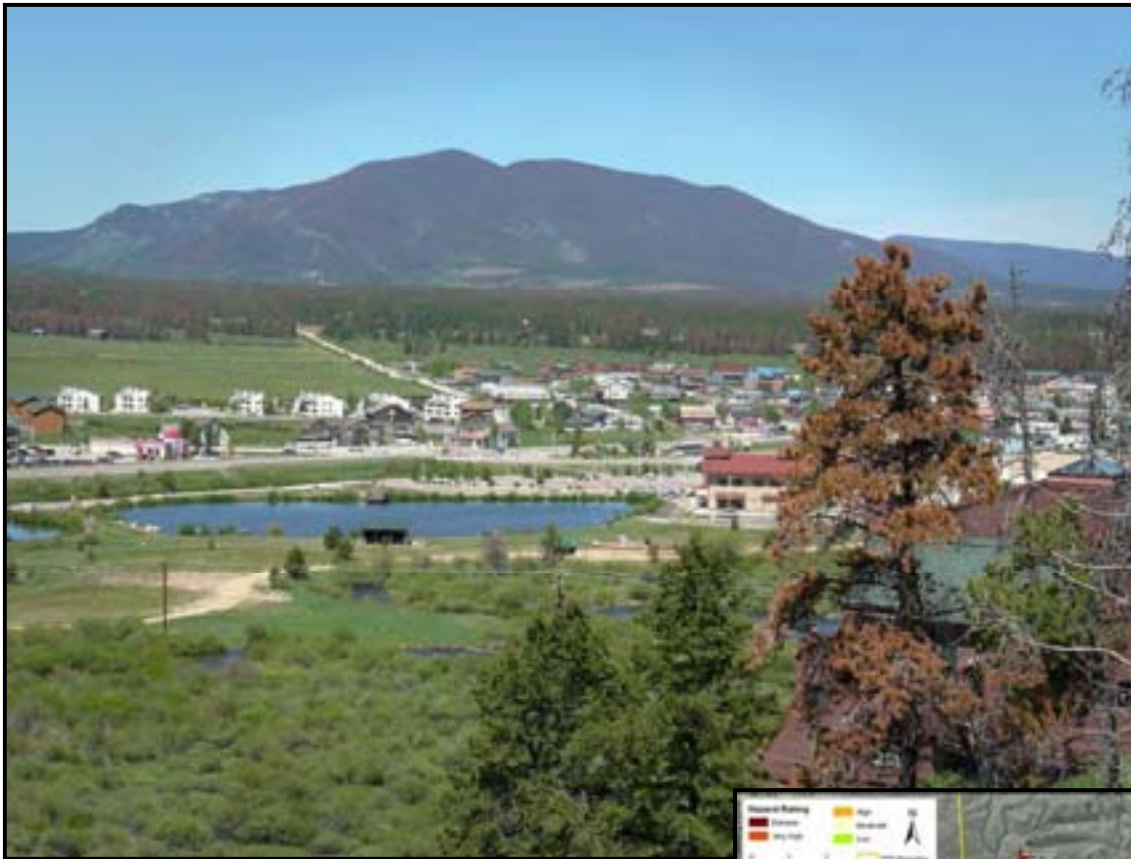


UPPER FRASER VALLEY, COLORADO

Wildland Urban Interface: Community Wildfire Protection Plan



Prepared For:
East Grand Fire
Fraser, Colorado

Submitted By:
Anchor Point Group Fire Management
Boulder, Colorado

DECEMBER, 2007

TABLE OF CONTENTS

PURPOSE	1
INTRODUCTION	1
THE NATIONAL FIRE PLAN AND THE HEALTHY FOREST RESTORATION ACT	2
GOALS AND OBJECTIVES	3
OTHER DESIRED OUTCOMES	3
COLLABORATION: COMMUNITY/AGENCIES/COUNCILS	4
STUDY AREA OVERVIEW	6
VALUES.....	10
LIFE SAFETY AND HOMES	10
COMMERCE AND INFRASTRUCTURE.....	10
<i>Economic Values</i>	10
<i>Critical Infrastructure</i>	11
<i>Cultural Sites</i>	14
<i>Recreation and Life Style</i>	14
ENVIRONMENTAL RESOURCES	14
<i>Watershed Concerns</i>	14
<i>Threat of Insect Loss</i>	15
<i>Wildlife</i>	15
CURRENT RISK SITUATION	16
FIRE REGIME CONDITION CLASS	20
FIRE BEHAVIOR POTENTIAL.....	22
<i>Fire Behavior Modeling Limitations and Interpretation</i>	22
<i>Flame Length</i>	23
<i>Rate of Spread</i>	23
<i>Crown Fire Activity</i>	24
SOLUTIONS AND MITIGATION	31
ESTABLISHING AND PRIORITIZING FIRE MANAGEMENT UNITS (FMUs)	31
ADDRESSING AND EVACUATION FMU	31
<i>Addressing</i>	31
<i>Evacuation Routes</i>	33
<i>Other Access Route Recommendations</i>	36
PUBLIC EDUCATION FMU	36
<i>Recommendations</i>	37
LOCAL PREPAREDNESS AND FIRE FIGHTING CAPABILITIES FMU.....	37
<i>Recommendations</i>	40
HOME MITIGATION FMU	42
<i>Defensible Space</i>	43
<i>Recommendations</i>	44
LANDSCAPE SCALE FUELS MODIFICATIONS FMU.....	45
<i>Current and Planned Projects</i>	47
<i>Access Route Fuels Modification Recommendations</i>	50
<i>Other Fuels Modification Recommendations</i>	51
WATER SUPPLY FMU.....	58
<i>Recommendations</i>	59
AREAS OF SPECIAL INTEREST FMU.....	61
<i>Introduction</i>	61

<i>YMCA of the Rockies Snow Mountain Ranch</i>	62
<i>Recommendations</i>	62
<i>Crooked Creek Ranch (Young Life)</i>	63
<i>Recommendations</i>	63
<i>The Devil's Thumb Ranch</i>	64
<i>Recommendations</i>	64
<i>Shelter-In-Place</i>	65
POST-FIRE REHABILITATION PROCEDURES	66
GLOSSARY	67
RECOMMENDED READING	70
WEBSITE RESOURCES.....	72

TABLE OF FIGURES

FIGURE 1. HAZARD RANKING OF COMMUNITIES IN THE STUDY AREA	7
FIGURE 2. SLOPE	8
FIGURE 3. ELEVATION	9
FIGURE 6. USFS FIRE HISTORY 1977-2006	17
FIGURE 7. ADJACENT FEDERAL LAND MANAGEMENT DISTRICTS	19
FIGURE 8. CONDITION CLASS MAP	20
FIGURE 9. FLAME LENGTH PREDICTIONS (MODERATE WEATHER CONDITIONS)	25
FIGURE 10. FLAME LENGTH PREDICTIONS (EXTREME WEATHER CONDITIONS).....	26
FIGURE 11. RATE OF SPREAD PREDICTIONS (MODERATE WEATHER CONDITIONS)	27
FIGURE 12. RATE OF SPREAD PREDICTIONS (EXTREME WEATHER CONDITIONS)	28
FIGURE 13. CROWN FIRE ACTIVITY PREDICTIONS (MODERATE WEATHER CONDITIONS)	29
FIGURE 14. CROWN FIRE ACTIVITY PREDICTIONS (EXTREME WEATHER CONDITIONS).....	30
FIGURE 15. INTERSECTION WITH NO STREET SIGNS	32
FIGURE 16. HOME-MADE MARKER.....	32
FIGURE 17. WOODEN MARKER MOUNTED ON A TREE	32
FIGURE 18. HOME-MADE FLAGGED ADDRESSING	32
FIGURE 19. EVACUATION ROUTES	35
FIGURE 20. MAP - COMMUNITY DISTANCES TO NEAREST FIRE STATIONS.....	39
FIGURE 21. SADDLE & RIDGE TOP DEVELOPMENT	43
FIGURE 22. DEFENSIBLE SPACE ZONES	44
FIGURE 23. CURRENT AND EXISTING FUELS TREATMENT PROJECTS	48
FIGURE 24. RECOMMENDED TREATMENT AREAS.....	52
FIGURE 25. TREATMENT AREA K DETAIL.....	53
FIGURE 26. WATER SUPPLY LOCATIONS IN THE STUDY AREA	58
FIGURE 27. AREAS OF SPECIAL INTEREST.....	61
FIGURE 28. THE Y FIRE.....	62

INDEX OF TABLES

TABLE 1. CWPP DEVELOPMENT TEAM	4
TABLE 2. CWPP FUNDING CONTRIBUTORS	5
TABLE 3. CONDITION CLASS DESCRIPTIONS	21
TABLE 4. UPPER FRASER COMMUNITY HAZARD RATINGS	42
TABLE 5. RECOMMENDED TREATMENT DISTANCES FOR MID-SLOPE ROADS	47

APPENDICES

APPENDIX A. FIRE POTENTIAL ANALYSIS METHODOLOGY	A1–A22
APPENDIX B. COMMUNITY IGNITABILITY ANALYSIS AND RECOMMENDATIONS	B1–B69
APPENDIX C. STRUCTURAL TRIAGE AND PREPARATION	C1–C3
APPENDIX D. ACCESS AND WATER SUPPLY RECOMMENDED GUIDELINES	D1–D4

PURPOSE

This document has the following primary purposes:

1. Provide a comprehensive, scientifically-based analysis of wildfire related hazards and risks in the Wildland Urban Interface (WUI) areas of the Upper Fraser Valley.
2. Using the results of the analysis, generate recommendations designed to prevent and/or reduce the damage associated with wildfire to WUI values in the study area.
3. Create a Community Wildfire Protection Plan (CWPP) document which conforms to the standards for CWPPs established by the Healthy Forest Restoration Act (HFRA).

INTRODUCTION

The Upper Fraser Valley CWPP is the result of a community-wide planning effort that included extensive field data gathering, compilation of existing documents and GIS data, and scientifically-based analyses and recommendations designed to reduce the threat of wildfire related damages to values at risk. This document incorporates new and existing information relating to wildfire which will be valuable to citizens, policy makers, and public agencies in Grand County, Colorado. Participants in this project include homeowners, East Grand County, Colorado, adjacent state and federal land managers, and other stakeholders. This document meets the requirements of the federal Healthy Forest Restoration Act of 2003 for community fire planning.

The assessment portion of this document estimates the hazards and risks associated with wildland fire in proximity to WUI areas. This information, in conjunction with identification of the values at risk, defines “areas of concern” and allows for prioritization of mitigation efforts. From the analysis of this data, 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.

Wildfire hazard data is derived both from the Community Wildfire Hazard Rating system (WHR) and from the analysis of Fire Behavior Potential, which are extensive and/or technical in nature. Detailed findings and methodologies for these analyses 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 Upper Fraser Valley wildfire hazard and risk assessment.

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 Wildland-Urban Interface (WUI) neighborhoods 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 intrinsic values identified by citizens as being important to the way of life in the study area (e.g., life safety, property conservation, access to recreation, and wildlife habitat).

THE NATIONAL FIRE PLAN AND THE HEALTHY FOREST RESTORATION ACT

In the year 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 report, prepared by a federal interagency group, was titled "Review and Update of the 1995 Federal Wildland Fire Management Policy" (2001). This report concluded, among other points, that the condition of America's forests had continued to deteriorate.

The second report, titled "Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000," was issued by the Bureau of Land Management (BLM) and the United States Department of Agriculture Forest Service (USFS). It became known as the National Fire Plan (NFP). This report, and the ensuing congressional appropriations, ultimately required actions to:

- Respond to severe fires
- Reduce the impacts of fire on rural communities and the environment
- Ensure sufficient firefighting resources

Congress increased its specific appropriations to accomplish these goals. 2002 was another severe season: more than 1,200 homes were destroyed and over seven million acres burned. In response to public pressure, congress and the Bush administration continued to designate funds specifically for 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 Upper Fraser Valley CWPP.

This CWPP meets the requirements of HFRA by:

1. Identifying and prioritizing fuels reduction opportunities across the landscape (see *Fuels Modification FMU* on pages 45-57 of this document)
2. Addressing structural ignitability (see pages 42-45 and **Appendix B**)
3. Assessing community fire suppression capabilities (see *Local Preparedness and Firefighting Capabilities FMU* on pages 37-41)
4. Collaborating with stakeholders (see **Appendix E**)

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, watersheds, and quality of life.

To accomplish these goals, the following objectives have been identified:

1. Establish an approximate level of risk (the likelihood of a significant wildfire event in 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 on 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: Quantifying 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: Community awareness, combined with education, will help to reduce the risk of unplanned human ignitions.
3. Facilitate and prioritize appropriate hazardous fuel reductions: Organizing and prioritizing hazard mitigation actions into Fire Management Units (FMUs) will provide stakeholders with social and fire-management perspectives, allowing them to make better decisions about their future efforts.
4. Promote improved levels of response: The identification of areas of concern will improve the focus and accuracy of pre-planning, and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

COLLABORATION: COMMUNITY/AGENCIES/COUNCILS

Representatives involved in the development of the Upper Fraser Valley CWPP are included in the following table. Their names, organizations, and various roles and responsibilities are indicated in **Table 1**. Principle funding contributors for the project are shown in **Table 2**. For more information on the collaborative process that led to the development of this CWPP see **Appendix E**, *Upper Fraser Valley CWPP Collaborative Effort*.

Table 1. CWPP Development Team

Name	Organization	Roles / Responsibilities
Todd Holzwarth, Chief Dennis Soles, Fire Prevention Officer	East Grand Fire	Local information and expertise, including community values. Development of community protection priorities. Implementation of fuels treatment project areas and methods.
Ron Cousineau, District Forester	Colorado State Forest Service	Facilitation of planning process and approval of CWPP minimum standards. Provides input and expertise on forestry, fire and fuels, and FireWise concepts.
Paul Mintier, Fire Management Officer, Sulphur Ranger District	United States Forest Service	Provides input and expertise on planning and hazard mitigation. Provides information on existing and planned projects on adjacent federal lands.
Chuck Swanson, Town Engineer	Town of Winter Park	Primary contracting officer. Provides local information and expertise. Acts as liaison with other stakeholders.
Rod Moraga, Fire Behavior Analyst and Managing Partner Marc McDonald, Project Manager Mark McLean, GIS Project Manager	Anchor Point Group LLC Consultants	Development of the CWPP document. Scientific analysis of fire behavior, community hazard and risk. Development of hazard mitigation actions and priorities. Establishment of fuels treatment project areas and methods.
Lynn Barclay, PIO Justin Kincaid, Fire Management	Bureau of Land Management	Provides funding, expertise on planning, public education and hazard mitigation. Provides information on existing and planned projects on adjacent federal lands.

Table 2. CWPP Funding Contributors

Date	Organization	Amount
2/5/2007	East Grand Fire	\$10,000
2/14/2007	Town of Fraser	\$20,000
2/20/2007	Town of Winter Park	\$20,000
4/25/2007	Young Life-Crooked Creek Ranch	\$ 750
6/19/2007	Denver Water Board	\$20,000
7/30/2007	Intrawest/Winter Park Operations Corporation	\$10,000
8/14/2007	Bureau of Land Management	\$10,000

STUDY AREA OVERVIEW

The study area is located approximately 70 miles west of Denver, Colorado and comprises 131,185 acres (205 square miles), stretching from south of Winter Park, Colorado to north of Tabernash, Colorado. The study area is accessed via US Highway 40. The area is considered to be in the Montane (8,000-9,500 ft) and Sub-alpine (9,200-11,000 ft.) life zones of the western slope of the Central Rockies of Colorado.¹ The dominant vegetation in the study area is lodgepole pine (*Pinus contorta*), often mixed with other conifers, varying in coverage from open stands to dense forest. Most of these stands are mature or decadent, and coverage variation is due primarily to insect mortality and human intervention (mechanical thinning). Insect mortality is very high in conifer stands throughout the study area. Along stream corridors and drainages conifers are intermixed with riparian vegetation—primarily shrubs. The study area also contains significant stringers and patches of quaking aspen (*Populus tremuloides*) and various species of sage (genus *Artemisia*).

For this project, the most densely populated areas were divided into 31 communities. Each community represents certain dominant hazards from a wildfire perspective. Fuels, topography, structural flammability, availability of water for fire suppression, egress and navigational difficulties, as well as other hazards both natural and manmade are considered in the overall hazard ranking of these neighborhoods. The methodology for this assessment uses the WHR community hazard rating system that was 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. **Figure 1** shows the communities that define the WUI study area. For more information on the WHR methodology, please see **Appendix B**.

As a reference for the rest of this document, please see **Figure 2** and **Figure 3**, which show the general topography of the area. These graphic representations of the landforms within the study area (elevation and slope) will be helpful in interpreting other map products in this report.

¹ Elevation limits for life zones were based on life zone ranges from: Jack Carter, "Trees and Shrubs of Colorado." Johnson Books. Boulder, CO. 1988.

