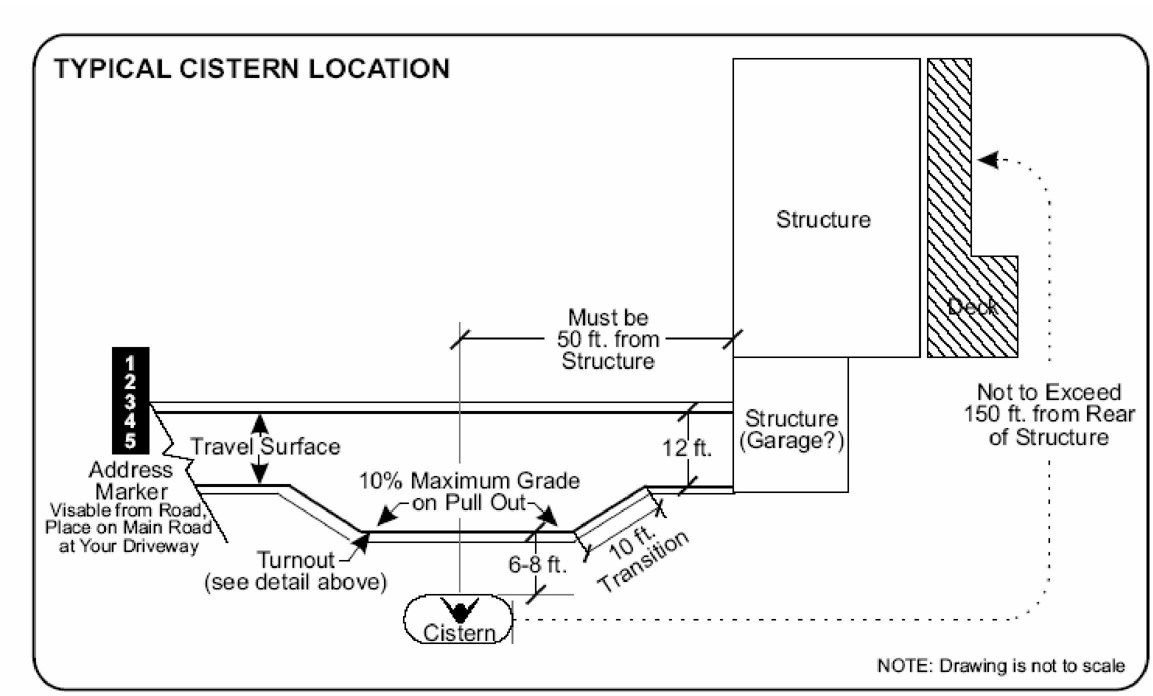
In the study area, like many of the mountainous areas of Colorado, water is a critical fire suppression issue. Although the Berthoud Fire Protection District (BFPD) has a good network of pressurized hydrants, the hazard assessment revealed several communities in the study area which are a considerable 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 FMU** section of the main report.

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 the BFPD.



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 FMU** section of the main report. 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 District. BFPD 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, the BFPD is in the best position to offer site-specific information.

Appendix E

Berthoud Fire Protection District 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 Berthoud Fire Protection District (BFPD), 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

The Berthoud Fire Protection District used internal budgets in combination with a CSFS grant 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 BFPD. The BFPD 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 BFPD 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 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 BFPD, will have the greatest responsibility for implementing the recommended mitigation projects. The CSFS, Boulder and Larimer Counties 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. The Berthoud Fire Protection District 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 BFPD, 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 BFPD web site is http://www.berthoudfire.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.[1]"

State, local, and private agencies (stakeholders) participated in the Berthoud Fire Protection District CWPP. These stakeholders are:

- The Berthoud Fire District
- Loveland Fire District
- Larimer County Parks and Open Lands
- Boulder County Parks and Open Space
- Little Thompson Water District
- The Colorado State Forest Service
- Anchor Point Group

The true collaborative process was initiated thru a number of stakeholder meetings held within Larimer 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 Berthoud Fire Protection District ten communities were delineated and analyzed for hazard and risk.

Two meetings were held. The BFPD stakeholder meeting was held at the Northern Colorado Water Conservancy District. The public meeting was held at the Berthoud Fire District Station 2. The public meeting was very successful with over twenty citizens present stimulating a large exchange of information. The attendance was largely due to the aggressive advertising on behalf of the Berthoud FPD. Door hung flyers were distributed to most homes within the 10 defined wildfire hazard communities.

The purpose of these meetings was to discuss the findings 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.

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/federalfunding.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

Berthoud Fire CWPP