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

Figure 1. Hazard Ranking of Communities in the Study Area

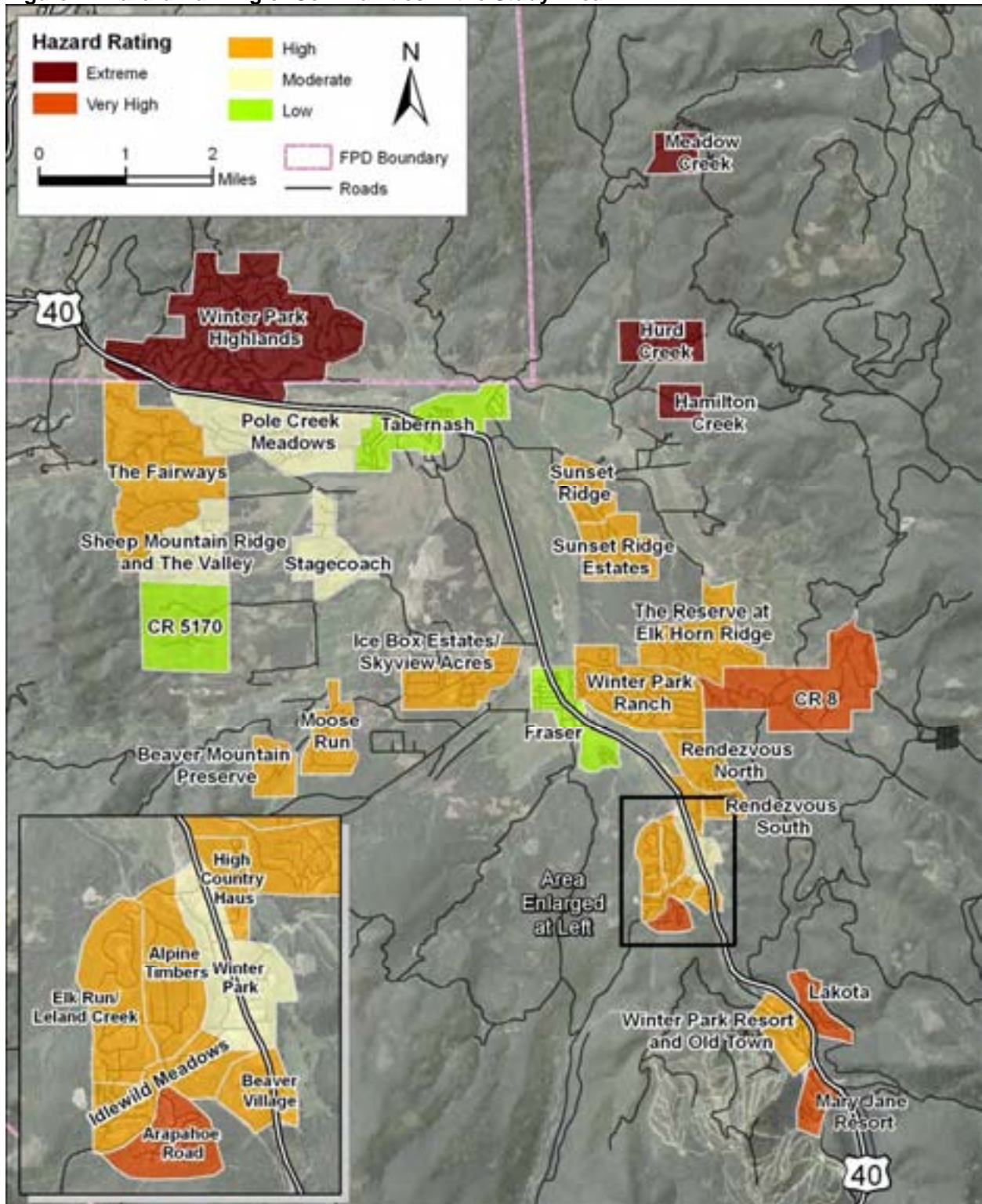


Figure 2. Slope

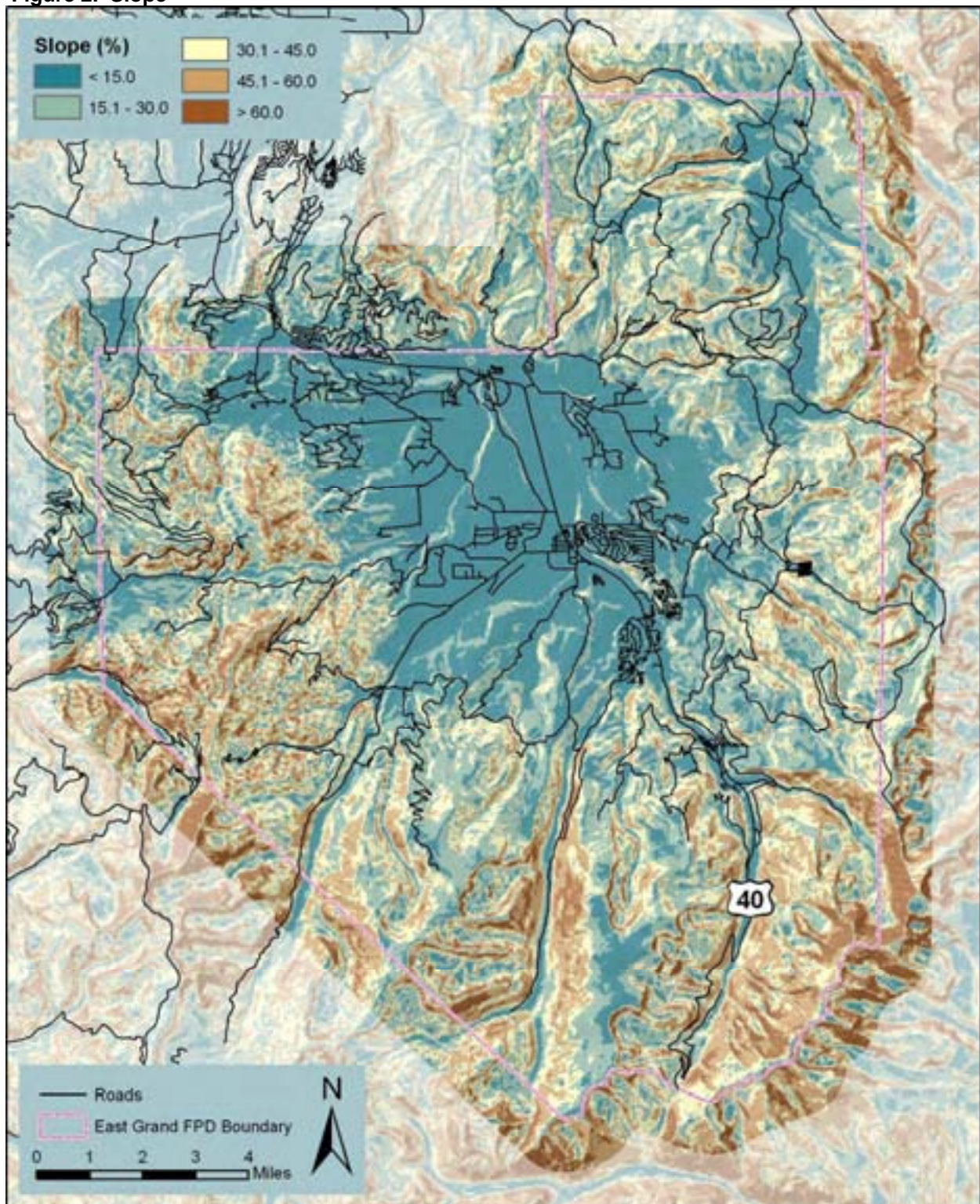
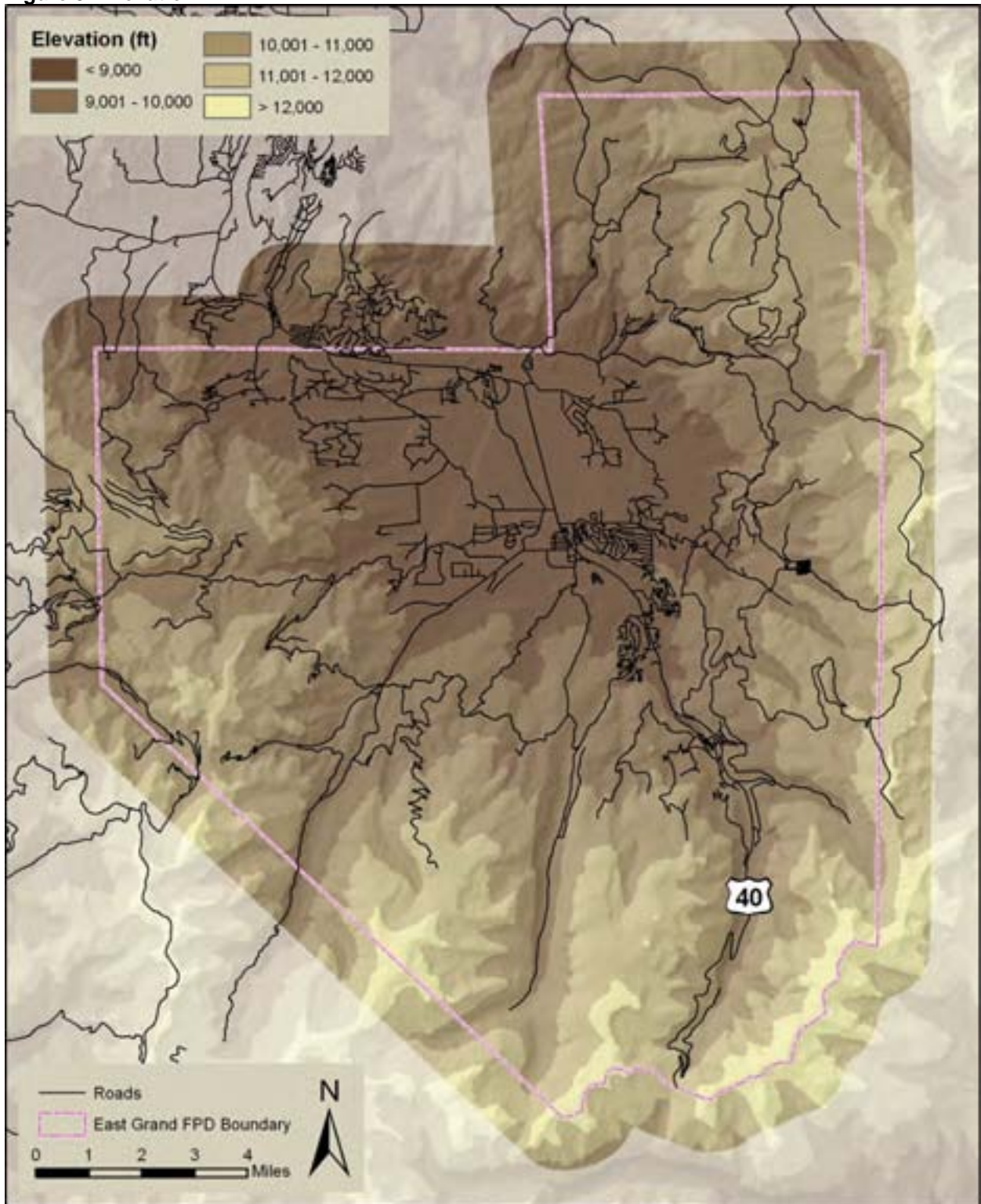


Figure 3. Elevation



VALUES

LIFE SAFETY AND HOMES

The Upper Fraser Valley study area encompasses the towns of Fraser, Winter Park, and Tabernash. There are 1,737 residents and approximately 2,046 housing units.³ The relatively low ratio of residents to housing units reflects the fact that 80% of the single-family homes in Winter Park and Fraser are second homes.⁴ Although population and housing unit data for the rural portions of the study area were not available for this report, the number of housing units and residents in the rural portions of the study area could easily equal the figures above. Construction of additional housing units is ongoing throughout the study area, and the number of residents and visitors is expected to increase. With a population increase of 5.9% between 2000 and 2003,⁵ Grand County, in which the study area is located, is the 19th fastest-growing of Colorado's 63 counties. 341 new building permits for single-family homes were issued from January through July of 2007 in Grand County.⁶ As the demand for building sites increases, building in remote mountain areas with difficult access has become a growing concern.

The hazard assessment identified 9 of the 31 communities in the study area to be extreme or very high hazard areas. All but one of these communities are located outside the town limits of the incorporated towns of the study area. Under extreme burning conditions, there is a likelihood of rapid increases in fire intensity and spread in these communities 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 serious threat to life safety, due to poor egress, the likelihood of heavy smoke, heat, and/or long response times.

Most of Grand County is vulnerable to some form of natural disturbance, and wildland fire is one of the main concerns. Recent national disaster events have focused increased attention at both local and state government levels on the need to mitigate such events where possible, and to prepare to cope with them when unavoidable.

COMMERCE AND INFRASTRUCTURE

Economic Values

In 2005 Grand County had a per capita personal income (PCPI) of \$33,672. The 2005 PCPI reflected an increase of 5.2% from 2004. The 2004-2005 state change was 4.7% and the national change was 4.2%. The 1995-2005 average annual growth rate of PCPI was 4.7%. The average annual growth rate for the state was 4.5% and for the nation was 4.1%.⁷

³ 2000 census data from <http://www.epodunk.com>

⁴ <http://www.winterpark-info.com/community/index.aspx?pageID=8>

⁵ <http://www.epodunk.com/top10/countyPop/coPop6.html>

⁶ <http://socds.huduser.org/permits/index.html?>

⁷ <http://www.bea.gov/bea/regional/bearfacts/action.cfm?fips=08049&areatype=08049&yearin=2005>

In 2005, Grand County had a total personal income (TPI) of \$442,451,000. The 2005 TPI reflected an increase of 4.7% from 2004. The 2004-2005 state change was 6.2% and the national change was 5.2%. The 1995-2005 average annual growth rate of TPI was 7.6%. The average annual growth rate for the state was 6.6% and for the nation was 5.2%.⁸

The earnings for people employed in Grand County increased from \$290,801,000 in 2004 to \$307,349,000 in 2005, an increase of 5.7%. The 2004-2005 state change was 6.5% and the national change was 5.6%. The average annual growth rate from the 1995 estimate of \$143,448,000 to the 2005 estimate was 7.9%. The average annual growth rate for the state was 7.1% and for the nation was 5.5%.⁹

The Fraser Valley economy is tourism-based and highly seasonal in nature. Jobs in the retail and service sector dominate the workforce, with ski areas being among the largest employers. Unemployment is low in Grand County and many people work two jobs.¹⁰ Another significant component of the local economy is the quality of life that attracts professionals to establish residences. The 2002 NAICS Economic Census for Grand County reported 69 businesses with 234 employees offering professional, scientific, and/or technical services. These businesses reported sales receipts of \$17,556,000 and an annual payroll of \$6,639,000.¹¹ Wildfire, therefore, has the potential to cause significant damage to the local economy.

Critical Infrastructure

Critical utility infrastructure such as water treatment plants, electric power supply lines, substations, and natural gas lines are essential to supply residents and businesses with services that are in some cases critical to health and life safety. The infrastructure discussed below is considered to be the most critical to life safety that would be threatened by wildfire and is not meant to constitute a comprehensive list of all the infrastructure values existing in the study area.

There are two water treatment plants for the town of Winter Park that could be threatened by wildfire. Fuel treatments are recommended for both (see **Project P**, *Other Fuels Modification Recommendations*, p. 57).

Well heads and other values related to the gas pipeline exist along the gas pipeline road between the CR 8 community and Corona Pass Road. Point protection for these values is recommended (see **Project O**, *Other Fuels Modification Recommendations*, p. 56).

In many parts of the study area, electric power is needed to power pumps for the domestic water supply, and to provide heating and lighting. Wildfire is a significant threat to the electric utility supply. The two critical transmission lines and the Mettler Substation are necessary to maintain a reliable power supply to the Fraser Valley (see **Figure 4**). The Mettler Substation to Henderson Mill Substation transmission line could be damaged by a wildland fire in the Williams Fork Wilderness west of the Fraser Valley. Depending on the extent of the damage, rebuilding the line could take several months. If the Mettler Substation is destroyed, replacement transformers could take a year to manufacture and deliver. Defensible space clearing for the

⁸ <http://www.bea.gov/bea/regional/bearfacts/action.cfm?fips=08049&areatype=08049&yearin=2005>

⁹ Ibid

¹⁰ <http://www.winterpark-info.com/community/index.aspx?pageID=8>

¹¹ <http://www.census.gov/econ/census02/data/co/CO045.HTM>

Mettler Substation, as well as fuelbreaks designed to limit damage to the two transmission lines, are recommended (see **Projects K and M**, *Other Fuels Modification Recommendations*, pp. 55-56).

Figure 4.

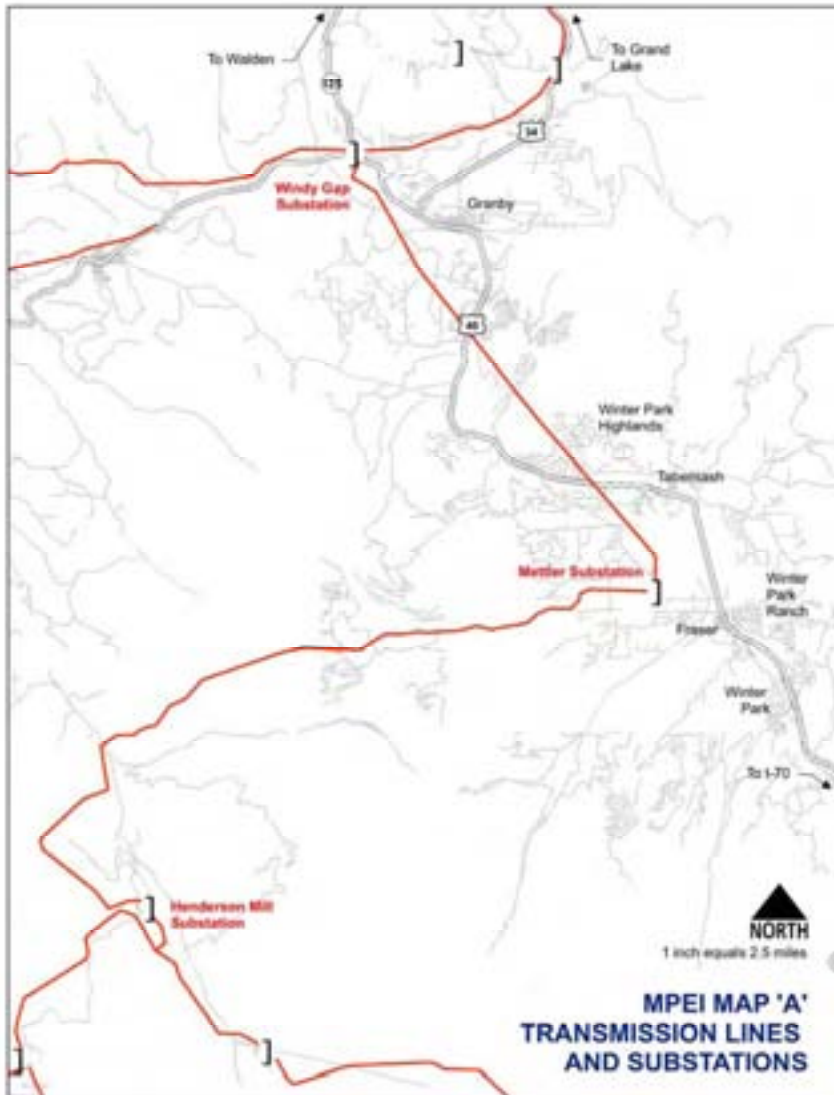
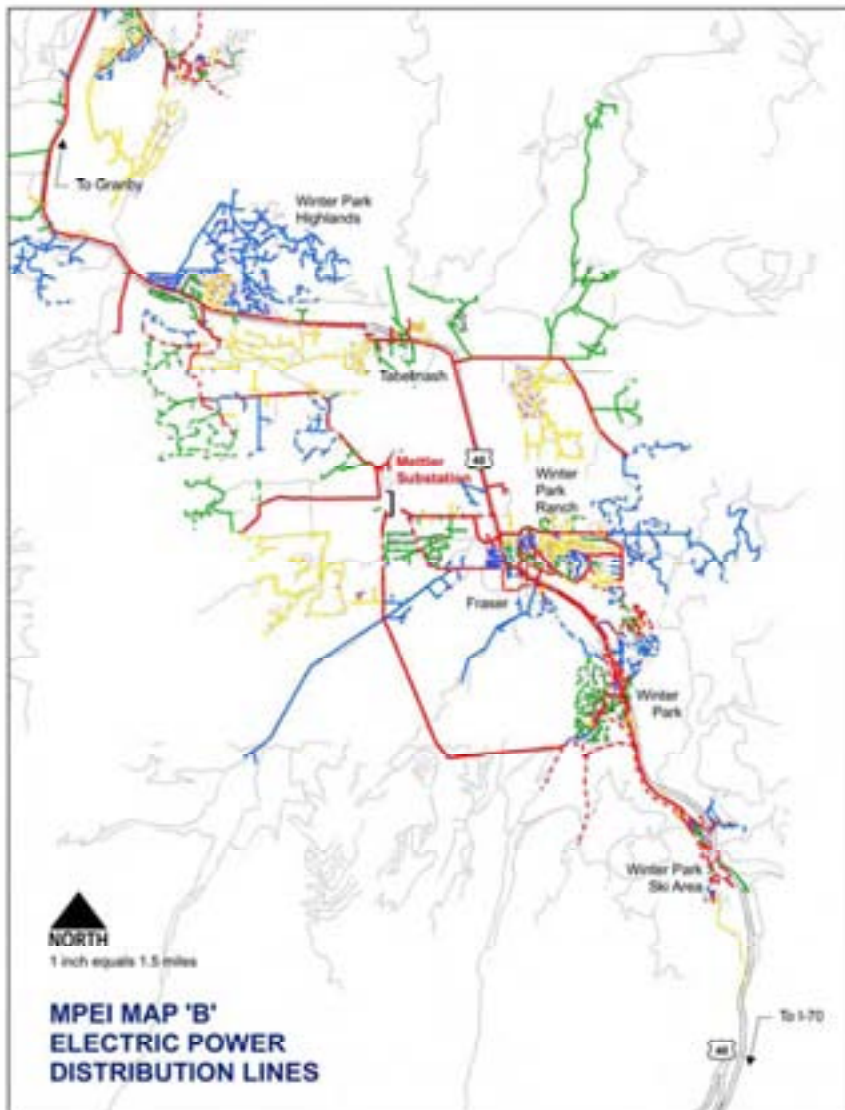


Figure 5 shows the primary electric distribution lines supplying the Fraser Valley. The main feeder lines are shown in red and are critical to supply power from the Mettler Substation to various local neighborhoods, water treatment plants, pumps and other facilities that may be critical to life safety or property protection. While it is desirable for all above-ground power lines to be cleared of flammable vegetation we recognize this would be an arduous task. Les Shankland, Manager of Engineering at Mountain Parks Electric, identified the most critical distribution feeder lines to be the Express #1 and Express #2 lines running south and west from the Mettler Substation to Winter Park. Fuelbreaks designed to limit the damage to these lines are recommended (see **Project L**, *Other Fuels Modification Recommendations*, p. 56).

Figure 5.



Cultural Sites

Although no cultural/historic sites were identified in surveys returned by stakeholders for this project, there are historic buildings in the study area that could be threatened by wildfire. The most prominent of these is the 19th century stage stop located on County Road 5. It is likely that buildings of historic value are located on some of the larger parcels in the study area. Landowners should be contacted, and where possible, the locations of historic properties should be included in the fire department's Wildland Fire Pre-attack Plan.

Recreation and Life Style

Approximately 75% of the land in Grand County is publicly owned.¹² A large portion of the study area is included in the Arapahoe National Forest, which ranks among the top National Forests for year-round recreational use. Winter Park Resort is located in the study area and is the largest ski area in Grand County in terms of employees, acreage, and skier visits. Sol Vista Basin at Granby Ranch, one of the fastest growing ski areas in the region, is located a few miles to the north of the study area. Berthoud Pass, located south of the study area, is closed to commercial operation, but still provides some of the most extreme backcountry skiing in Colorado. Snowmobiling, snowshoeing, and cross-country skiing are a strong source of income for the county in winter. There are two commercial Nordic ski areas in the Fraser Valley. Snow Mountain Ranch/YMCA of the Rockies, has 100km of groomed trails, allows dogs on some of the trails, and has lights for night skiing. Devil's Thumb Ranch has 85km of groomed trails, and allows dogs on some trails.¹³ Both of these resorts are located in the study area. Winter Park is a major mountain bike destination in the summer, with over 600 miles of marked and mapped trails.¹⁴ Other popular summer recreation activities in the study area include hiking, fishing, camping, river rafting, and backpacking. Residents who live in the study area have a keen appreciation for their natural environment. Indeed, recreation and the natural beauty of the area are frequently quoted as key reasons local residents have chosen to live in the study area.

ENVIRONMENTAL RESOURCES

The Upper Fraser Valley is a mix of private and public lands. The area has a long history of timber harvesting, railroad, and recreational use. Preserving environmental resources in such a heavy use area will represent an ongoing challenge to both public and private land managers. Fire has the potential to cause numerous deleterious effects to environmental resources. However, fire is also a natural component of this ecosystem and cannot be excluded from the landscape without consequence.

Watershed Concerns

Numerous streams, lakes, and tarns exist in the study area. The major watersheds—the Fraser River watershed and the Upper Fraser River Composite—were both rated as Class III (non-functional) in the Arapahoe National Forest watershed-condition assessment. The 1997 revision of the Land and Resource Management Plan for the Arapaho National Forest emphasizes the need to improve conditions in these watersheds. Loss of soil stability and erosion resulting from high-intensity fires, which will in turn lead to increased silting, represents a threat to efforts to

¹² <http://www.winterpark-info.com/community/index.aspx?pageID=8>

¹³ Ibid

¹⁴ <http://www.grand-county.com/Biking.aspx>

improve conditions in these critical watersheds. Heavy fire retardant use during suppression efforts may also result in detrimental effects to watersheds.

Threat of Insect Loss

The forests in the study area are currently experiencing insect losses of epidemic proportions. In some areas public land managers have chosen to accept insect and disease losses unless they threaten other ownership or cause unacceptable resource damage. In other areas, particularly WUI areas, private landowners are aggressively fighting insect losses through removal of infected trees and chemical control methods. In spite of these efforts, mortality, especially in lodgepole pine stands, is increasing rapidly. For some years following death, conifers will remain standing with red (dead) needles. It is widely believed in the fire community that red-needle snags (standing dead trees) contribute to increased fire intensity. Regardless of the level of mortality, or whether or not red-needle snags result in increased fire intensity, fires in lodgepole stands historically tend to be stand replacement fires, in which tree mortality is nearly 100%. This will allow for a new forest to regenerate over time, and for other species, especially aspen, to establish in the newly disturbed areas.

Wildlife

Residents are clear that the preservation of wildlife is important to the quality of life of the area. The Arapahoe National Forest provides critical habitat to several indicator species and species of concern, including Colorado River Cutthroat Trout, Boreal Toad, Northern Leopard Frog, Townsend's Big-Eared Bat, and others.¹⁵ 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 that 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).¹⁶ The USFS has made improving habitat effectiveness and ensuring the viability of these species one of their forest-wide objectives.¹⁷ Wildfire, specifically severe wildfire, can have significant adverse effects on habitat effectiveness and species viability.

The Upper Fraser Valley CWPP process is in concert with the guiding principles of environmental stewardship. Through public involvement, local support and a regional perspective, the fuels reduction elements described in this document can and should enhance and protect the values of the study area.

¹⁵ Arapahoe and Roosevelt National Forests and Pawnee National Grassland 1997 Revision of the Land and Resource Management Plan, Chapter 1, pages 28-29.

¹⁶ *Peak to Peak Community Indicators Project 2003*. ©2003, Peak to Peak Healthy Communities Project

¹⁷ Arapahoe and Roosevelt National Forests and Pawnee National Grassland 1997 Revision of the Land and Resource Management Plan, Chapter 1, page 17, Objectives 44-45.

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 study area is at a moderate risk for WUI fires. This assessment is based on an analysis of the following factors:

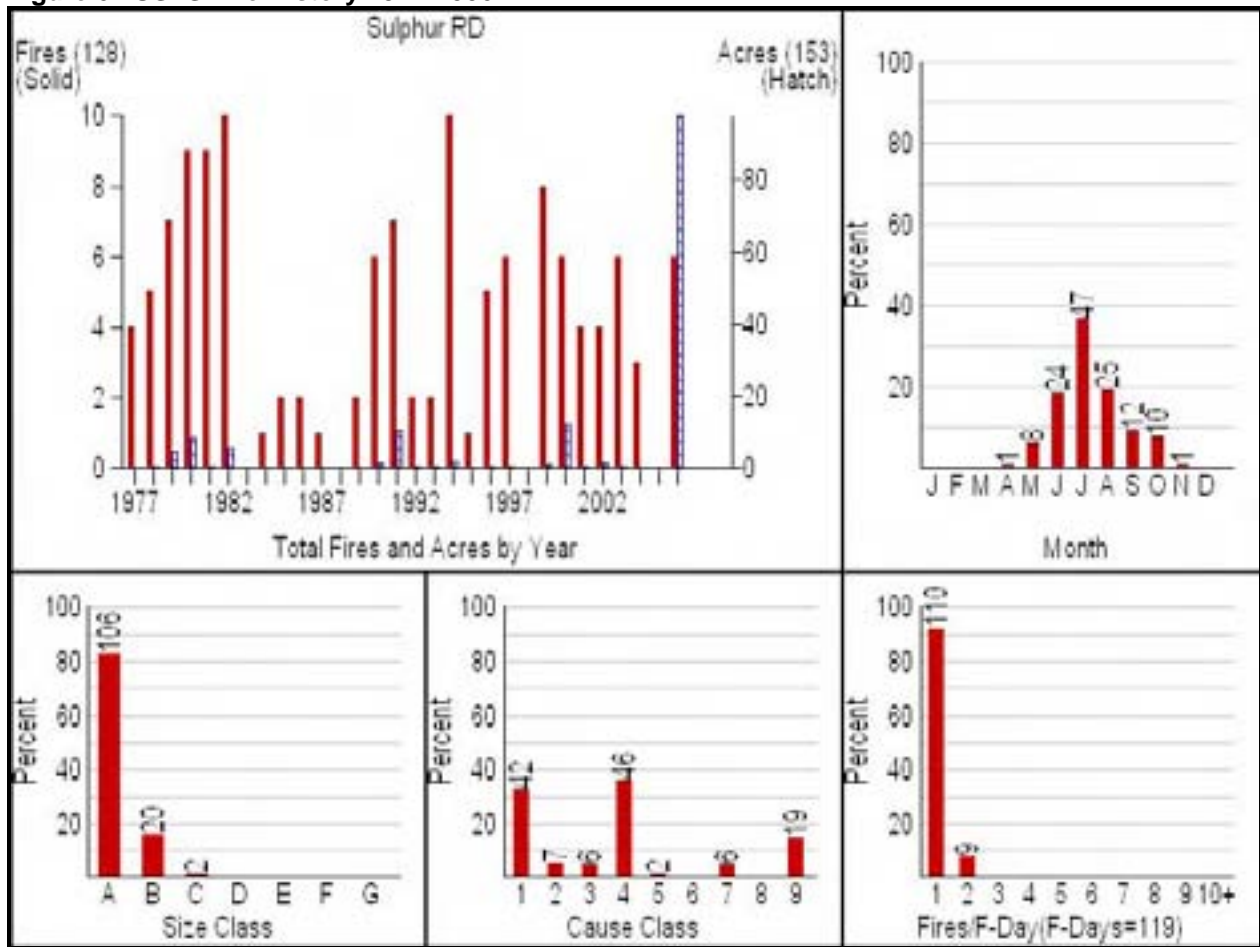
The Fraser Valley and the Town of Winter Park are listed in the Federal Register (<http://www.forestsandrangelands.gov/resources/documents/351-358-en.pdf>) as communities at risk from wildfire.

The study area is shown on 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). 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 to substantially altered. Please see the “Fire Regime and Condition Class” section of this report for details.

East Grand Fire responded to 13 wildland ignitions from 2002 to 2006. This reflects a low to moderate level of recent fire activity (approximately 3.25 fires/year). Although most of these were small fires, the “Y Fire” burned over 50 acres within the study area in July, 2007.

The nearest USFS lands, the Sulphur Ranger District, report low to moderate levels of fire activity (128 fires in 29 years for an average of 4.4 fires/year). Fire occurrences for the Sulphur District were calculated from the USDA Forest Service Personal Computer Historical Archive for the twenty-year period from 1977-2006. This calculation does not include any data from state, county or private lands (see **Figure 7**). The data have been processed and graphed using the Fire Family Plus software program and are summarized below.

Figure 6. USFS Fire History 1977-2006



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

Figure 6a shows the number of fires (red bars) and the total acres burned (blue hatched bars) in the Sulphur Ranger District each year. While the number of annual fires ranges from one to ten, there is little year-to-year pattern to the variation. The number of fires steadily increased between 1977 and 1982, only to be followed by a seven-year period during which less than three fires per season were reported. From 1990 to 2006 fire occurrence per year appears to be random. Acres burned per season were consistently less than ten until 2006, when the Brinker Fire (an arson fire) burned 94 acres in the district. The only other fire in the period to burn more than 10 acres was the Cabin Creek fire in 2000, which burned 12 acres. It is interesting to note that in 2002 (the most severe fire year in this period for the state of Colorado) less than two

acres burned and the number of fires was less than half that of the peak years of 1982 and 1994.

Figure 6b shows the percentage and number of fires between 1977 and 2006 occurring in each month of the year. Almost twice as many fires occurred in July than the next most active months, August and June. Fire occurrences were also relatively common in the fall, with September and October both reporting roughly half as many fire starts as June and August. No reported fires occurred between the months of December and March, which reflects the climate conditions and high elevations in this area.

Figure 6c shows the size class distribution of fires. Approximately 98% of the reported fires (126 of 128) were less than ten acres in size. This statistic reflects the widely held opinion that throughout the western US, the vast majority of fires are controlled during initial attack.

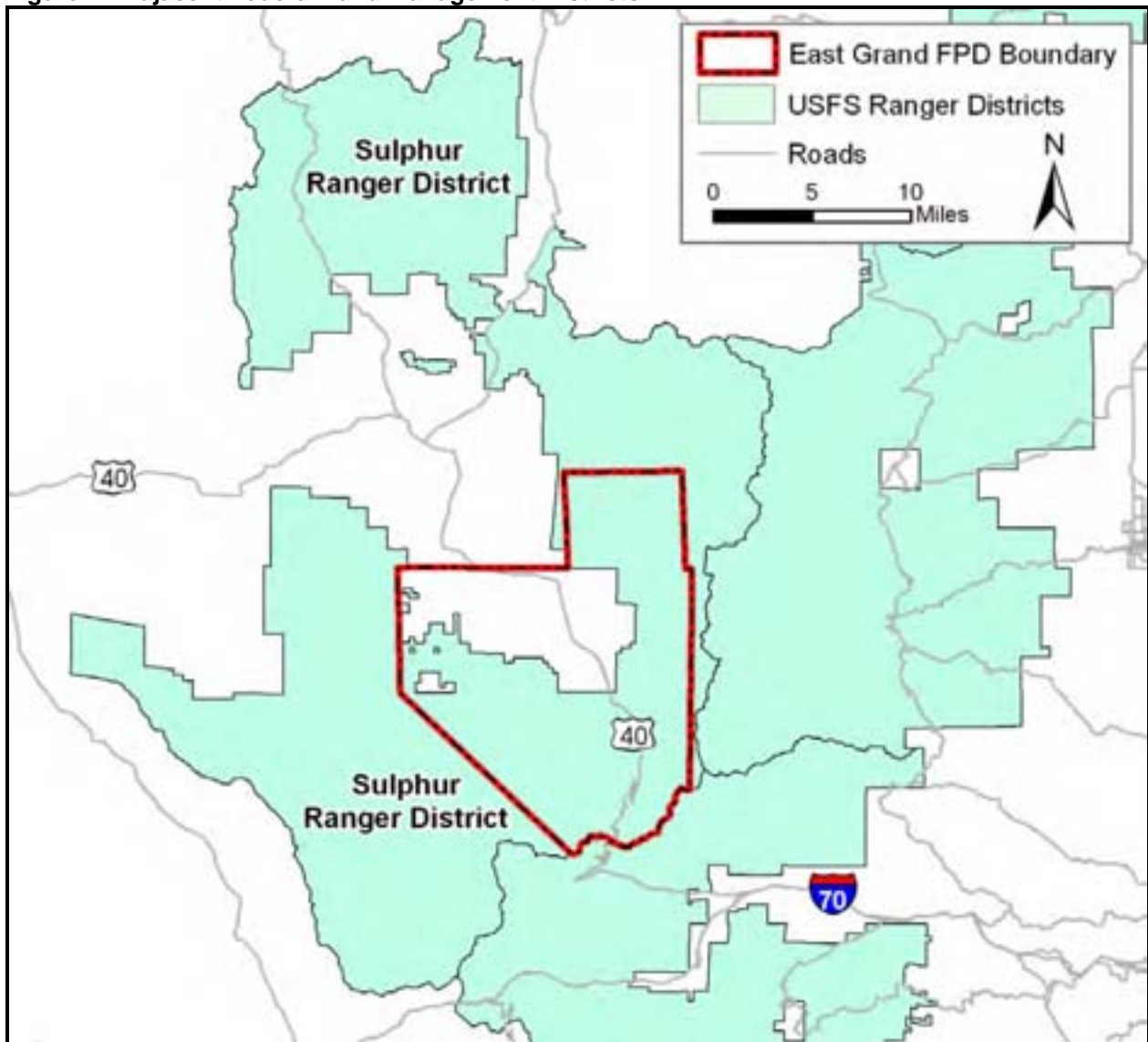
Figure 6d shows the number of fires caused by each factor. As shown in this graph, the most common cause for ignitions is campfires (36%); the next most common cause is lightning (33%). If the “miscellaneous cause” category is removed, human causes represent a significant majority of ignitions (61% human causes and 39% natural causes). It should be noted that even these numbers suggesting the predominance of human starts are likely to be conservative, since this data is only for national forest areas lacking the concentrated development and other human-related risk factors present in the portions of the study area where private land is dominant.

Figure 6e shows the number of fire starts for each day that a fire start was recorded. Most fires (110) occurred on days that only had one fire start. Less than 1% of fire days had two or more fire starts in the twenty nine-year period. The statistics suggest that multiple start days are a rare occurrence, compared to fire days with a single ignition.

PLEASE NOTE:

Residential development in the WUI is increasing in the study area. As the density of structures and the number of residents in the interface increases, potential ignition sources will multiply. Unless efforts are made to mitigate the increased likelihood of human ignition spreading to the surrounding wildland fuels, the probability of a large wildfire occurrence will increase.

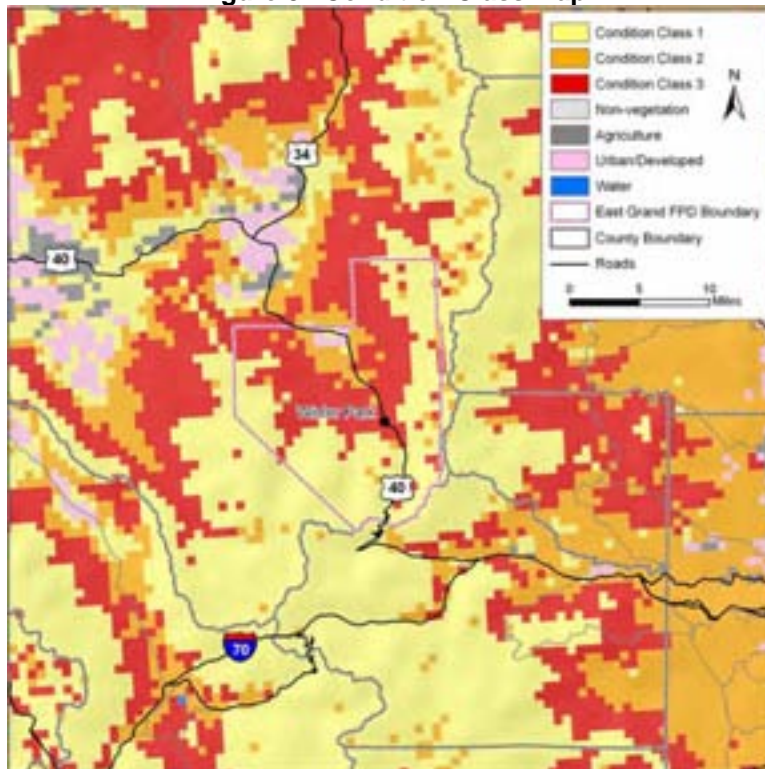
Figure 7. Adjacent Federal Land Management Districts



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 of this report), which provide the fire behavior potential analysis for expected flame length, rate of spread, and crown fire development.

Figure 8. Condition Class Map




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 such as the loss of key ecosystem components (soil, vegetation structure, species) or alteration of key ecosystem processes (nutrient cycles, hydrologic regimes). Consequently, the FRCC is an index of hazards to the status of many components (e.g., water quality, fish status, wildlife habitats, etc.). **Figure 8** displays graphically the return interval and condition class of the study area.

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 to likely ecosystem effects. In applying the condition class concept, it is assumed that historical fire regimes represent the conditions under which the ecosystem components within fire-adapted ecosystems evolved and have been maintained over time. Thus, if it is projected that fire intervals and/or fire severity have changed

from the historical conditions, then one would expect that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, it is assumed that if 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 reflects the probability that key ecosystem components may be lost if a fire were to occur within the study area. It should be noted that key ecosystem components can be represented by virtually any attribute of an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).¹⁸

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

Table 3. Condition Class Descriptions



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 a 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 than that 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 from those expected under historic fire regimes.

The populated portions of the study area are dominantly classified under Condition Class 2 and 3. By definition, historic fire regimes have been moderately to substantially changed. Consequently, **wildfires are likely to be larger, more severe and have altered burn patterns from those expected under historic fire regimes.**

¹⁸ Fire Regime Condition Class, website, <http://www.frcc.gov/>, July 2005.

FIRE BEHAVIOR POTENTIAL

From the fire behavior potential analysis carried out as a part of this study (see **Appendix A**), the fire behavior potential of the study area was mapped. These maps 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.

Figures 9, 11 and 13 show fire behavior potential maps for moderate burning conditions. They graphically display potential crown fire activity, flame length, and rate of spread generated. These maps were generated with FlamMap 2.0 fire behavior modeling software (see **Glossary**). Weather observations for a twenty two-year period (1985-2007) from the Porcupine Creek Remote Automated Weather Station (RAWS) site were used to derive relevant wind and fuel moisture variables for inclusion in FlamMap. The moderate conditions class (16th to 89th percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed) using the Fire Family Plus (see **Glossary**) computer software package. This weather condition class most closely represents an average fire season day.

The extreme conditions maps, **Figures 10, 12, and 14**, were calculated using ninety-seventh percentile weather data. This means that the weather conditions of the most severe fire weather days (sorted by Spread Component) in each season for the twenty two-year period were used for this analysis. It is reasonable to assume that similar conditions may exist on at least three to five 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. For a more complete discussion of the fire behavior potential methodology, please see **Appendix A**.

Fire Behavior Modeling Limitations and Interpretation

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point-source ignition in every cell (each 10 x 10 meter area). 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. These calculations may be conservative (under-predict) compared to observed fire behavior.

This model can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other values at risk identification to generate current and future “areas of concern,” which are useful for prioritizing mitigation actions. This is sometimes referred to as a “values layer.” One possibility is to overlay the fire behavior potential maps with the community hazard map (**Figure 1**) in order to make general evaluations of the effects of the predicted fire behavior in areas of high hazard value (that is, areas where there are concentrations of residences and other man-made values). However, one should remember that the minimum mapping unit used for fire behavior modeling is one acre; therefore, fine-scale fire behavior and effects are not considered in the model. Additionally, weather conditions are extremely variable, and not all combinations are accounted for. The fire behavior prediction maps are best used for pre-planning and not as a stand-alone product for tactical planning. If this information is used for tactical planning, fire behavior calculations should 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. Please see **Appendix B** for a further discussion of the WHR methodology.

Flame Length

Figures 9 and 10 display flame length predictions for the two weather scenarios. Flame length is a proxy for fire intensity. It is important to note that flame length is considered to be the entire distance from the base of the flame to the tip, irrespective of angle—not simply the flame height above the ground. It is possible in high wind conditions to have very intense flames (high flame lengths) which are relatively close to the fuel bed. The legend boxes display flame length in ranges which are meaningful to firefighters. Flame lengths of four feet and less are deemed low enough intensity to be suitable for direct attack by hand crews, and therefore represent the best chances of direct extinguishment and control. Flame lengths of less than eight feet are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of eight to 12 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12 feet, the most effective tactics are fuel consumption ahead of the fire by burnouts or mechanical methods. Although indirect fire line and aerial attack are also used for fires with flame lengths of greater than 12 feet, as flame lengths increase, the effectiveness of these tactics decreases, and their use is generally designed to slow rates of spread and reduce fire intensity, especially in areas where values at risk are concentrated.

In the moderate fire weather scenario, the model predicts that fires in most of the populated portions of the WUI could be attacked directly by either hand crews or equipment. It is interesting to note that significantly higher flame lengths (eight to 12 feet under moderate conditions and greater than 12 feet under extreme conditions) are predicted for portions of the Snow Mountain Ranch property. This prediction is in line with fire behavior observed on the 2007 “Y Fire.”

Under the extreme fire weather scenario, high to extreme flame lengths are predicted in most of the areas covered by the WUI communities, with the exception of a few communities located primarily in the lower elevations of the central portion of the study area. Even in these areas, the predicted flame lengths indicate that fires are likely to be too intense for direct attack by hand crews. Nonetheless, hand crews would be vital for structure preparation, triage, and the construction of indirect fire line. Under extreme weather and fuel moisture conditions, fire intensity in many of the WUI communities could be a serious issue, and control would be difficult to establish and maintain.

Rate of Spread

Figures 11 and 12 show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios respectively. Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by loggers and firefighters. It is equal to 66 feet. Therefore, one mile equals 80 chains. Rates of fire spread are influenced primarily by wind, slope grade, fuel type/continuity, and fuel sheltering from the wind. Fire is the only force of nature which moves faster uphill than downhill. When all other factors are equal, fire moves twice as fast uphill on a slope of 30% than it does on flat terrain. In areas where high to extreme rates of spread are predicted (ROS of >40 CPH or ½ mile per hour) it is possible that fires will

spread faster than humans can escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident.

In the moderate fire weather scenario, low to moderate rates of spread are predicted in the WUI communities where dense stands of conifers are the dominant fuel. This effect is due primarily to sheltering of surface fuels from the wind. In areas where grasses are dominant with little or no sheltering overstory, rates of spread are predicted to be very high, even under moderate burning conditions.

In the extreme fire weather scenario, higher rates of spread are predicted in most of the WUI communities in the study area, because the sheltering effects of the canopy are overridden by more extreme fuel moisture conditions. The model shows rates of surface spread can be expected to increase even in the dense canopy, making control efforts more difficult and requiring control and suppression tactics to be implemented further ahead of the fire.

Crown Fire Activity

The Crown Fire Activity maps (**Figures 13 and 14**) display the potential for fires to move from the surface into the canopy of trees and shrubs. The likelihood of progression from the surface into the aerial fuels is displayed in four categories. N/A refers to areas where surface fires are unlikely to develop due to the lack of combustible fuels. These would include any area such as rock, ice, snow fields, water, sand, or some urban landscapes. The surface fire category covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas in which grass fuels without overstory plants are dominant fall into this category, regardless of the energy produced by the fire due to the lack of an aerial fuel bed. Areas covered by the torching category are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. In other words, individual or relatively small clusters of trees will be completely involved, but these fires lack the energy to initiate sustained horizontal movements (referred to as “runs” by fire fighters) through the crowns. The active crown fire category includes areas where sustained horizontal movements through tree crowns are expected. This category can be further subdivided into dependent or independent crown fire. Dependent crown fires rely on the presence of surface fires to support aerial burning. Independent crown fires develop when aerial burning is sustained, without the need for associated surface fire. Independent crown fires are rare and are associated with the most extreme fire behavior conditions. Current fire behavior models do not have the ability to predict independent crown fire development. All crown fires, regardless of whether they are dependent or independent, represent extreme fire behavior conditions and are notoriously resistant to typical methods of suppression and control.

It is interesting to note that torching should be expected in virtually all of the timbered areas of the WUI communities, even under moderate burning conditions. Under extreme conditions, active crown fires are expected to develop in Winter Park Highlands, the Winter Park and Mary Jane Resort areas, and in most of the higher elevations outside the central valley area, including significant portions of the Snow Mountain Ranch and Crooked Creek Ranch properties.

Figure 9. Flame Length Predictions (Moderate Weather Conditions)

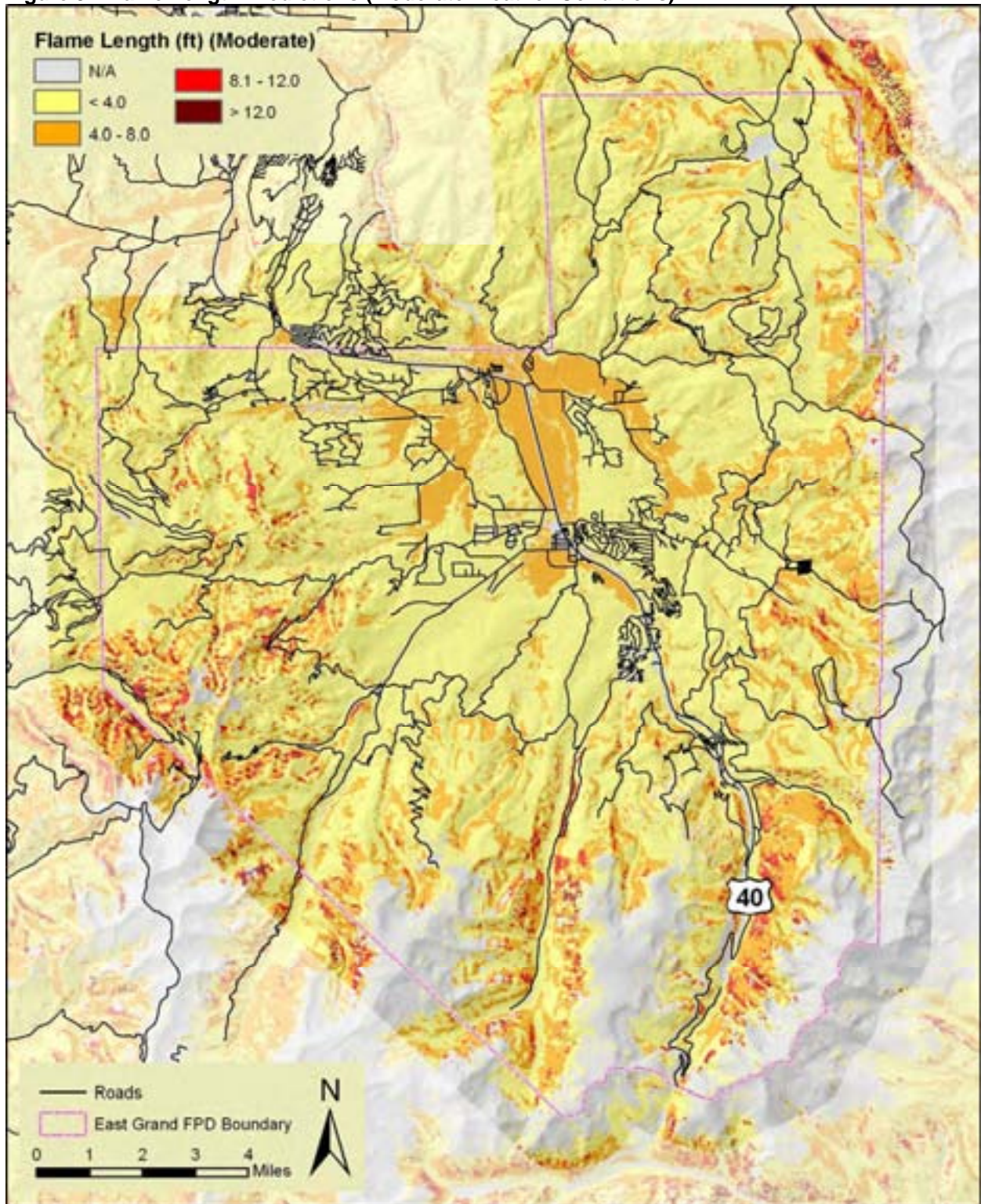


Figure 10. Flame Length Predictions (Extreme Weather Conditions)



Figure 11. Rate of Spread Predictions (Moderate Weather Conditions)

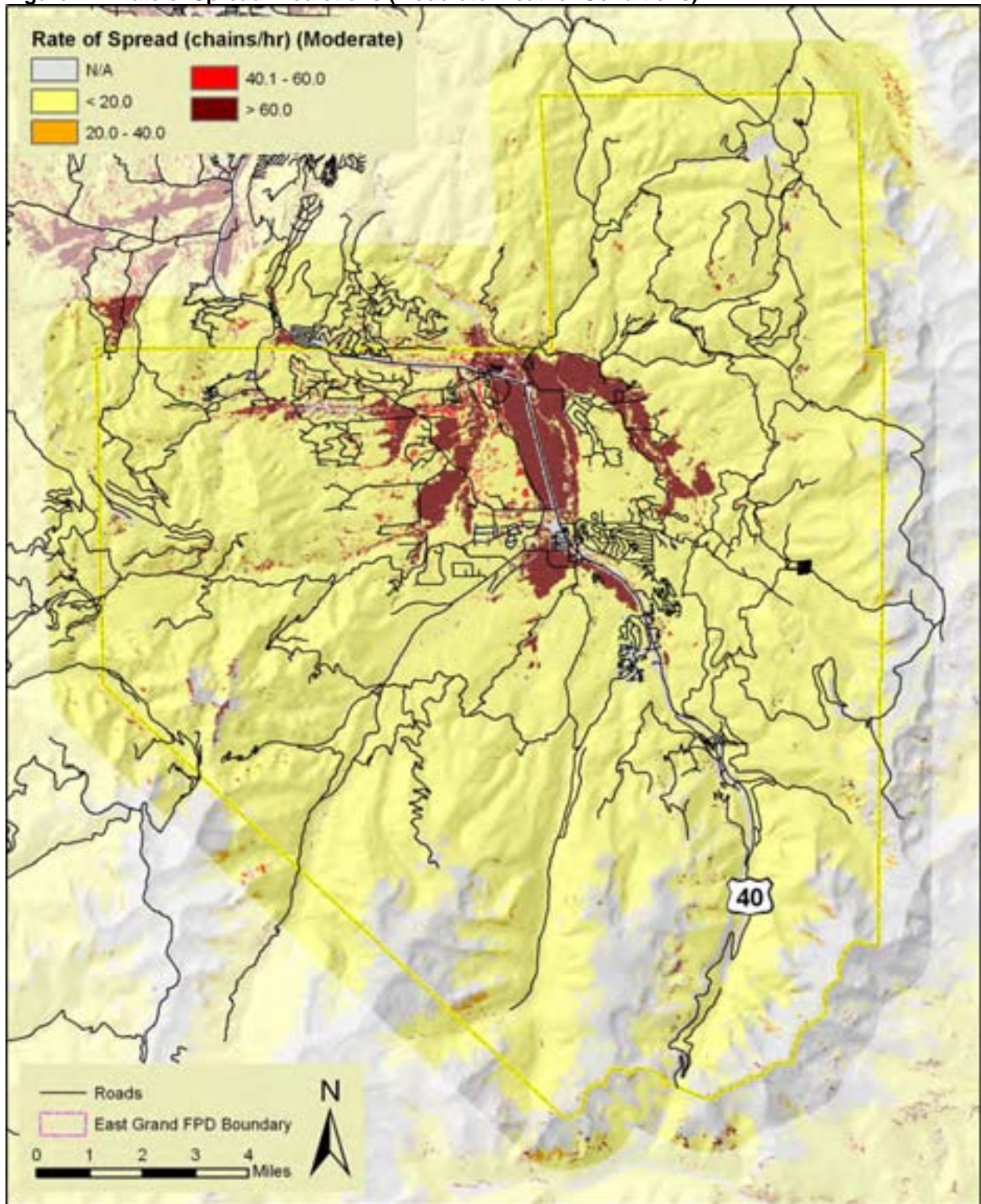


Figure 12. Rate of Spread Predictions (Extreme Weather Conditions)

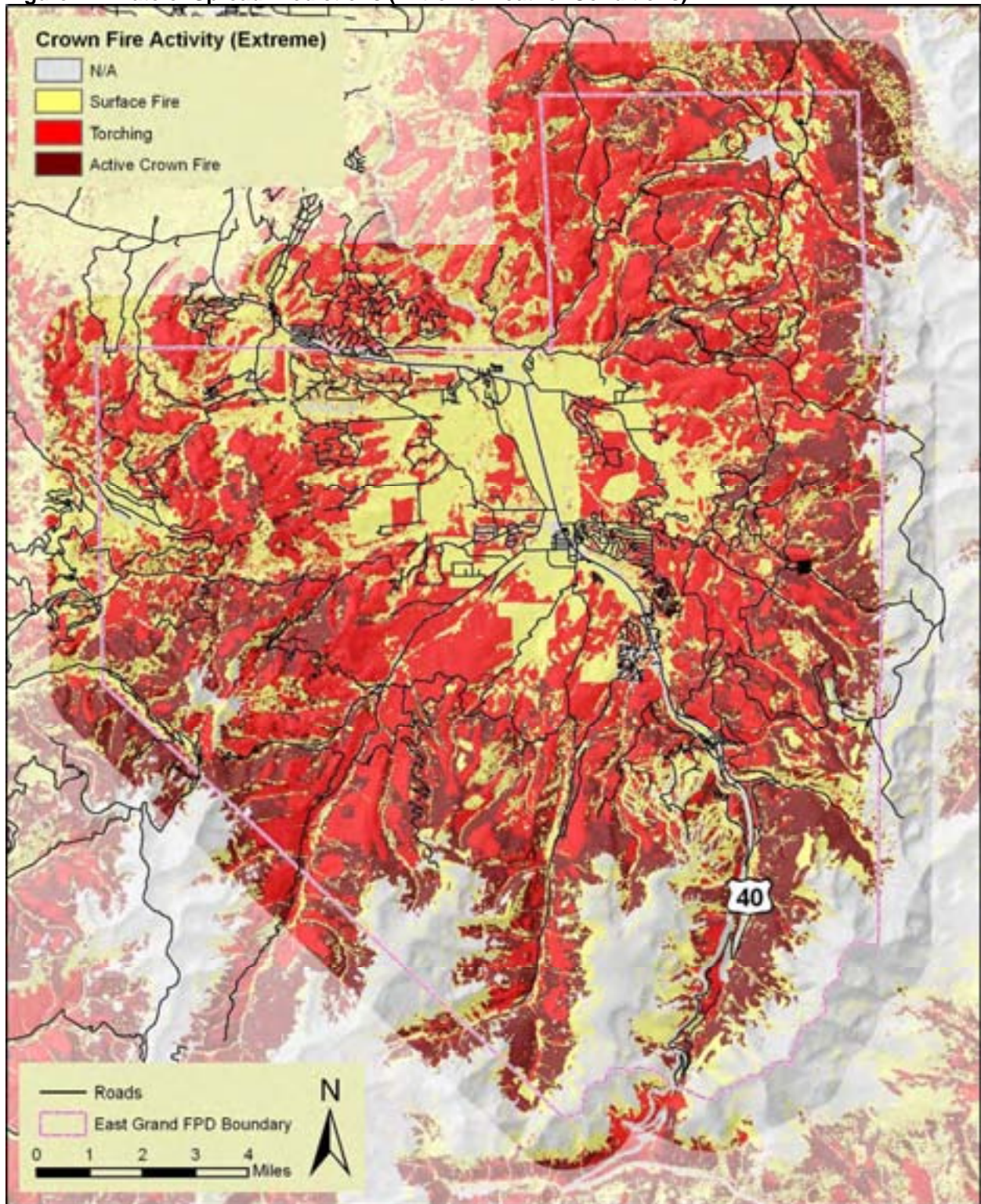


Figure 13. Crown Fire Activity Predictions (Moderate Weather Conditions)

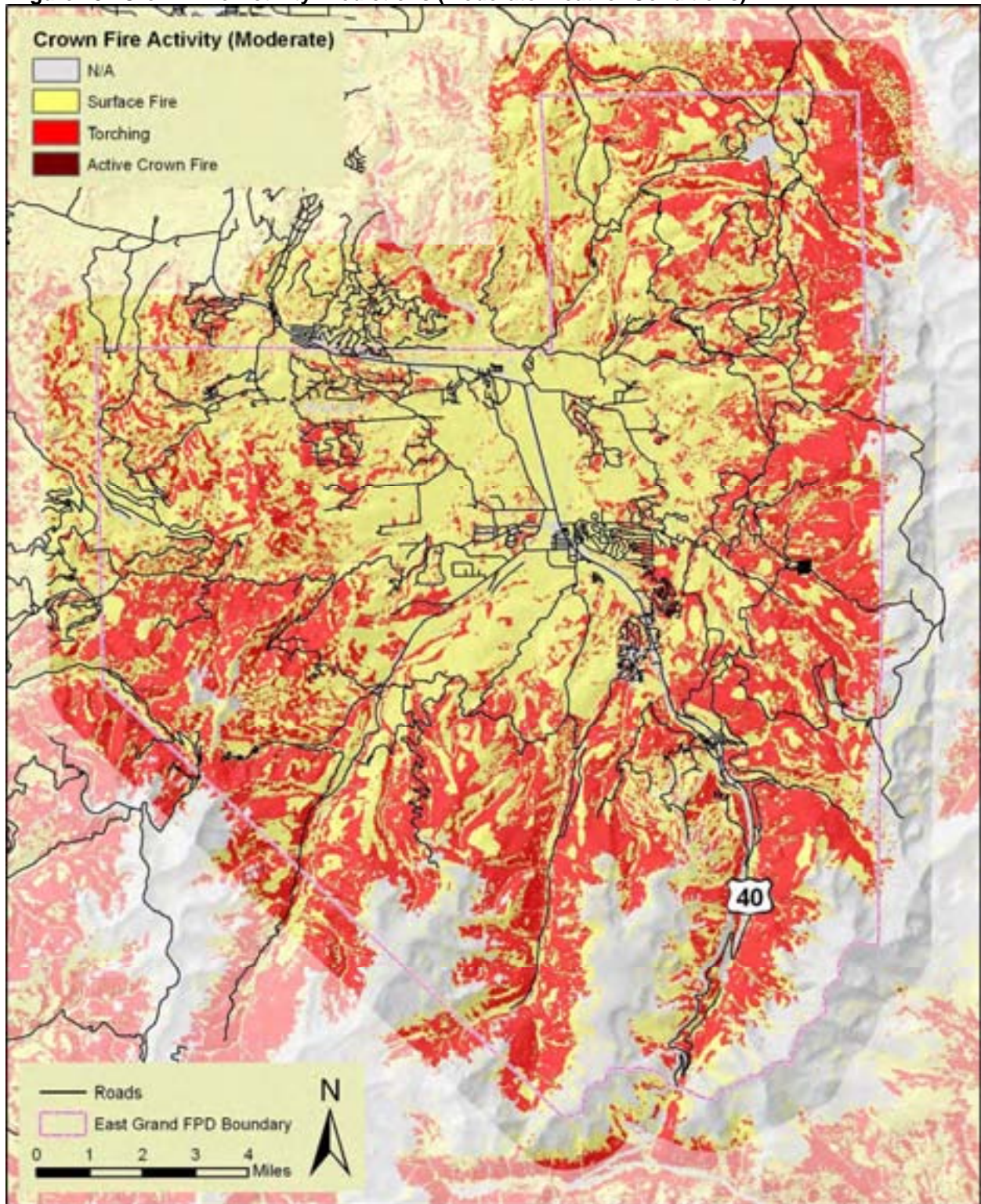
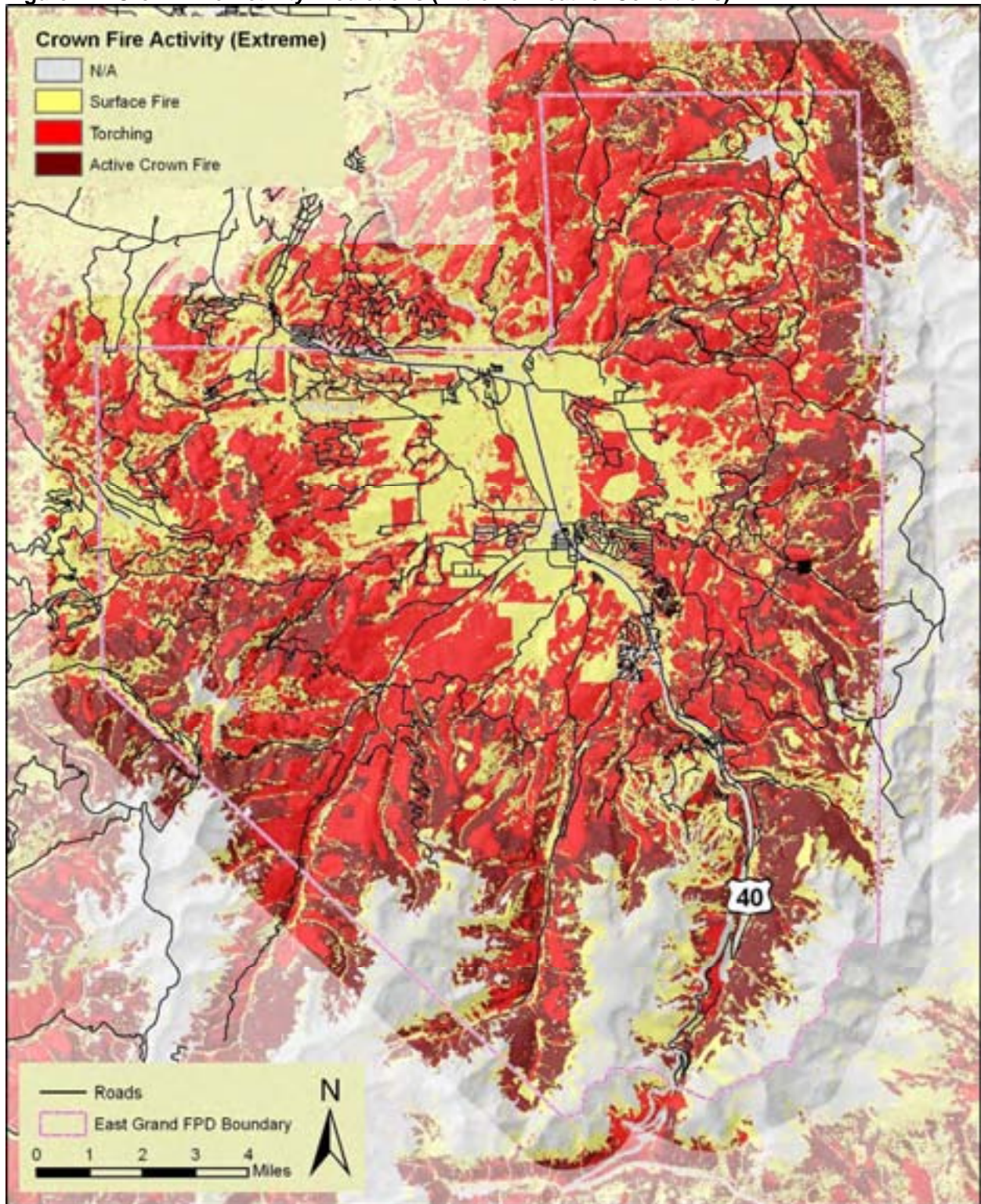


Figure 14. Crown Fire Activity Predictions (Extreme Weather Conditions)



SOLUTIONS AND MITIGATION

ESTABLISHING AND PRIORITIZING FIRE MANAGEMENT UNITS (FMUS)

An efficient method for prioritizing work efforts is to create Fire Management Units (FMUs). FMUs should be created prior to planning or initiating fuels management projects and other mitigation. There are unique vegetation and/or mitigation management activities recommended for each unit. Units may be functional or geographic. The local land management and fire management agencies (ideally with the input of the citizen's advisory council) must determine priority actions. The following FMUs have been identified for the study area, and recommendations are provided for each. FMUs are NOT ranked by priority, although priority recommendations have been provided for specific tactical mitigation actions, where appropriate, within FMUs.

- Addressing and Evacuation FMU
- Public Education FMU
- Local Preparedness and Firefighting Capabilities FMU
- Home Mitigation FMU
- Fuels Modification Projects FMU
- Water Supply FMU
- Areas of Special Interest FMU

ADDRESSING AND EVACUATION FMU

Addressing

Most of the communities within the Upper Fraser Valley have missing or inadequate street signage and/or addressing. This problem was especially notable in the following communities: Hurd Creek, Winter Park Highlands, Meadow Creek, Hamilton Creek, CR 8, Winter Park Ranch, Winter Park Resort and Old Town, Beaver Meadows Preserve, Idlewild Meadows, Sunset Ridge, Elk Run/Leland Creek, Icebox Estates/Skyview Acres, Alpine Timbers, Sunset Ridge Estates, and Moose Run. This problem is also noted, where applicable, in the individual community descriptions in **Appendix B**. In some parts of the study area, there are intersections with no street signs (see **Figure 15**). The only address marker for many homes is a homemade marker. These vary widely in type and location, some are difficult to identify as address markers. Most are not reflective and would be difficult to locate in dark or smoky conditions (see **Figure 16**). In most of the communities there are address markers mounted on wooden poles or trees. Some of these are located in the middle of the yard rather than at the driveway or the structure (see **Figure 17**). There are community driveways in the study area where multiple homes are accessed from a single driveway off the public road. Some of these have flagged addressing. Flagged addressing is a term that describes the placement of multiple addresses on a single sign, which services multiple structures located on a common access. Where flagged addressing exists, the marker placements are inconsistent, often difficult to read and in some cases confusing (see **Figure 18**).

While residents may consider non-reflective wooden address signage to be decorative, it is an impediment to quick and effective response. Proper reflective signage is a critical operational need. The value of the time saved, especially at night and in difficult conditions, cannot be overestimated. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true for volunteer operators who do not have the opportunity to train on access issues as often as career firefighters. Recommended specifications for address markers can be found in **Appendix D**.

Figure 15. Intersection with no street signs



Figure 16. Home-made marker



Figure 17. Wooden marker mounted on a tree



Figure 18. Home-made flagged addressing



RECOMMENDATIONS

- A program of replacing worn or difficult to read street signs should be developed, and should include the County, developers, HOAs and the East Grand and Grand fire departments. Every intersection and street name change should have adequate, reflective signage.
- In the Winter Park Ranch community address numbers are not sequential, sometimes switching randomly from increasing to decreasing. In at least one case the same address number can be found in two different condo complexes. Address numbers in Winter Park Ranch should be reviewed and corrected by Grand County as soon as possible to eliminate this confusing and potentially dangerous situation.
- Flagged addressing on community driveways should be replaced with reflective markers that indicate the proper road fork, where applicable, for each address. This system should be repeated at every place where the driveway divides and an individual driveway leaves the community driveway.
- For each home, reflective markers should be placed where the driveway leaves an access road and on the house itself. These may be in addition to, or in place of, existing decorative address markers. Consistency in height and placement should be stressed.
- Lot markers should be replaced with address markers as soon as a home has a certificate of occupancy.
- Where dead-end and private road markers occur, the addresses of homes beyond the marker should be clearly posted. This can be done with a group address marker, for example “14391-14393 Highway 119.”
- Develop a public education campaign to advise property owners of the importance of proper street addressing and how to properly address their property.

Evacuation Routes

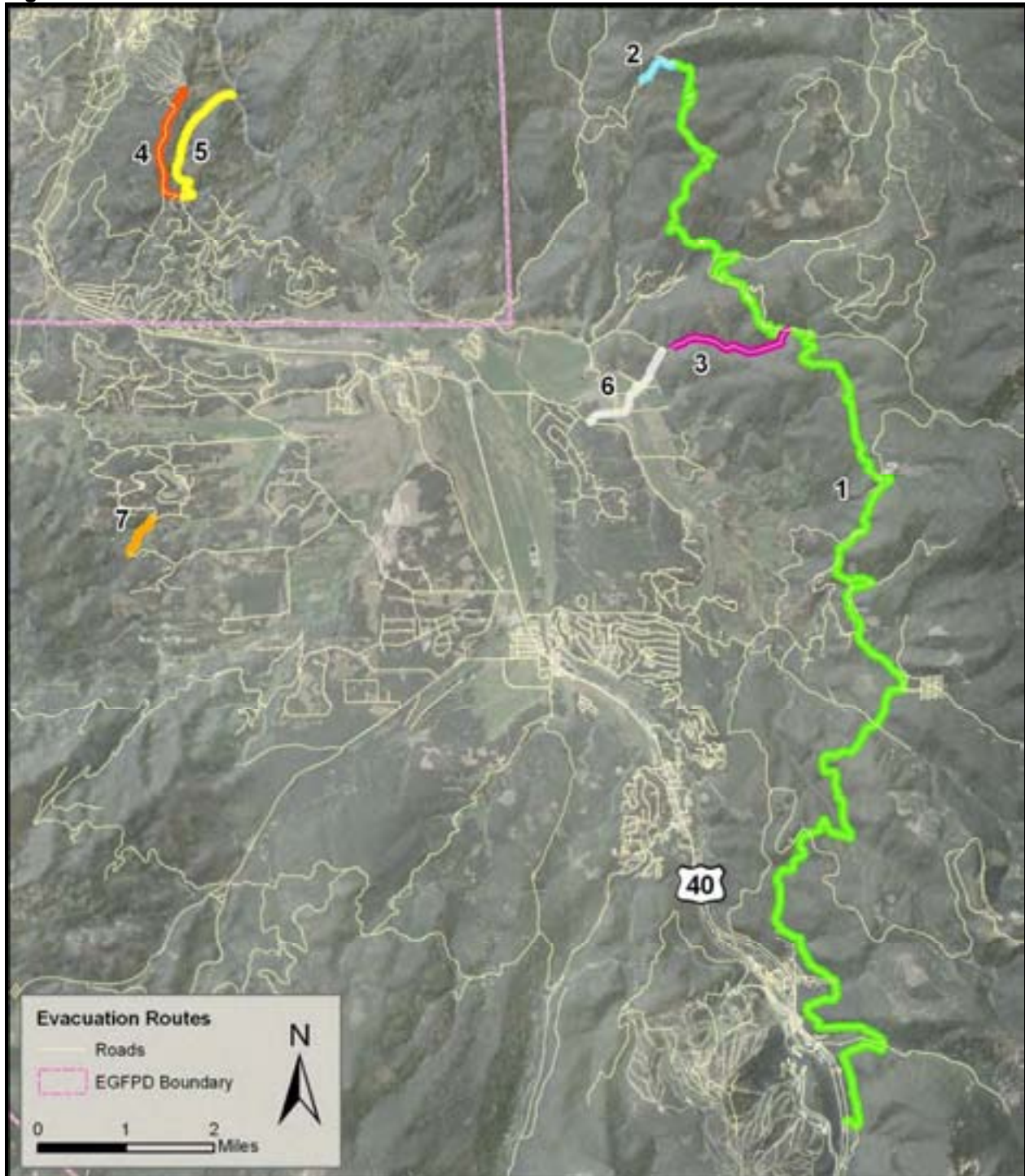
Seven projects have been identified which could serve as alternative evacuation routes and/or firefighter access routes to the primary access. These projects are highlighted in the overview of the district shown in **Figure 19**.

1. **Denver Water Board Road Improvements: *Priority level High***. The Denver Water Board Road runs along the east side of the study area from Meadow Creek Reservoir to US 40 east of Mary Jane Ski Resort. The road is improved dirt and along most of its length is suitable for passenger cars in dry conditions. Its position east of US 40 could be especially valuable for escaping fires burning from west to east (the dominant direction of winds in the study area), if access to US 40 is blocked by heat and smoke. When combined with road improvements and emergency-use pre-planning for Meadow Creek Road and Hamilton Creek Road, the Denver Water Board Road could become a critical secondary escape route for the hazardous communities of Meadow Creek, Hurd Creek, Hamilton Creek, and CR 8. It could potentially be useful for evacuations in the east side of Lakota and future development along Jim Creek. The road should be pre-planned as an “emergency use only” escape route and maintained to allow for passenger car access in dry conditions. Fuels should be thinned to shaded fuelbreak standards along both sides of the road.

2. **Meadow Creek Road Improvements:** *Priority level High*. Meadow Creek Road below the Meadow Creek community is an improved dirt road with some good pullouts, but it is the only public access to this community. The road above the community becomes narrow, rough, and rutted for a short distance before connecting with the Denver Water Board Road. In order to complete a secondary escape route from Meadow Creek as described in Project 1 above (*Denver Water Board Road Improvements*), this section of Meadow Creek Road will need to be improved, widened where possible, and fuels will need to be thinned away from the roadside. Fuels should also be thinned to shaded fuelbreak standards along the primary access portion of Meadow Creek Road (the lower portion of the road running southwest from the Meadow Creek community to the intersection of Meadow Creek Road and Hamilton Creek Road).
3. **Hamilton Creek Road Improvements:** *Priority level High*. Hamilton Creek Road intersects the Denver Water Board Road east of the Hamilton Creek community. This route could provide an important secondary escape route from the hazardous Hamilton Creek and Hurd Creek communities. Unfortunately, access has been blocked by private land owners, and the road becomes rough, narrow, and rutted on its eastern end. If a political solution can be reached to use the road as an emergency-only escape route, the road should be improved and widened where possible. Where necessary, fuels should be thinned to shaded fuelbreak standards along Hamilton Creek Road from its intersection with the Denver Water Board Road to the intersection with Meadow Creek Road. This is a high-priority project because it improves access safety for two extremely hazardous communities.
4. **Unnamed Dirt Road Connecting Winter Park Highlands to Sol Vista:** *Priority level High*. An unnamed dirt road running west and north from the intersection of Lions Creek and Callahan Way could be planned and improved as an emergency-only escape route from the northern portion of Winter Park Highlands. This road connects with a service road for the Sol Vista ski resort and runs back to the base area of the resort. The road would need to be inspected for suitability for passenger cars and pre-planned for emergency-only use because of gates. If the road proves to be suitable, it should be maintained and fuels should be thinned to shaded fuelbreak standards. This is a high-priority project due to the high density and hazardous conditions in the Winter Park Highlands community.
5. **Railroad Grade Access Road Improvements:** *Priority level Moderate*. An unnamed dirt road running northeast from the intersection of Lions Creek and Callahan Way could be pre-planned and improved as a firefighter access route from the northern portion of Winter Park Highlands to the railroad grade running along the east side of this community. This access would also be useful as a containment line for ignitions occurring along the railroad grade, if it were thinned and maintained to shaded fuelbreak standards for 200 feet from the centerline of the road. If possible, this road should be anchored by safety/deployment zones cut at both ends to improve firefighter safety.
6. **Hamilton Creek Power Line Escape Route:** *Priority level Moderate*. It may be possible to improve an existing power line cut that runs south from the Hamilton Creek community to connect with existing unnamed roads leading to Devil's Thumb Road. Although this route will not be suitable for citizen evacuation, it could provide a useful escape route/access point for firefighters. This route crosses private land, and permission to improve and preplan it for firefighter use would need to be secured from the affected landowners.

7. **Aslan Way Escape Route:** *Priority level Moderate.* Investigate the possibility of using an existing meadow and two-track to connect the end of Aslan Way to Snow Ridge Drive. This could become a more important secondary escape route as the CR 5170 community becomes more populated.

Figure 19. Evacuation Routes



OTHER ACCESS ROUTE RECOMMENDATIONS

- See *Access Route Fuels Modification*, p. 50.
- **Priority level High.** In order to reduce potential 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. Golf courses and large irrigated meadows may make good safety zones for firefighting forces. Local responders are encouraged to preplan the use of potential staging areas with property owners.
- **Priority level High.** Identify and pre-plan primary escape routes for all WUI communities. Emergency management personnel should be included in the development of preplans for citizen evacuation.
- **Priority level High.** Educate citizens on the proper escape routes and evacuation centers to use in the event of an evacuation.
- **Priority level High.** Employ 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 should be expanded to include wildfire notifications.
- **Priority level Moderate.** Perform response drills to determine the timing and effectiveness of escape routes and fire resource staging areas.

PUBLIC EDUCATION FMU

The Upper Fraser Valley, like the rest of Grand County, is experiencing ongoing development. Increasing property values and the associated rise in the number of non-resident owners has resulted in a varied understanding among property owners of the intrinsic hazards associated with building in WUI areas. In addition to community and emergency services efforts at risk reduction, an approach to wildfire education emphasizing safety and hazard mitigation on an individual property level should be undertaken. 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.

A definitive shift to shared responsibility must be promoted. Homeowners must be made aware that fire suppression resources cannot be the only line of defense against wildland fires. Landowners and homeowners must take responsibility as key players in mitigation efforts. The Anchor Point analysis has shown that landscape-scale fuels modifications may not be effective in preventing the loss of structures in the fuels and conditions that exist in the study area. Defensible space planning, maintenance, ignition-resistant construction, and preventative landscaping techniques are critical to the mitigation of the loss of life and property during wildfire events.

RECOMMENDATIONS

- Use these web sites for a list of public education materials, and for general homeowner education:
 - http://www.fs.fed.us/fire/links/links_prevention.html
 - <http://www.firewise.org>
 - <http://csfs.colostate.edu/protecthomeandforest.htm>
 - <http://www.blm.gov/nifc/st/en/prog/fire.1.html>
- Provide citizens with the findings of this study including:
 - Levels of risk and hazard.
 - Values of fuels reduction programs.
 - Consequences of inaction for the entire community.
- Create a Fire Safe Council or similar WUI citizen advisory council to promote the message of shared responsibility. Too often, advice from government agencies can be construed as self-serving. Consequently, citizens may resist acting on this information. The Fire-Safe Council should consist of local citizens, and its primary goals should be:
 - Bringing the concerns of the residents to the prioritization of mitigation actions.
 - Selecting demonstration sites.
 - Assisting with grant applications and awards.
- Make use of regional and local media to promote wildfire public education messages in the fire district.
- Develop a wildfire educational presentation explaining the concepts of defensible space and wildfire hazard mitigation. The information in this report should be incorporated into that presentation for the education of homeowners district-wide. This could be done through informational gatherings sponsored by the fire department, homeowners associations or neighborhood groups, such as local festivals, school events, times of extreme fire danger, and other times of heightened awareness concerning wildfire. It is far easier to bring the information to citizens than to bring citizens to the information, making this an especially powerful resource.

LOCAL PREPAREDNESS AND FIRE FIGHTING CAPABILITIES FMU

Fire suppression services for the study area are provided by East Grand Fire (EGF) and the Grand Fire Protection District (GFPD). EGF provides fire suppression for most of the study area; only the Winter Park Highlands community falls within the boundaries of GFPD. EGF and GFPD are jointly building a new fire station near the YMCA of the Rockies Snow Mountain Ranch and have an auto aid agreement. Mutual aid is available from the Grand Lake Fire Protection District, Hot Sulphur Springs – Parshall Fire Protection District, Kremmling Fire Department, Clear Creek Emergency Services District and the Northwest Colorado – I 70 Corridor Mutual Aid Group.

EGF has 35-45 resident and volunteer members. Ten of these firefighters are certified to the National Wildfire Coordinating Group (NWCG) S130/190 (basic wildland firefighter) level, but none are qualified as advanced wildland firefighters (Squad Boss level or higher).

EGF currently operates two fire stations and is building a third station (the Red Dirt Station) jointly with EGFD. EGF has 11 pieces of fire apparatus, a communications/command post vehicle and two utility vehicles. The headquarters station is located on US Hwy 40 and is staffed by a crew of two residents and 30 volunteer firefighters. The headquarters station has three full-time administrative staff weekdays during business hours. Station 2 is located on County Road 526 and is staffed by a crew of one resident and eight volunteer firefighters. The Red Dirt Station is located on the main access to Snow Mountain Ranch just west of US 40.

Distances to the nearest fire stations were calculated in ArcGIS and take into account the road distance to a given area, rather than merely the “flight distance.” **Figure 20** shows the road distances from the communities to the nearest fire station.

All or a portion of the Winter Park Highlands, Beaver Mountain Preserve, Moose Run, CR 5170, Meadow Creek, Sheep Mountain Ridge/The Valley, Fairways, Lakota, Mary Jane Resort and CR 8 communities are greater than five miles from a fire station. However, for the purposes of this report, this is not an Insurance Services Office (ISO) issue, but one of defining response distance to potential fire ignitions. The distance analysis calculates *drivable distance, not drive time*. However, the distance is an important factor in rating community hazards. Response times will vary greatly over the same distance due to road conditions, steepness, curvature of roads, and evacuation traffic. Most fire service leaders agree that response time is composed of a number of distinct elements: call processing time (the time it takes for dispatchers to ascertain the location and nature of the emergency and initiate the appropriate response), turnout or staffing time (the time it takes for personnel to respond to the dispatch, board apparatus, and begin traveling to the scene), and travel time (the actual time it takes to travel from the station to the scene).

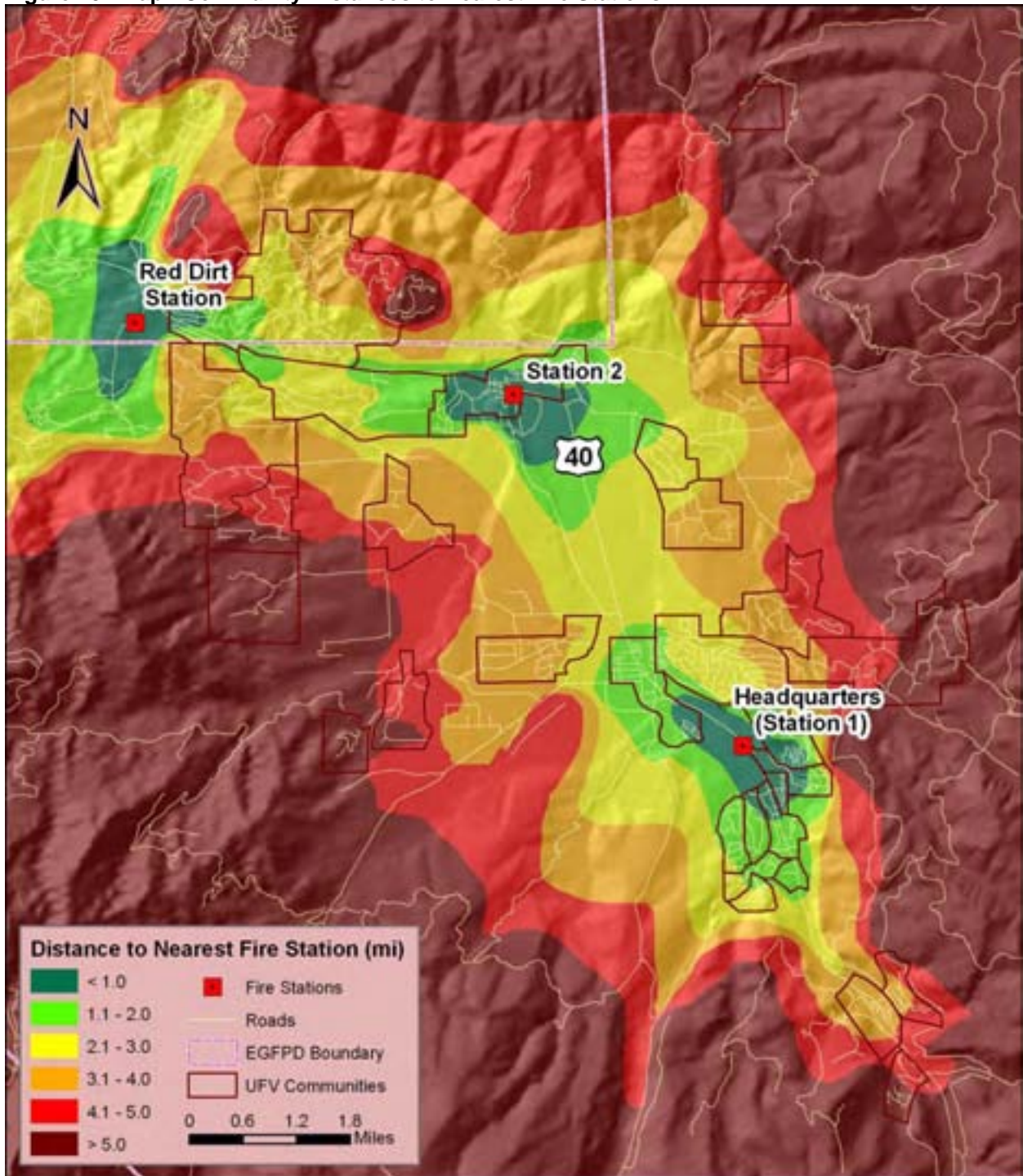
The National Fire Protection Association (NFPA) has established time objectives for volunteer organization fire response. NFPA 1720 requires:

- Ten minutes or less for the arrival of the first arriving engine company at a fire suppression incident and a staffing level of ten members or more.¹⁹

If a turnout time of two minutes is observed and the average driving speed is 30 MPH, then the engine company will be able to drive four miles in the ten minutes established by NFPA 1720. Therefore, communities with mean distances greater than four miles from a fire station were given a weighted increase in their hazard rating.

¹⁹NFPA 1720-6 “Organization and Deployment of Fire Suppression Operations by Volunteer Departments”, National Fire Protection Association 2004, table 4.3.2 (Staffing and Response Time).

Figure 20. Map - Community Distances to Nearest Fire Stations



RECOMMENDATIONS

- Training: **Priority level High**. Provide continuing education for all firefighters including:
 - NWCG S-130/190 for all department members.
 - Annual wildland fire refresher and “pack testing” (physical standards test) for all department members.
 - In house engine operation training for all department members.
 - S-212 Wildland Power Saws for at least one department member per/shift per/apparatus.
 - S-215 Fire Operations in the Urban Interface for all officers and engine operators.
 - S-290 Intermediate Fire Behavior for all officers.
 - I-200 and I-300 – Basic and Intermediate ICS for all firefighters.

- Equipment:
 - **Priority level High**. Ensure that all firefighters have wildland Personal Protective Equipment (See NFPA Standard 1977 for requirements).
 - **Priority level High**. Provide gear bags for both wildland and bunker gear to be placed on engines responding to fire calls. This helps ensure that firefighters have both bunker gear and wildland PPE available when the fire situation changes. It is recommended that auto-aid agencies carry the same equipment on their apparatus.
 - **Priority level Moderate**. Provide and maintain a ten-person wildland fire cache at Station 2 and the new fire station (Station 3) in addition to any tools on the apparatus. The contents of the cache should be sufficient to outfit two squads for handline 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:
 - **Priority level Low to Moderate** (depending on cost effectiveness). Surveys revealed that radio communications are generally good except for canyon and drainage bottoms, especially in the more remote areas such as Berthoud Pass. Due to the restrictions of terrain, it is unlikely that more powerful base stations or portable radios would make any impact on VHF communication problems. Some areas may see slight improvements in base station reception by increasing the height above average terrain of the base station antenna. However, the best solution is to increase the number of VHF repeaters in the problem areas. If

landowners are a barrier to fixed repeater sites, another solution is to construct one or more mobile repeaters in engines or command vehicles. Mobile repeaters allow the vehicle to be positioned for optimum communication for each incident. Repeaters are expensive, but grants and other sources of funding could be pursued in order to solve this operational problem. If it is not possible to obtain a repeater frequency, which is likely, satellite phones may be a reasonably efficient additional tool for incident communication.

- o *Priority level **Low to Moderate*** (depending on the cost effectiveness of test units). Surveys of EGF officers indicated that their VHF communications system has difficulty in some high rise buildings and parking structures, especially at the ski areas. Although VHF radios operating in the 150 MHz band are still the primary radios for many wildland fire resources and generally have better reception than 800 MHz systems in complex terrain, it may be advisable to experiment with using Nextel units to supplement the existing radio system. Other Colorado fire departments located in mountainous terrain have had success with this solution, however the usefulness of Nextel units should be thoroughly tested before any purchase is considered due to the limited number of Nextel sites in the study area.

HOME MITIGATION FMU

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

The community-level assessment has identified 8 of the 31 communities in the study area to be at extreme or very high risk. Construction type, condition, age, the 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 4** illustrates the relative hazard rankings for communities in the study area.

In the communities with extreme and very high hazard ratings a parcel-level analysis should be implemented as soon as possible. Please see **Appendix B** for more detailed information.

Table 4. Upper Fraser Community Hazard Ratings

Hurd Creek - Extreme	Sunset Ridge - High
Winter Park Highlands - Extreme	The Fairways - High
Meadow Creek - Extreme	Elk Run/Leland Creek - High
Hamilton Creek - Extreme	Ice Box Estates/Skyview Acres - High
CR 8 – Very High	Alpine Timbers - High
Arapahoe Road – Very High	Sunset Ridge Estates - High
Lakota – Very High	Moose Run - High
Mary Jane Resort – Very High	High Country Haus - High
Winter Park Ranch - High	Stagecoach - Moderate
Beaver Village - High	Sheep Mountain Ridge & The Valley - Moderate
Winter Park Resort and Old Town - High	Pole Creek Meadows - Moderate
Reserve at Elk Horn Ridge - High	Town of Winter Park - Moderate
Beaver Mountain Preserve - High	Tabernash - Low
Rendezvous North - High	Fraser - Low
Idlewild Meadows - High	CR 5170 - Low
Rendezvous South - High	

Defensible Space

The most important element for the improvement of life safety and property preservation is conforming, effective defensible space for every home in the study area. 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 (see **Figure 21**).

Figure 21. Saddle & Ridge Top Development²⁰



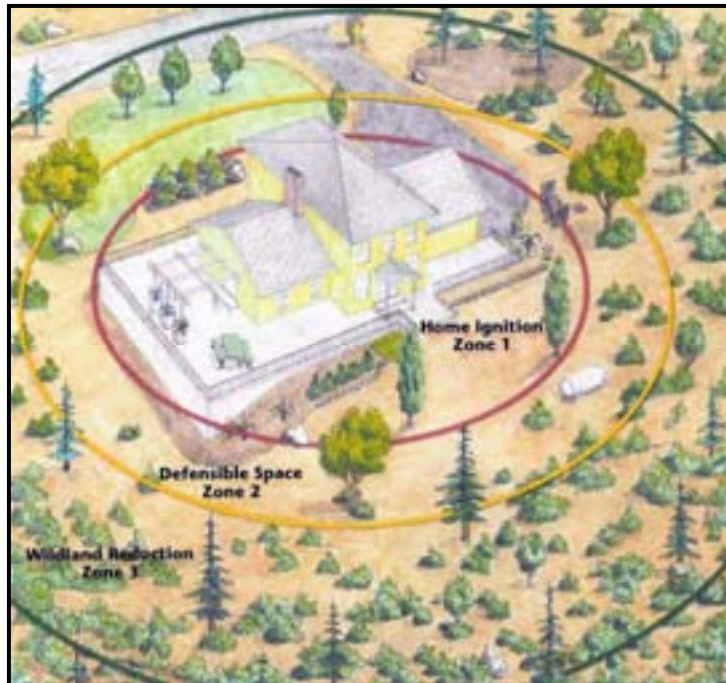
An aggressive program of evaluating and implementing defensible space for homes will do more to limit fire-related property damage than *any other single recommendation in this report*.

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 challenge is deciding how much to remove. 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. Then 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 22**). 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 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 now 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.

²⁰ *FireWise Construction*, Peter Slack, Boulder, Colorado

Figure 22. Defensible Space Zones²¹



RECOMMENDATIONS

- **Priority level High.** Conduct a parcel-level wildfire hazard analysis for all the homes in communities rated from extreme to high hazard. Completing this process will facilitate the following important fire management practices:
 - Establish a baseline hazard assessment for individual 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 study area. A pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate damage when incidents do occur.
- **Priority level High.** Request that home owner's associations and other neighborhood groups promote the development of defensible space and Firewise plantings. Eliminate any covenants or deed restrictions that require or endorse the use of flammable building materials such as shake roofs.

²¹ A Homeowner's Guide to Fire Safe Landscaping(2005) www.FireSafeCouncil.org

- **Priority level High.** Add reflective address signs at each driveway entrance to 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 defensible.

LANDSCAPE SCALE FUELS MODIFICATIONS FMU

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as a “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 to remove 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 to create an open park-like appearance. The use of fuelbreaks under normal burning conditions can limit uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions where spotting occurs for miles ahead of the main fire and probability of ignition is high, even the best fuelbreaks are not effective. That said, fuelbreaks have in fact proven to be effective in limiting the spread of crown fires in Colorado.²² 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, compared 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, would be good candidates for fuel breaks.

Crown fire activity values for the study area were generated by the FlamMap model and classified into three standard ranges (surface fire only, passive crown fire, and active crown fire). In areas where active crown fire activity is likely, fuelbreaks should be considered. If there are known likely ignition sources (such as railroads and recreation areas that allow campfires) in areas where there is a threat of fire being channeled into communities, fuelbreaks should be considered. Fuelbreaks should also be considered, where appropriate, to help protect critical infrastructure and ecosystem values.

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

²² Frank C. Dennis, “Fuelbreak Guidelines for Forested Subdivisions” (Colorado State Forest Service, Colorado State University, 1983), p. 3.

from backing down the other side or spotting into the next drainage. This is sometimes not practical from a WUI standpoint, because the structures that 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 either of defensible space work or of existing roads and escape routes.

One tactic would be to create fuelbreaks on slopes below homes that are located either mid-slope or 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 tactic that is commonly used is positioning fuelbreaks along the bottom of slopes. In most of the study area this would require the cooperation of many individual landowners. In some areas, the only way to separate residences from fuels is to locate the fuelbreak mid-slope above homes. This would provide some protection from backing fires and rolling materials. Where possible, it would make sense to locate fuelbreaks mid-slope below homes, to break the continuity of fuels into the smaller units mentioned above. Even though this position is considered the least desirable from a fire suppression point of view, it would be the most effective approach in some portions of the study area.

Fuelbreaks are often easiest to locate along existing roadbeds (see *Access Route Fuels Modification Recommendations*, p. 50). The minimum recommended fuelbreak width is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuel break should be increased, with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = $100' + (1.5 \times \text{slope } \%)$, above road distance = $100' - \text{slope } \%$ (see **Table 5**). Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%.²³ Since fuelbreaks can have an undesirable effect on the aesthetics of the area, crown separation should be emphasized over stand density levels, because isolating groupings rather than cutting for precise stem spacing will help to mitigate the visual impact of the fuelbreak. Irregular cutting patterns that reduce canopy and leave behind islands with wide openings are effective in shrub models. This is sometimes referred to as a mosaic cut.

Another issue in mechanical thinning is the removal of cut materials. 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, perhaps making the area more hazardous than before treatment. Slash materials must be disposed of by piling and burning, chipping, physical removal from the area, or lopping and scattering. Of all of these methods lopping and scattering is the cheapest, but it is also the least effective, since it adds to the surface fuel load.

It is also important to note 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. Fuelbreaks should not be constructed without a maintenance plan.

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

²³ Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" (Colorado State Forest Service, Colorado State University, 1983), p. 11.

United States Forest Service, the Bureau of Land Management, the Denver Water Board, The Colorado State Forest Service, The Town of Winter Park and possibly others.

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

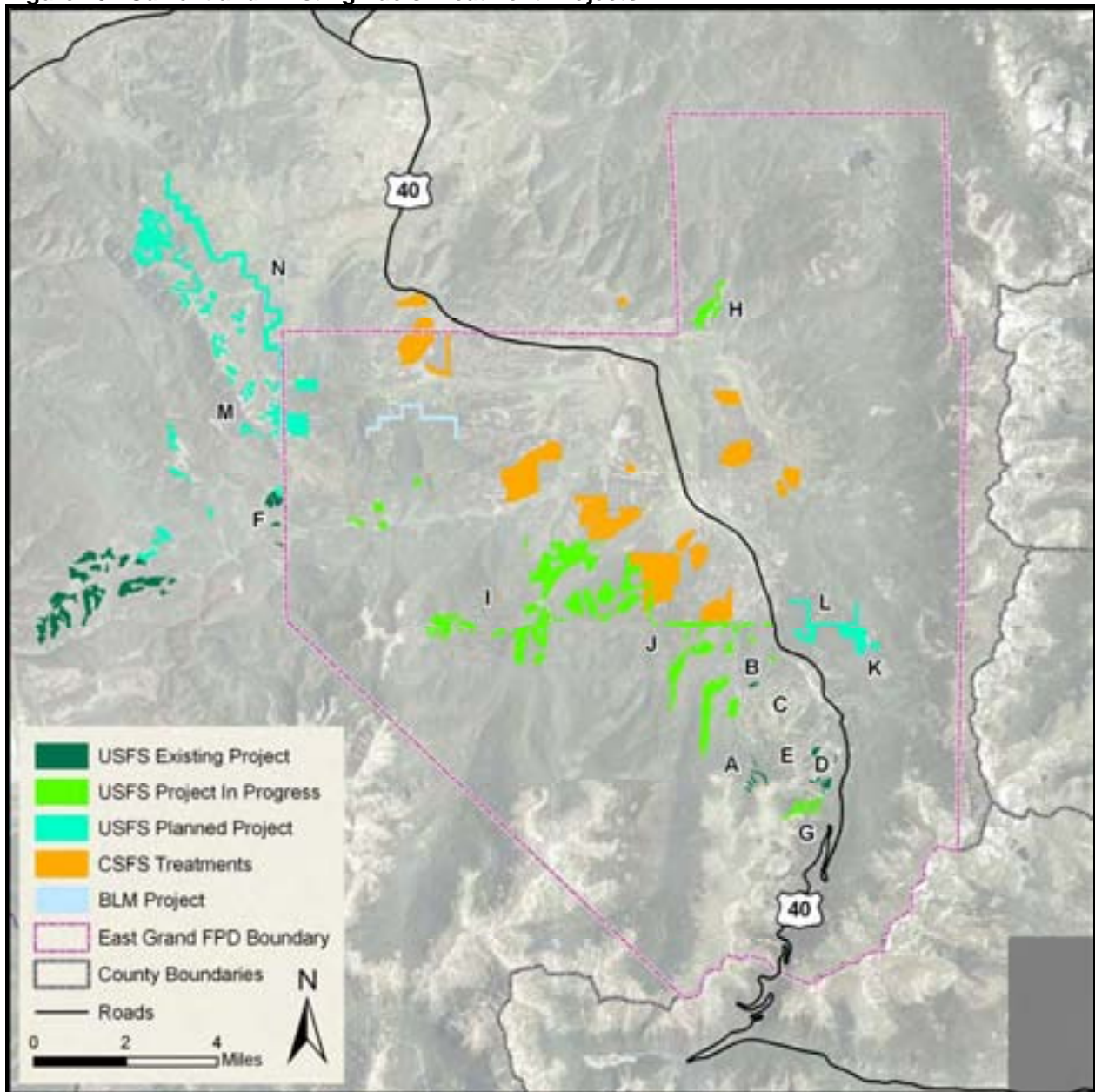
Current and Planned Projects

The principal public land managers in the study area are the USFS, the BLM, and the CSFS. All of these entities have existing, current, and/or planned fuels reduction treatments in the study area. These treatments vary from prescribed fire to hazard tree/hazardous fuels removal to salvage cuts and clear cuts. The map in **Figure 23** shows the boundaries of treatment areas for projects in and near the Upper Fraser Valley study area. Projects delineated on the map are shown in one of the following categories:

- **Existing** – Units where treatments have been completed.
- **In Progress** – Units where treatments are currently in progress and/or have been partially treated.
- **Planned** – Treatment unit boundaries have been defined, but may not be exact. Planning may not be finalized.

More detailed information on each treatment area can be found in the list on page 49.

Figure 23. Current and Existing Fuels Treatment Projects



- A. **Parsenn and Bearscat Cutting Units:** (USFS) These are completed treatments units in the Winter Park Ski Area. These units are timber cuts and most appear similar to clear cuts.
- B. **Cache Settlement Cutting Unit:** (USFS) This is a completed treatment unit in the Winter Park Ski Area.
- C. **Discovery Cutting Units:** (USFS) This is a completed treatment unit in the Winter Park Ski Area.
- D. **Mary Jane Settlement Thinning Area:** (USFS) This is a completed treatment area in the Winter Park Ski Area.
- E. **Summit Express Timber Units:** (USFS) These are completed treatment units in the Winter Park Ski Area.
- F. **Simpson Units:** (USFS) This is a completed timber sale, and the units have been harvested. They appear similar to clear cuts.
- G. **Sweeds Ridge Units:** (USFS) These units are currently being treated in the Winter Park Ski Area.
- H. **Tabernash Units:** (USFS) These units are currently being treated. When finished, the treatments will appear similar to clear cuts.
- I. **Upper Fraser Units:** (USFS) The Upper Fraser units are partially for timber removal and partially for hazard tree and hazardous fuel removal. Logging and treatments started in 2007.
- J. **Upper Fraser Units II:** (USFS) The Upper Fraser units are partially for timber removal and partially for hazard tree and hazardous fuel removal. Logging and treatments started in 2007.
- K. **Arrow Timber Units:** (USFS) This planning project has not been finalized. These units will be treated commercially to remove timber and to reduce the fuel hazard. These polygons do not represent the exact treatment boundaries but are a close representation.
- L. **Arrow Fuels Units:** (USFS) This planning project has not been finalized. These units will be treated for fuel removal purposes only. They will not be harvested commercially. No change in habitat structure stage is expected. Fuels will be removed or dealt with on site in order to reduce hazards.
- M. **Blue Ridge Ground Units:** (USFS) This planning project has not been finalized. These units will be treated commercially to remove timber and reduce fuel hazards. These polygons do not represent the exact treatment boundaries but are a close representation.
- N. **Blue Ridge WUI Fuelbreaks:** (USFS) This planning project has not been finalized. These polygons do not represent the exact treatment boundaries but are a close representation. These units will be treated for fuel removal purposes only. They will not be harvested commercially. Fuels will be removed or dealt with on site in order to reduce hazards.

In addition to the projects shown here, numerous projects are being conducted by developers and other private property owners. New projects are continuously developing in the study area and are impossible to track in this kind of document. In accordance with the National Fire Plan, federal and state land managers in this area have demonstrated a willingness to preplan treatments with local fire departments and landowners, in order to create cross-boundary hazard reduction efforts. It is important for EGF, the town of Winter Park, and private landowners to coordinate fuels reduction projects so they complement these efforts.

ACCESS ROUTE FUELS MODIFICATION RECOMMENDATIONS

The primary transportation corridor through the district is US 40. Throughout most of the study area, US 40 has an adequate opening to wildland fuels. Nonetheless, many of the communities in the study area would benefit from fuels reduction along their access routes. Some of the communities in the study area have a single narrow access with fuels encroaching on the road surface. In these single access areas, it is especially important to thin and/or remove any hazardous fuels that could compromise safe access.

Wherever practical, thinning along primary access roads into communities should include an area of at least 100' on either side of the centerline of the access routes. 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 communities that should be considered highest priority for fuels reduction along access corridors are:

- Winter Park Highlands
- Meadow Creek
- Hurd Creek
- Hamilton Creek
- CR 8
- Arapahoe Road
- Beaver Mountain Estates
- Ice Box Estates/Sky View Acres
- Winter Park Ranch

In addition to the access road treatments for the communities listed above and along the escape routes suggested on pages 33-35, other possibilities should be defined and similar fuels reduction projects employed. In areas where multiple routes exist, consider differentiating, in pre-attack plans, between access routes for responders and escape routes for citizens.

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 in access road fuels reduction projects allows for more flexible tree and shrub selection/removal. It also allows greater consideration for the elements of visual screening and aesthetics. Enlarging the project dimensions creates more options for vegetative selection, while still protecting the access/egress corridor.

- Elements of the fuels modification space for access and egress routes should include:
 - o Tree crown separation of at least 10', with groups of trees and shrubs interspersed as desired
 - o Crown separation greater than 10' may be required to isolate adjacent groups or clumps of trees

- o Limbing of all remaining trees to a height of 8' or 1/3 of the tree height (whichever is lower)
- o Removal of ground fuel within the project area
- o Posting of placards that clearly mark "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.

OTHER FUELS MODIFICATION RECOMMENDATIONS

The following recommendations are in addition to, not in place of, the fuels reductions mentioned in the *Access Route Fuels Modification Recommendations* section of this report. These recommendations have been designed to take advantage of prevailing wind patterns in this area (winds from the west) and cannot account for all weather conditions and circumstances.

Recommendations are listed by priority level. However, recommendations within each priority level are of relatively equal importance, and no further sorting is necessary. The prioritization of recommendations was driven principally by life safety concerns. Conservation of property and operability were considered as secondary factors. Only treatments affecting values inside the boundaries of the study area have been included. Obviously, fire does not respect administrative boundaries, so cooperative efforts with adjoining fire districts are highly recommended. Many of the recommendations in this report will require the cooperation of private landowners, and in some cases, land managers from public agencies. Negotiations and public education efforts should begin as soon as possible to secure a consensus for future fuels reduction projects on the landscape scale.

These recommendations are not a replacement for defensible space or other recommendations in this report. It is important to understand that defensible space for all homes is a critical element in reducing hazards to life and property. Large scale fuels reductions were considered for all communities rated from high to extreme hazard. However, reasonable landscape-scale projects could not be identified to slow the rate of fire spread and intensity for every community. It is critical that land owners and managers understand the importance of defensible space for all structures in close proximity to flammable vegetation. These recommendations will only achieve maximum effectiveness if they are used in conjunction with defensible space treatments. An overview of recommended treatment areas is shown in **Figures 24 and 25**.

Figure 24. Recommended Treatment Areas

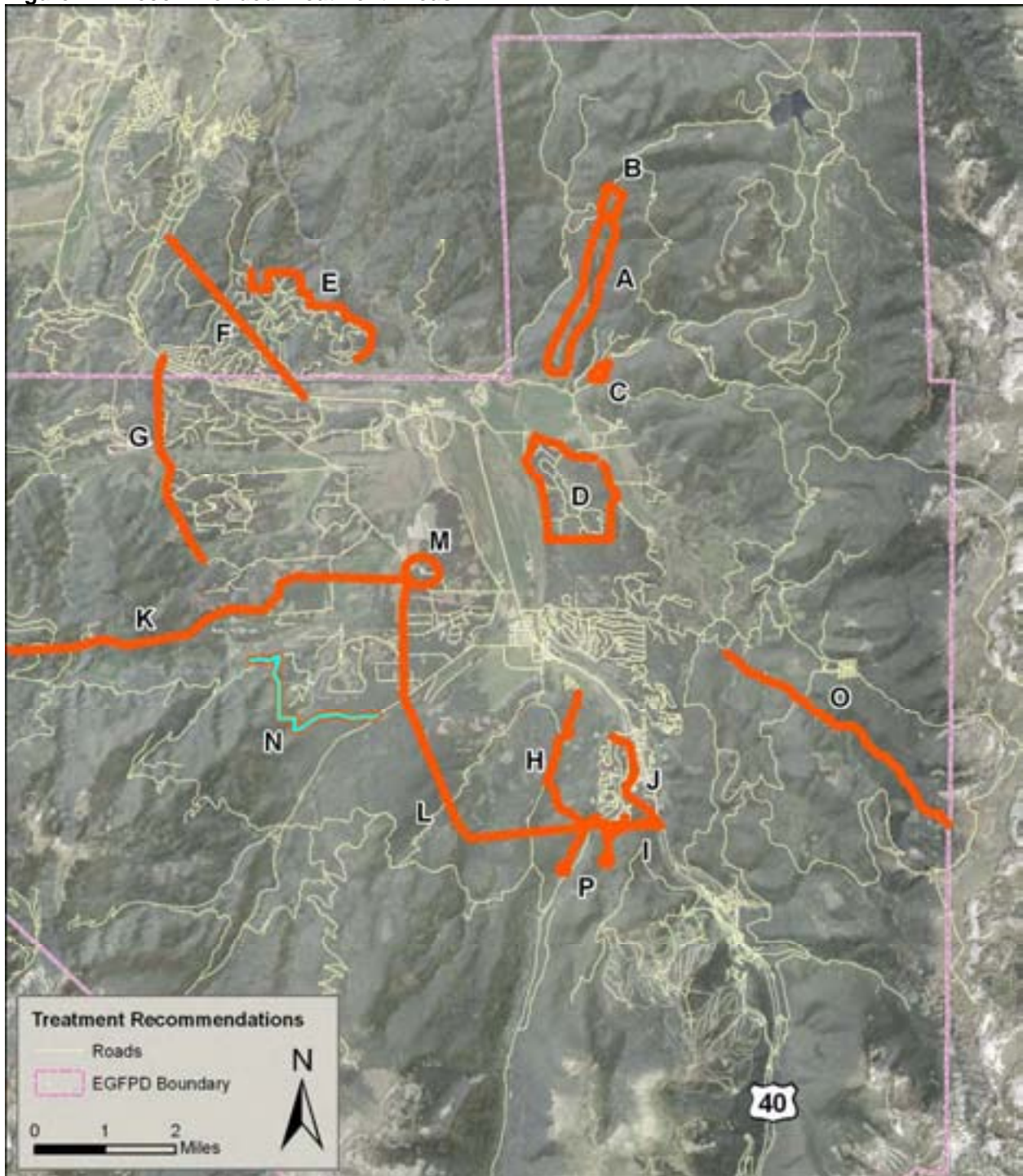
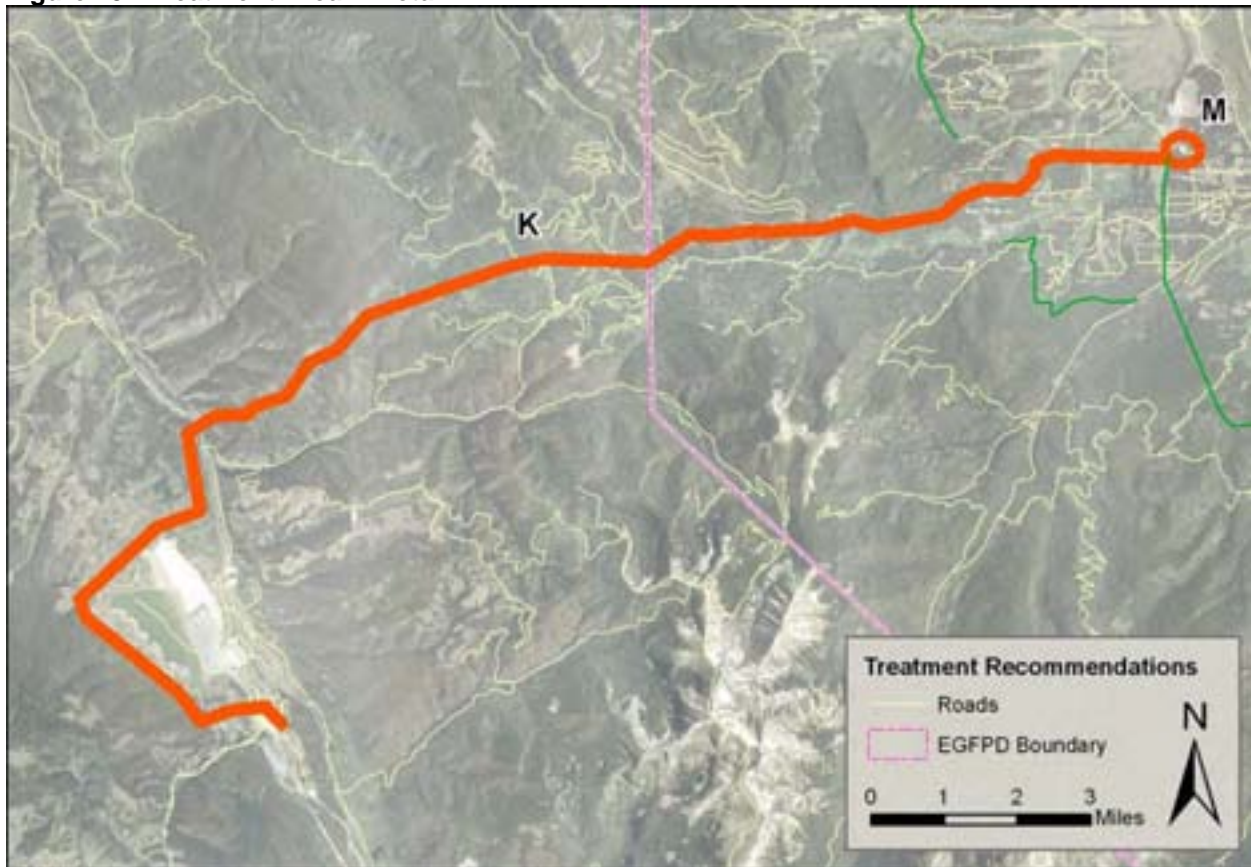


Figure 25. Treatment Area K Detail



In addition to the defensible space treatments and access route fuels reduction projects previously mentioned in this document, the following landscape-scale fuels treatments are recommended:

- A. **Meadow Creek Fuelbreak (Approx. 81 Acres) *Priority level High***. This project connects a series of meadows running roughly parallel to Meadow Creek Road from the south end of the Meadow Creek community to Hamilton Creek Road. Thinning to shaded fuelbreak standards to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. This project is designed to provide a fuelbreak from ignitions moving from the west for the hazardous communities of Hurd Creek and Hamilton Creek, as well as provide a control line for firefighting resources.
- B. **Meadow Creek Safety Zone (Approx. 55 Acres) *Priority level High***. This project improves a meadow located at the south end of the Meadow Creek community. Clearing of all fuels (other than light grasses to prevent erosion and provide a natural appearance) is recommended for a separation distance (firefighter to the outer edge of the treatment area) of at least four times the flame lengths predicted by the extreme weather scenario fire behavior model. This project is designed to provide a safety zone for firefighting resources and an anchor point for the Meadow Creek Fuelbreak (**Project A**). For more general safety zone recommendations, see **Appendix C**.

- C. **Hurd Creek Safety Zone (Approx. 21 Acres) *Priority level High***. The project area is located on USFS land just north of the intersection of Hurd Creek Road and Hamilton Creek Road. Clearing of all fuels (other than light grasses to prevent erosion and provide a natural appearance) is recommended for a separation distance (firefighter to the outer edge of the treatment area) of at least four times the flame lengths predicted by the extreme weather scenario fire behavior model. This safety zone leverages the road treatments recommended for Hurd Creek and Hamilton Creek in *Evacuation Routes* (p. 33), and *Access Route Fuels Modification Recommendations* (p. 50), in order to provide a safety zone and staging area for firefighting resources. If private landowners to the south are cooperative, this safety zone should be extended to include the intersection of Hurd Creek Road and Hamilton Creek Road.
- D. **Sunset Ridge Fuelbreak (Approx. 111 Acres) *Priority level High*** This project involves edge thinning and mowing to create a fuelbreak separating the communities of Sunset Ridge and Sunset Ridge Estates from heavy fuel beds. Thinning to shaded fuelbreak standards to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. Mowing is recommended anywhere property lines are adjacent to continuous fuel beds of native grasses. In addition to providing a fuelbreak for these communities, this project improves access safety by continuing treatments along Devils Thumb Road.
- E. **Bear Paw Fuelbreak (Approx. 77 Acres) *Priority level High*** This project focuses on creating a fuelbreak along the northeast side of the Winter Park Highlands community. The project area includes the outermost roads from the intersection of Bear Paw and the unnamed dirt road mentioned in *Railroad Grade Access Road Improvements Project* (p. 34), and continues to the meadows south of Green Belt Road. Thinning to shaded fuelbreak standards to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. This project is designed to provide a fuelbreak from ignitions burning upslope from the railroad grade, as well as to provide a possible control line for firefighting resources.
- F. **Power Line Thinning, Winter Park Highlands (Approx. 71 Acres) *Priority level High*** Along the power line corridor running through the Winter Park Highlands community, thinning and maintenance cutting to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. The project area includes the power line cut from approximately the junction of US 40 and Winter Park Highlands Drive on the south end to large meadows southeast of the Sol Vista ski resort on the north end. This project will provide a fuelbreak designed to reduce the intensity and rate of spread of fires moving west from US 40 into the hazardous Winter Park Ranch community. It will also help protect a major power line from fire damage and reduce the possibility of a downed power line becoming an ignition source.
- G. **YMCA Fuelbreak (Approx. 75 Acres) *Priority level High*** This project focuses on creating a fuelbreak along the east side of the YMCA property and the western edge of the Fairways and Sheep Mountain Ridge communities. The project area connects a series of meadows. Starting on the north at the large meadow south of Marble Road, this

fuelbreak borders properties along Golf Course Circle, Fenton Way, Wildberry Lane and Samaia Court and ends in the large meadow at the end of Aslan Way. This meadow and the one south of Marble Road should be improved to provide safety zones for firefighters and anchor the project. This fuelbreak also takes advantage of areas burned by the Y fire in 2007. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. The existing meadows should be improved and/or maintained as necessary to preserve the integrity of the fuelbreak. This project is designed to provide a fuelbreak from ignitions originating on the YMCA property and to provide a possible control line for firefighting resources.

- H. **tubing Hill Fuelbreak (Approx. 57 Acres) *Priority level High*** This project focuses on creating a fuelbreak on the west side of the town of Winter Park. The project area connects a series of meadows. Starting on the north at the large meadow between Cozens Trail and US 40, this fuelbreak uses Tubing Hill Road (CR 72) to connect with meadows west of Winter Park ending on Vasquez Road. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. The existing meadows should be improved and/or maintained as necessary, to preserve the integrity of the fuelbreak. This project is designed to provide a fuelbreak from ignitions moving west toward Winter Park and to provide a possible control line for firefighting resources.
- I. **Vasquez Road Fuelbreak (Approx. 25 Acres) *Priority level High*** This project ties in with **Project H** and focuses on continuing the fuelbreak along the south side of the town of Winter Park. The project area starts at the anchor point of **Project H** on Vasquez Road and continues east along the border of USFS and private land to US 40. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. This project is designed to provide a fuelbreak from ignitions moving north toward Winter Park from the Vasquez Creek drainage and to provide a possible control line for firefighting resources.
- J. **Winter Park Railroad Easement Thinning (Approx. 40 Acres) *Priority level High*** This project focuses on thinning fuels along the railroad easement where it runs through the town of Winter Park. This project ties in with **Project I**, and focuses on fuels removal inside the railroad easement from where it begins on the border of USFS land at the anchor point of **Project I** on US 40, continuing to where the easement exits the north end of Winter Park. This project is designed to reduce the likelihood that ignitions generated by trains will spread to heavy fuels in the Alpine Timbers and Beaver Village communities. This project will be most effective when combined with defensible space treatments on the adjacent private property.
- K. **Transmission Line Fuelbreak (Approx. 520 Acres) *Priority level High*** Along the transmission line corridor running from the Mettler Substation to the Henderson Mill substation, thinning and maintenance cutting to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model from the center line of the transmission line corridor. This project is designed to protect the main transmission line feeding the Fraser Valley from

fire damage and reduce the possibility of a downed power line becoming an ignition source. This project will also provide a fuelbreak designed to reduce the intensity and rate of spread of fires moving east from the Williams Fork Wilderness into the communities on the west side of Fraser and Winter Park.

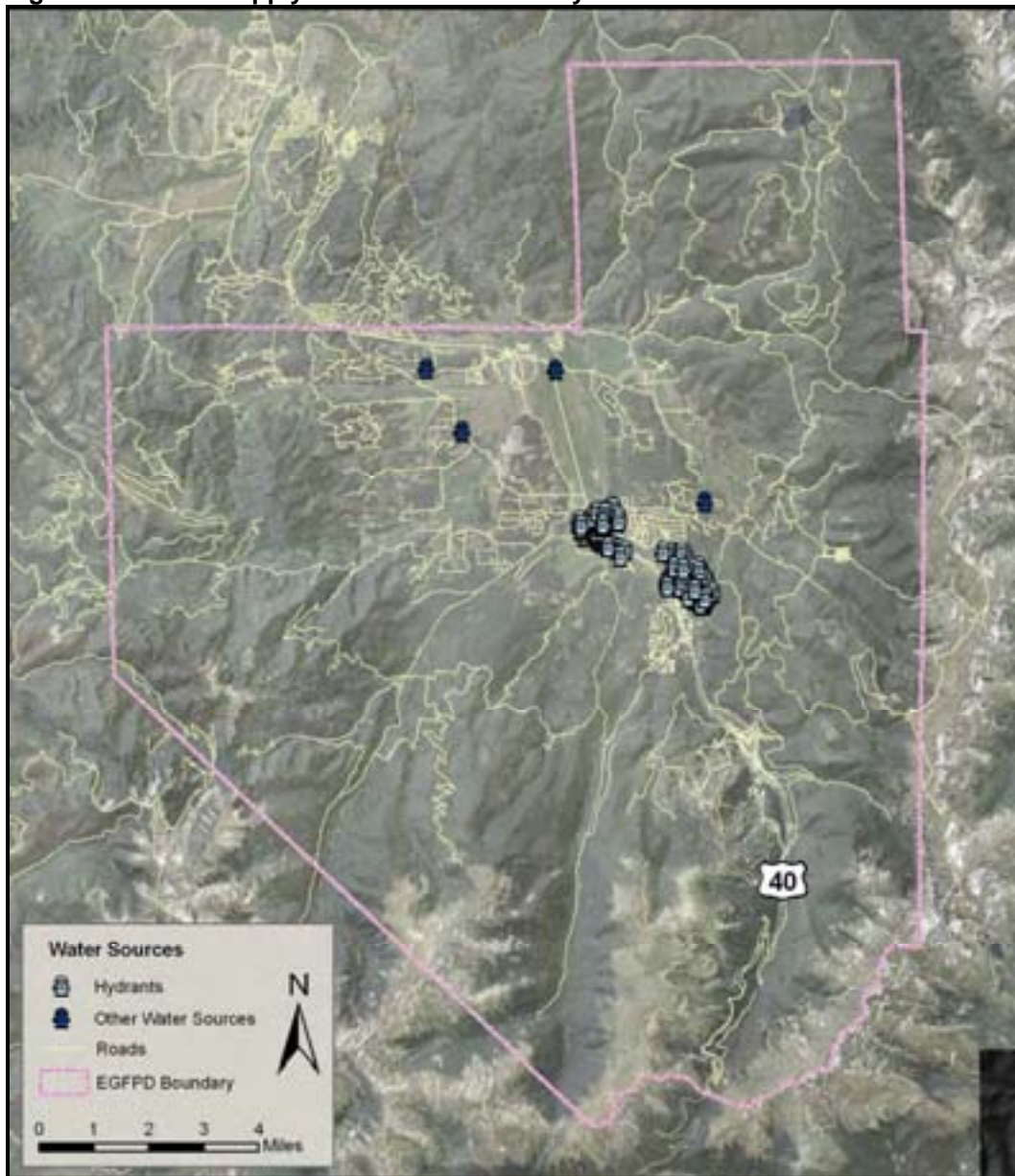
- L. **Distribution Line 1 and 2 Fuelbreak (Approx. 166 Acres)** *Priority level High* Along the primary distribution line corridor running from the Mettler Substation to Winter Park, thinning and maintenance cutting to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model from the center line of the power line corridor. The project area includes the distribution line corridor running south from the Mettler Substation for 1.7 miles to CR 73 and then southeast for two miles and east for another 2.6 miles to the town of Winter Park. This project is also designed to protect the primary distribution lines feeding the towns of Fraser and Winter Park from fire damage and reduce the possibility of a downed power line becoming an ignition source. This project will provide a fuelbreak designed to reduce the intensity and rate of spread of fires moving from the west into Fraser and Winter Park.
- M. **Mettler Substation Treatment (Approx. 11 Acres)** *Priority level High* This project focuses on providing protection for the substation providing electric power for most of the WUI communities of the study area. Around the substation facility, thinning to defensible space standards is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels along the access roads to the substation is also recommended.
- N. **Beaver Mountain Preserve Fuelbreak (Approx. 74 Acres)** *Priority level Moderate* This project is designed to provide a buffer between the Beaver Mountain Preserve community and hazardous fuels to the south. This fuelbreak begins at the intersection of St. Louis Creek Road and the unnamed dirt road ending south of Beaver Mountain Preserve. Thinning should continue along the border between USFS and private lands to the west and north, from the end of the dirt road to the large meadows located on the Crooked Creek Ranch Property. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. This project is designed to provide a fuelbreak from ignitions moving from the south and west into Beaver Mountain Preserve and Moose Run. The project is currently rated as moderate priority due to the relatively small number of homes in this area, but could become a higher priority as development increases.
- O. **Gas Line Point Treatments (Approx. 102 Acres)** *Priority level Moderate* This project focuses on providing point protection to well heads and other values along the gas pipeline road between the CR 8 community and Corona Pass Road. Where well heads and other valuable infrastructure exist, thinning to defensible space standards is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model.

- P. **Water Treatment Plant Fuelbreaks (Approx. 50 Acres)** *Priority level Moderate* This project focuses on providing protection for the two water treatment plants servicing the town of Winter Park and their access. Around the water treatment plant buildings, thinning to defensible space standards is recommended for a distance of at least three times the flame lengths predicted by the extreme weather scenario fire behavior model. Thinning to shaded fuelbreak standards in order to reduce ladder fuels and interrupt the crown continuity of fuels along the access roads for both plants is also recommended.

WATER SUPPLY FMU

Water is a critical fire suppression issue in the study area, as it is in most of the mountainous areas of Colorado. Some areas have an adequate network of hydrants, but in some of the most hazardous interface communities, city hydrants are not available. As part of this study, an on-the-ground evaluation of alternative water sources was conducted in these areas. Additional (non-pressurized hydrant) water sources were identified and pre-planned. Approximate locations of hydrants and these supplemental water sources within the study area are shown in **Figure 26**.

Figure 26. Water Supply Locations in the Study Area



Field verification showed that the hydrants shown in **Figure 26** (the hydrant layer was provided by the Northwest Council of Governments) did indeed exist in the areas depicted. However,

several communities have that appeared to be in good condition, but are not shown in **Figure 26**. These communities include Arapahoe Road, Lakota, Mary Jane Resort, Beaver Village, Winter Park Resort and Old Town, Idlewild, Elk Run/Leland Creek, Alpine Timbers, High Country Haus, Sheep Mountain Ridge/The Valley, Winter Park and Tabernash.

Although there are several additional water sources shown on the map, as well as hydrants that were located during the fieldwork but not shown, there are still residences located more than 1,000 feet from the nearest water source or hydrant in several communities. These communities include Winter Park Ranch, The Reserve at Elkhorn Ridge, Beaver Mountain Reserve, The Fairways, Moose Run, Stagecoach, Sheep Mountain Ridge/The Valley, Pole Creek Meadows and CR 5170. Although these communities have some existing water supply, there are some homes located in all the communities listed above that are located at a considerable distance from reliable water sources for fire suppression. The following communities have no water supply for fire suppression: Hurd Creek, Sunset Ridge, Hamilton Creek, Meadow Creek, Icebox Estates/Skyview Acres and Sunset Ridge Estates. Improvement of the water supply in all these communities constitutes an important FMU. In order for a water supply to be creditable for fire suppression use, it must meet all the criteria established by the EGF Board of Directors. For a complete list of these requirements please see *Access and Water Supply Recommended Guidelines* in **Appendix D**.

RECOMMENDATIONS

- **Priority Level High** Throughout the study area there are private ranches and landowners with water supplies suitable for fire suppression. Wherever such private water sources exist, agreements should be sought with the property owners for the use of the water as a secondary or supplemental source during emergency suppression operations. When such agreements are reached, the water source should be included in fire department pre-plans with information including maps, access information such as gate codes or key locations, the size and type of the water source, whether or not it is accessible to aircraft and equipment, and connections needed for use. This information will be important for the successful use of the water supply by outside resources unfamiliar with the area.
- **Priority Level High** Consider adding one or two cisterns (30,000 gallons or greater) in the Hurd Creek community for fire suppression use.
- **Priority Level High** Consider adding two or three cisterns (30,000 gallons or greater) in the Winter Park Highlands community for fire suppression use. At least one cistern should be located in the isolated northern portion of this community.
- **Priority Level High** A community cistern of 30,000 gallons or greater is highly recommended for the Meadow Creek community. The cistern should be located for easy access by fire apparatus.
- **Priority Level High** Although drafting from the creek may be possible in some areas, a community cistern of 30,000 gallons or greater is highly recommended for the Hamilton Creek community. The cistern should be located for easy access by fire apparatus.

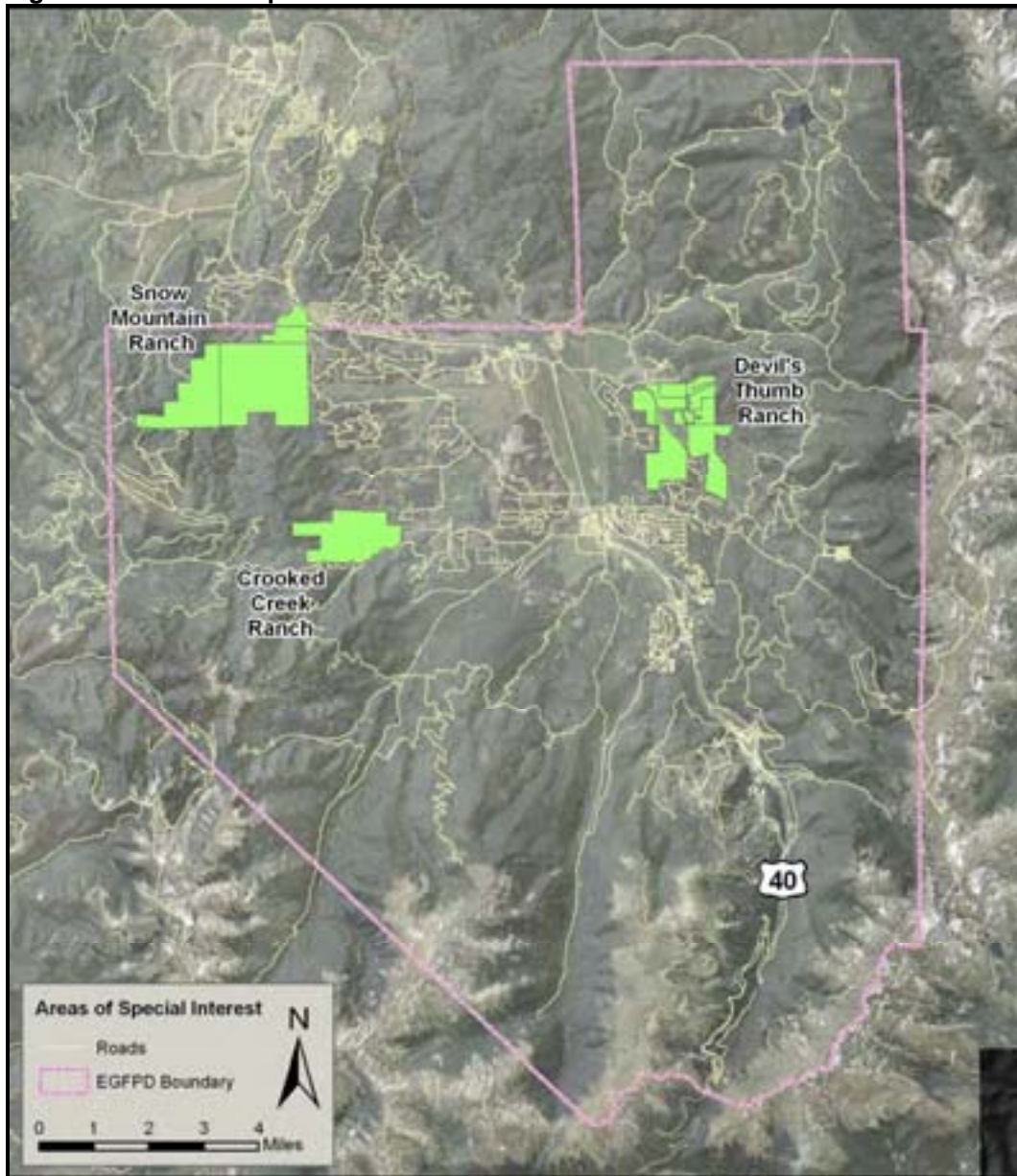
- **Priority Level High** At least three community cisterns of 30,000 gallons or greater should be added in the CR 8 community. At a minimum, one cistern should be located on CR 8, one on CR 809 and one on High Lonesome Trail.
- **Priority Level High** Consider adding one or two cisterns (30,000 gallons or greater) to create a water supply for Sunset Ridge and Sunset Ridge Estates. Additional water supply is a critical need in this community.
- **Priority Level High** Consider constructing a cistern of at least 30,000 gallons in the southern portion of the Fairways (south of the golf course) to compliment the one being installed in the northern portion of this community.
- **Priority Level High** Consider adding one or two cisterns (30,000 gallons or greater) to create a water supply for Icebox Estates and Skyview Acres. Additional water supply is a critical need in this community.
- **Priority Level High** Add a minimum of two cisterns (30,000 gallons or greater) to create a water supply for Moose Run. Additional water supply is a critical need in this community.
- **Priority Level High** Consider adding at least two cisterns (30,000 gallons or greater) to supplement the water supply in Stagecoach. Additional water supply is a critical need in this community and will be even more important as additional homes are built.
- **Priority Level High** Consider adding at least two cisterns (30,000 gallons or greater) to supplement the water supply in The Valley at Winter Park. Additional water supply will be important as additional homes are built.
- **Priority Level High** Consider adding one or two cisterns (30,000 gallons or greater) to supplement the water supply in Pole Creek Meadows. Additional water supply is a critical need in this community.
- **Priority Level High** Consider adding at least two cisterns (30,000 gallons or greater) to supplement the existing cistern in CR 5170. Additional water supply will be important as additional homes are built.
- **Priority Level Moderate** Add a 4.5" to 2.5" adapter to the existing cistern at the entrance to the Beaver Mountain Preserve community to make that water available for fire apparatus that do not have a 4.5" connection. Consider adding an additional cistern (30,000 gallons or greater) for fire suppression use in the southern end of this community.
- **Priority Level Moderate** Standardize connection size, sex, and thread type for all dry hydrants and cisterns (not just those approved as creditable storage). The standards adopted by the EGF Board of Directors (available for review in **Appendix D**) should be observed not only for new construction, but also for refitting existing water supplies. Standardization would result in a smoother, faster and more reliable connection.

AREAS OF SPECIAL INTEREST FMU

Introduction

In addition to residential communities, certain other properties have been identified by stakeholders as being of special concern or interest. In some cases, these areas present special problems for firefighters. A brief description of each of these properties is presented in this section, followed by recommendations, where applicable, designed to address concerns specific to the individual property. These recommendations are in addition to, not in place of, other recommendations in this report concerning the community or area where these properties are located. A map displaying the location and size of these areas is shown in **Figure 27**.

Figure 27. Areas of Special Interest



YMCA of the Rockies Snow Mountain Ranch

In June of 2007 a human-caused fire burned 50 acres on the Snow Mountain Ranch property. Extreme fire behavior including active crown fire was experienced on the fire (see **Figure 28**). The fire was stopped less than 200 feet from some of the homes in The Fairways community. Extensive fuels treatments and a rapid response most likely prevented the fire from consuming hundreds of acres in the insect-infested lodgepole stands.

Figure 28. The Y Fire



Snow Mountain Ranch operates year-round and can host as many as 1,500 guests in addition to the ranch staff. Many of these guests and campers are children. The ranch has implemented an aggressive program of removing dead and insect-infested trees. The ranch is also reforesting some of the logged areas with aspen, spruce, ponderosa pine and other species resistant to the mountain pine beetles which have infested the existing lodgepole stands (over 80% of the existing conifer stands on the ranch property are lodgepole pine).²⁴ The ranch is continuing to work with the Colorado State Forest Service to remove hazard trees and reforest the property.

Although there has been extensive clearing, many of the cabin and camp areas consist of flammable structures in close proximity to timber stands. In most portions of the ranch, shelter-in-place tactics are not applicable. The ranch has developed a fire evacuation plan to address these concerns.

RECOMMENDATIONS

- 100 feet of defensible space is recommended for all residential structures. For details about creating defensible space, see *Home Mitigation FMU* on page 42.
- For life safety and to help prevent a structure fire from spreading to the surrounding wildland fuels, sprinklers are recommended for all buildings. (Some of the newer buildings already have sprinklers.)
- Improve and maintain an existing opening from the ranch property to Fenton Way as an emergency-only access point.

²⁴ <http://www.ymcarockies.org/resources/files//PDFs/SMRPDFs/MtPineBeetle.pdf>, page 4.

- Building markings are inconsistent and non-reflective. Work with EGF to develop a consistent marking system for buildings.
- Work with EGF to complete a wildland fire preplan for the ranch property. Some elements of this plan should include the name/number of all buildings with their use and maximum occupancy, the location and type of all water sources, the location and condition of all roads and trails (all vehicle, 2WD high clearance, 4WD, bike trail passable by ATVs, foot traffic only).
- Include the ranch fire evacuation plan in EGF pre-plans and coordinate evacuation exercises with EGF.
- Investigate the possibility of pre-planning the Kiva Center as an incident command post and staging area for responders. This building is suitable for this purpose because of its extensive defensible space, large size, and ignition resistant construction.

Crooked Creek Ranch (Young Life)

The Crooked Creek Ranch occupies most of the land between the CR 5170 community and Church Park Road. Like Snow Mountain Ranch, Crooked Creek Ranch routinely houses large numbers of campers and guests during the fire season, most of them children. The ranch property has extensive stands of lodgepole-dominated mixed conifer, but these stands are broken by meadows and a large power line cut. The property has been heavily mitigated and most of the buildings have some defensible space. All of the residential buildings have sprinklers and many of the buildings have ignition resistant construction (heavy timber and rock siding with an asphalt or metal roof). There is a 150,000 gallon gravity-fed water supply and an extensive network of trails that could be useful for firefighter access and control lines. The ranch has livestock, and animal evacuation could be an issue.

RECOMMENDATIONS

- Maintain 100 feet of defensible space for all residential structures. For details about creating defensible space, see *Home Mitigation FMU* on page 42.
- Investigate the possibility of using existing meadows and roads to create a fuelbreak west of the main ranch buildings between Church Park Road and the power line cut on the north side of the ranch property.
- Work with EGF to develop a consistent marking system for buildings.
- Work with EGF to complete a wildland fire preplan for the ranch property. Some suggested elements of this plan are: the name/number of all buildings with their use and maximum occupancy, the location and type of all water sources, and the location and condition of all roads and trails (all vehicle, 2WD high clearance, 4WD, bike trail passable by ATVs, foot traffic only).
- Develop an evacuation plan (including a plan for animal evacuation), and coordinate evacuation exercises with EGF.

The Devil's Thumb Ranch

The Devil's Thumb Ranch occupies 5,000 acres on the northeast side of the study area. The ranch is operated year-round as a vacation property and working ranch. There are 16 cabins, residences (including the owner's residence), a 53-room lodge, and various other buildings on the property. Although the Devil's Thumb Ranch does not support the number of guests that Snow Mountain Ranch and Crooked Creek Ranch can, there is still a significant number of residents, staff and guests at the ranch during the fire season.

The ranch has maintained a natural setting, and although there are openings, significant stands of lodgepole-dominated mixed conifer exist throughout the property. Some insect-killed timber has been removed and more is scheduled for removal.

The lodge complex is a metal building with an ignition-resistant roof and sprinklers that is new as of 2007. Other buildings on the property are a mix of ignition resistant and flammable building materials. Some of the older buildings, especially the cabins, are too close to flammable vegetation, do not have sprinklers or a water supply for fire suppression, and have access that would be difficult, or perhaps impossible in some cases, for fire apparatus (narrow roads with flammable vegetation encroaching the drivable surface). There is a secondary access on the south end of the ranch (gated) that leads out to CR 8. The ranch has a significant amount of livestock and animal evacuation is an issue.

RECOMMENDATIONS

- A minimum of 100 feet of defensible space is recommended for all residential structures. For details about creating defensible space, see *Home Mitigation FMU* on page 42.
- For life safety and to help prevent a structure fire from spreading to the surrounding wildland fuels, sprinklers are recommended for all buildings. (Some of the newer buildings already have sprinklers.)
- Clear and thin vegetation to shaded fuelbreak standards along access roads and driveways to the cabin properties.
- Where possible, improve access roads to allow apparatus access and provide turnarounds at all residential structures.
- Investigate the possibility of pre-planning the new lodge building as a shelter-in-place center, in case evacuation becomes impossible due to heat and smoke on the access road.
- Work with EGF to develop a consistent marking system for buildings.
- Work with EGF to complete a wildland fire preplan for the ranch property. Some suggested elements of this plan are: the name/number of all buildings with their use and maximum occupancy, the location and type of all water sources, and the location and condition of all roads and trails (all vehicle, 2WD high clearance, 4WD, bike trail passable by ATVs, foot traffic only).
- The gated road connecting the Devil's Thumb Ranch with the Reserve at Elkhorn Ridge should be preplanned for use as an evacuation route during an emergency.
- Develop an evacuation plan (including a plan for animal evacuation), and coordinate evacuation exercises with EGF.

Shelter-In-Place

All of the areas of special interest could potentially have large numbers of people on site during the fire season. Evacuation of large numbers of people on the limited access roads will be especially difficult even under the best of conditions. In the worst case, fires could produce enough heat and smoke on the access roads to effectively block evacuation. In addition to improved access/egress in these areas, consideration should be given to developing “shelter-in-place” areas that are designed as alternatives to evacuation through hazardous areas. The communities of Hurd Creek, Hamilton Creek, Meadow Creek, CR 8, Sunset Ridge, Sunset Ridge Estates, Beaver Mountain Preserve and Moose Run could also be easily cut off by ignitions producing enough heat and smoke on the access to block evacuation by residents. Structures capable of serving as shelter-in-place facilities for residents of these communities should also be considered for pre-planning.

There are several ways to protect the public from an advancing wildfire. One of these methods is evacuation, and involves relocation of the threatened population to a safer area. Another is to instruct people to remain inside specially pre-planned buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response, where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia, where fast moving, non-persistent fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed pre-plan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, and current and expected weather and fire behavior.

Shelter-in-place should only be considered when the structure is determined to be “stand-alone” in structural triage terms. An example of such a structure in the study area would be the Kiva Conference Center at Snow Mountain Ranch. In order to be stand-alone, buildings must be of ignition-resistant construction and have defensible space. Depending on the fuel type and fuel bed depth, it may be necessary to continue treatment beyond the minimum recommended defensible space boundaries in order to make the building stand alone. For a list of defensible space recommendations, please see *General Recommendations*, **Appendix B**.

Ignition-resistant construction is necessary for shelter-in-place tactics. Wooden roofs and old structures with untreated wooden siding are particularly hazardous and should not be considered. It is necessary to have an ignition-resistant roof, such as metal or asphalt, and ignition-resistant siding materials such as stucco or concrete, especially close to the ground. Heavy timber constructions, such as log homes, are also resistant to surface fires. When combined with an ignition resistant roof type, heavy timber may be acceptable. Eaves should be enclosed. Any holes in the foundation, siding, or eaves should be covered to prevent embers from entering.

Threats to residents remaining in structures include heat, smoke, and ignition of the structure itself. Fires consume oxygen and produce toxic gasses and smoke. A great deal of research has been done in the hazardous materials field on the infiltration of toxic gasses into structures. Average homes under average weather conditions may experience indoor concentrations of smoke and contaminants of 45% to 65% of the outdoor concentrations in 30 minutes. In two hours the concentrations may reach 60% to 65% of the outdoor levels.²⁵ These numbers are for homes with all doors and windows closed and ventilation systems turned off. Buildings with

²⁵ “Handbook of Chemical Hazard Analysis Procedures” (Washington, D.C.: FEMA, 1990).

open windows, doors, or operating ventilation systems will experience contamination levels close to the outdoor levels in minutes. Occupants can further slow contamination by blocking gaps around doors and windows with wet towels. For more information on structural triage and preparation please see **Appendix C**.

POST-FIRE REHABILITATION PROCEDURES

The most common post-fire rehabilitation plan is implemented through the federal government. After a fire event, assistance can be requested through the BAER (Burned Area Emergency Rehabilitation) program. Common issues are erosion, runoff, siltation, sedimentation and re-vegetation. The bulk of this information can be found at:

<http://fire.r9.fws.gov/ifcc/esr/Policy/BAR%20Guidebook%2011-06.pdf> and is therefore not included in this report.

The procedures to activate the system can be summarized as follows:

1. A government agency needs to request a BAER team as soon as is reasonable during or after the fire.
2. This request will go through the NIFC ordering process and will be dispatched to the location.
3. A local contact needs to be established to help with the coordination of the process and to serve as a resource advisor.
4. Payment will be determined by the local agencies but is likely paid for by the same agencies as the fire.

GLOSSARY

The following definitions apply to terms used in the Upper Fraser 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: This is 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: This is Geographic Information System (GIS) software that is 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): This is 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. This is derived from fire behavior modeling programs using the following inputs: fuels, canopy cover, historical weather averages, elevation, slope, and aspect.

Fire Danger: In this document we do not use this as a technical term, 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. The hazard rating 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: This is 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 categorizing and 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 that is 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. Fuelbreaks 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 (as defined by the insurance industry) 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 fuels in a given area such as a slash pile.

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

Shelter-in-Place Areas: A method of protecting the public from an advancing wildfire that involves instructing people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response, where time, hazards, and sheer logistics often make evacuation impossible.

This concept is the dominant modality for public protection from wildfires in Australia, where fast-moving, short-duration fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed preplan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior. For a more complete discussion of the application and limitations of shelter-in-place concepts, see the *Addressing, Evacuation, and Shelter-In-Place FMU* section in the main report.

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

Spotting: Refers to the 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 in the surface litter, debris, and small vegetation on the ground.

Timelag: Time needed under specified conditions for a fuel particle to lose about 63% 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 in the study area, and are particularly susceptible to damage from undesirable fire outcomes.

WHR (Community Wildfire Hazard Rating, AKA Community Assessment): A sixty-point scale analysis designed to identify factors that 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. This is sometimes referred to as Urban Wildland Interface, or UWI.

RECOMMENDED READING

- Anderson, H. E., *Aids to Determining Fuel Models for Estimating Fire Behavior*, National Wildfire Coordinating Group, NFES 1574, April 1982.
- At Home in the Woods – Lessons Learned in the Wildland/Urban Interface*, FEMA, 2004.
- Bachmann, A., and Allgower, B., *A Consistent Wildland Fire Risk Terminology is Needed!*, Fire Management Today (61, 4), USDA Forest Services, Washington, DC, Fall 2001.
- Dennis, F.C., *Fuelbreak Guidelines for Forested Subdivisions*, Colorado State Forest Service, Colorado State University, 1983.
- Developing a Cooperative Approach to Wildfire Protection*, National Wildland-Urban Interface Fire Protection Program.
- Development Strategies in the Wildland/Urban Interface*, International Association of Fire Chiefs and Western Fire Chiefs Association, Billings, Montana, July 1991.
- Firefighter Safety in the Wildland/Urban Interface – A Video Series* (VHS Video - 60 Minutes.), National Wildland/Urban Interface Fire Program, 2003.
- Fires that Changed the Fire Service – Wildlands* (VHS Video – 84 Minutes.), American Heat, March 2000.
- FireSmart – Protecting Your Community from Wildfire*, Partners in Protection, Edmonton, Alberta, Canada, May 1999.
- Hirsch, K.G., Pinedo, M.M., and Greelee, J.M., *An International Collection of Wildland-Urban Interface Resource Materials*, Information Report NOR-X-344, Canadian Forest Service – Northwest Region – Northern Forestry Centre, 1996.
- Home Improvement: A Firewise Approach* (VHS Video – 15 Minutes.), 2003.
- Introducing Firewise Communities Workshops* (VHS Video– 6 Minutes.), Firewise Communities, Quincy, MA.
- Mangan, R. J., *Improving Firefighter Safety in the Wildland-Urban Intermix*, FE02P16 – USDA Forest Service Technology and Development Program, Missoula, Montana, Feb. 2000.
- National Wildland/Urban Interface Fire Protection Program Building a Fire wise Home* (VHS Video – 20 Minutes.), Hearst-Argyle Television Productions, Needham, MA, Nov. 1997.

Langowski, P., *Fire and Fuels Analysis to Support Project Planning*, Nov. 2003.

Preparing a Community Wildfire Protection Plan – a Handbook for Wildland-Urban Interface Communities, Sponsored by: Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, Western Governors' Association, March 2004.

Queen, Phillip L., *Fighting Fire in the Wildland/Urban Interface*, Fire Publications, Inc., Bellflower, California, 1993.

Quincy, M.A., *Wildfire! Preventing Home Ignitions!* (VHS Video – 19 Mins.), Firewise Communities,

Slaughter, R. (ed.), *California's I-ZONE – Urban/Wildland Fire Prevention & Mitigation*, Sacramento, California, Jan. 1996.

Standard for Protection of Life and Property from Wildfire, NFPA 299, National Fire Protection Association, Quincy, MA, 1997.

Standard for Protection of Life and Property from Wildfire, NFPA 1144(02) (Formerly *NFPA 299*) National Fire Protection Association, Quincy, MA, 2002.

Urban-Wildland Interface Code™, International Fire Code Institute, Whittier, California, Jan. 2000.

White, C., *Dry Hydrant Manual – A Guide for Developing Alternative Water Sources for Rural Fire Protection*, Developed for Summit County, Colorado.

Wildland/Urban Interface Fire Hazard Assessment Methodology, Developed by National Wildland/Urban Interface Fire Protection Program.

Wildland/Urban Interface Fire Policy Action Report, Western Governor's Association, Feb. 1996.

WEBSITE RESOURCES

FireWise, <http://firewise.org/>, January 2005.

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

FRAMES -- Fire Research and Management Exchange System,
<http://www.frames.gov/tools/>, January 2005.

Interagency Wildland Fire Communications Group – Rocky Mountain Area,
<http://www.rockymountainwildlandfire.info/grants.htm>, January 2005.

NFPA 1710 summary, <http://www.iaff.org/academy/content/online/modules/1710/summary.htm>

National Database of State and Local Wildfire Hazard Mitigation Programs,
<http://www.wildfireprograms.com>, January 2005.

RAMS - (Risk Assessment and Mitigation Strategies), U.S. Department of Interior, Bureau of Land Management, National Interagency Fire Center, Wildland Fire Management Information,
http://www.nifc.blm.gov/nsdu/fire_planning/rams, January 2005.

Standard for Protection of Life and Property from Wildfire, NFPA 1144,
[http://www.normas.com/NFPA/PAGES/NFPA-1144\(02\).html](http://www.normas.com/NFPA/PAGES/NFPA-1144(02).html), January 2005.

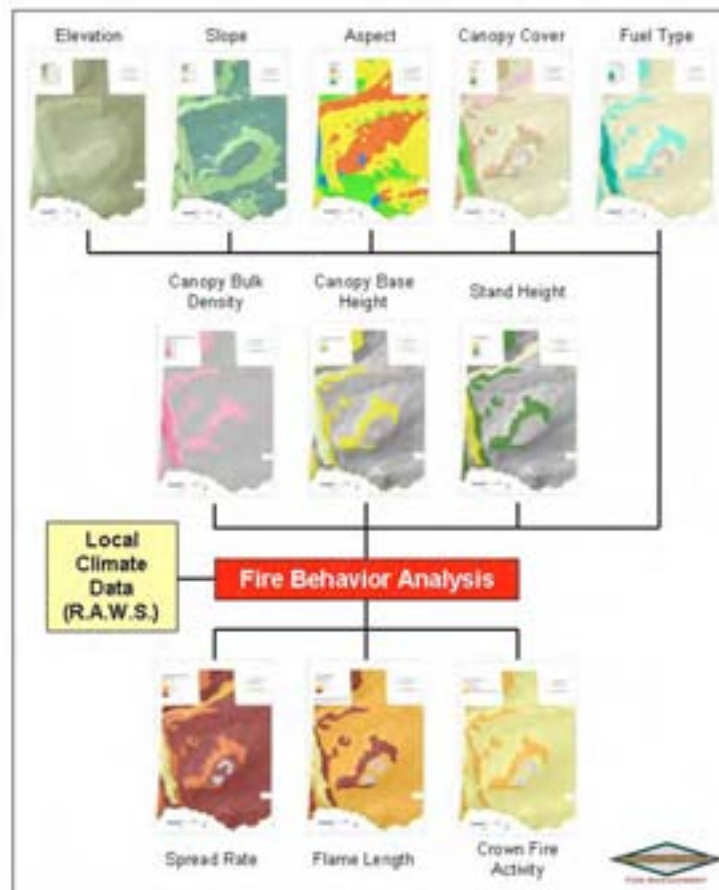
Standard for Protection of Life and Property from Wildfire, NFPA 299,
<http://webstore.ansi.org/ansidocstore/product.asp?sku=29997PDF>, January 2005.

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



The fire behavior potential analysis reports graphically the probable range of spread rate, flame length, and crown fire potential for the analysis area, based upon a set of inputs significant to fire behavior. The model inputs include aspect, slope, elevation, canopy cover, fuel type, canopy bulk density, canopy base height, stand height, and climate data. The model outputs are determined using FlamMap¹, which combines surface fire predictions with the potential for crown fire

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).

development. Calculations for surface fire predictions (rate of spread and flame length) are based on the USDA Forest Service's BEHAVE² model.

BEHAVE

The BEHAVE fire behavior prediction and fuel modeling system was employed to determine surface fire behavior estimates for this study. BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread, given certain conditions of topography, fuels, and weather. The BEHAVE modeling system has been used for a variety of applications, including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, and fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space, given simple user-defined fuels, weather, and topography. Requested values depend on the modeling choices made by the user.

Assumptions of BEHAVE:

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

FlamMap

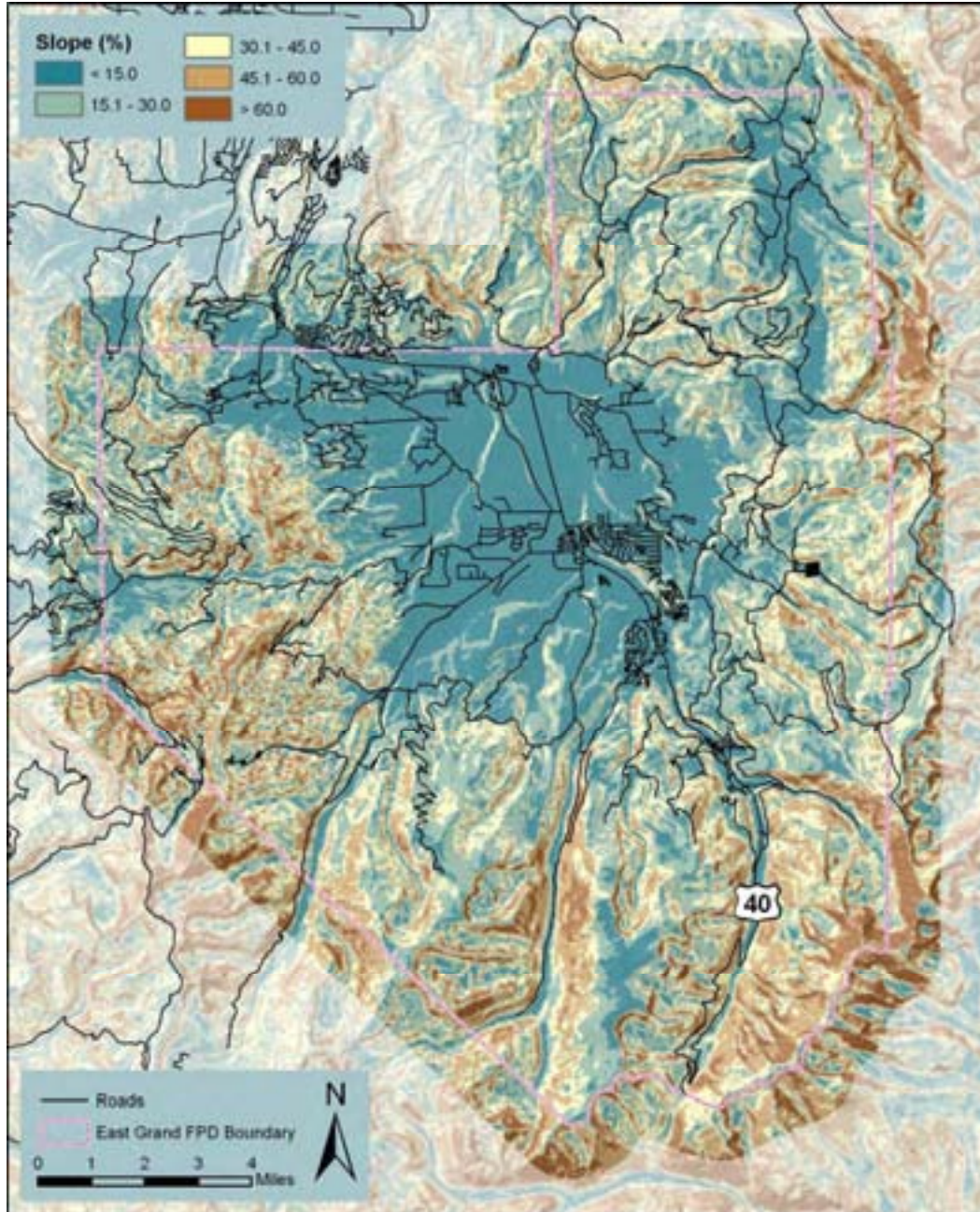
Anchor Point used FlamMap to evaluate the potential fire conditions in the fire behavior study area. The Upper Fraser Valley study area encompasses 131,185 acres (205 square miles). The study area for the fire behavior analysis covers approximately 172,675 acres (270 square miles). This area includes the study area and a half-mile buffer in all directions. The inclusion of this buffer provides the user 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 area of interest. 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 Porcupine Creek Remote Automated Weather Station information). The outputs of FlamMap include the estimated Rate of Spread (ROS) (from BEHAVE), Flame Length (FL) (from BEHAVE) and Crown Fire Activity for a fire in that 10M cell. The model computes these values for each cell in the study area independently, so the data in each cell is unaffected by adjacent cells.

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).

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 approximately 8,300' to over 13,000'. As elevation increases, environmental conditions, fuel species, and characteristics change.

Fuel Models and Fire Behavior

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

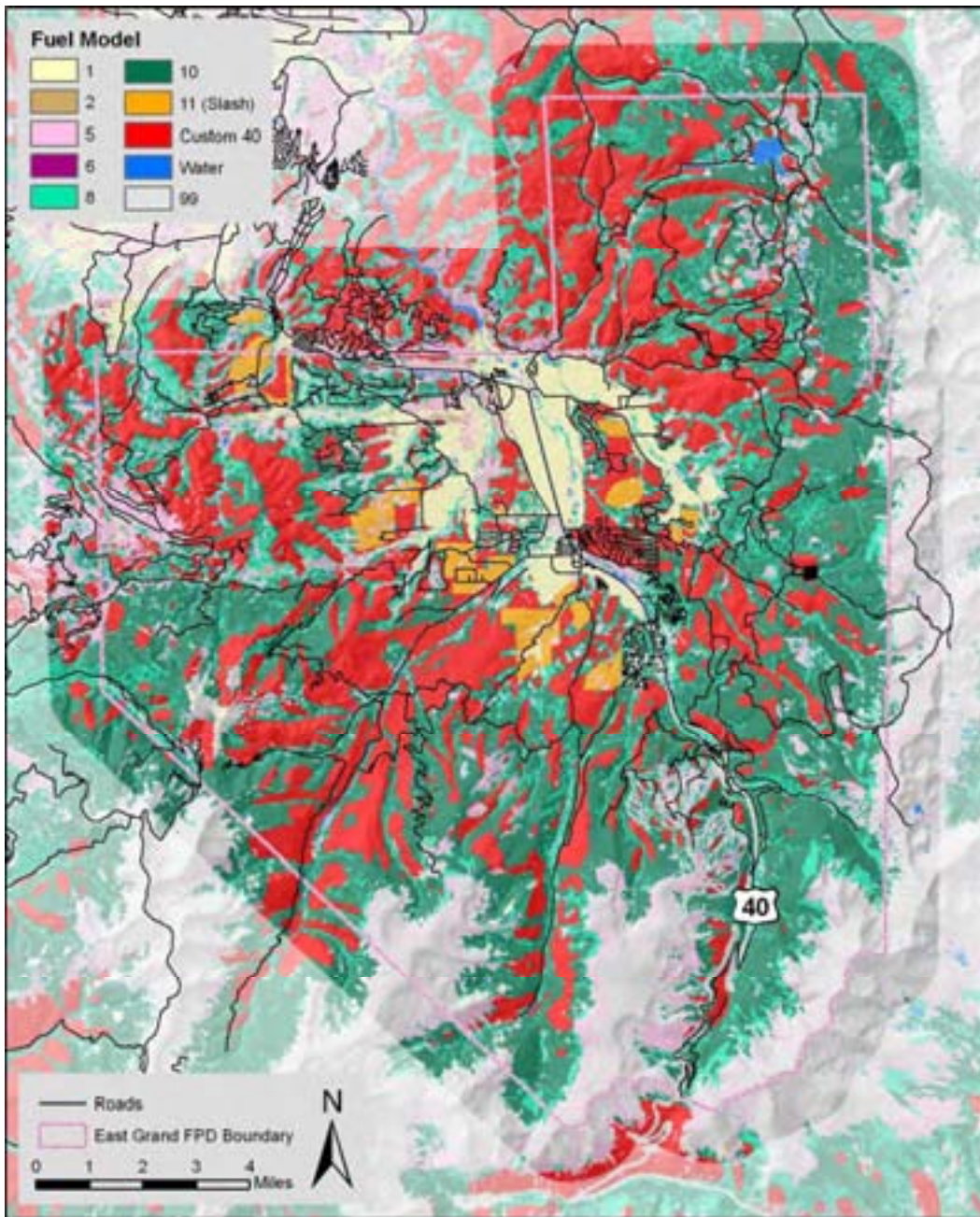
- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content

Each of the major fuel types present in the study area are described below, in terms of the characteristics that coincide with that fuel model. Fuel model descriptions are taken from Anderson's *Aids to Determining Fuel Models for Estimating Fire Behavior*³, a national standard guide to fuel modeling, unless otherwise noted. **Vegetation for the project area may or may not be specifically listed in the description.** Plant species are only an aid to help visualize the characteristics of the model. The photos are taken from the project area and show where the local vegetation fits in. A table showing a range of surface fire behavior under moderate burning conditions based on the **BEHAVE** system is also included.

The study area is represented primarily by six fuel models (FM): FM 1, 5, 8, 10, 11 and 40. Other fuel models exist, but not in quantities sufficient to significantly influence fire behavior in the Wildland Urban Interface. Fuel models 97, 98, and 99 in the map legend indicate areas of insignificant combustibility such as water, rock, sand, etc. Fuel model 40 is a custom fuel model to describe standing dead stands of conifers with the needles still on (standing red-needle trees). **Figure 5** displays the fuel types graphically for the study area.

³ Anderson, Hal E., *Aids to Determining Fuel Models for Estimating Fire Behavior*, National Wildfire Coordinating Group, NFES 1574, April 1982.

Figure 5. Upper Fraser Valley Fuel Models



FUEL MODEL 1

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.

FUEL MODEL 1

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

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

10-hr fuel = 10%, 100-hr fuel = 14%, herbaceous fuel moisture = 101%, slope = 10%

Flame Length in Feet

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

FUEL MODEL 5

Figure 7. Young Shrub Stands with Primarily Live Fuels



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 no 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.

FUEL MODEL 5

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %		7.5	17.5	29.8	43.7	59.2	75.9
	2.0	5.8	13.6	23.0	33.9	45.8	58.8
	4.0	3.0	6.9	11.8	17.3	23.5	30.1
	6.0	2.4	5.7	9.7	14.2	19.2	20.1
	8.0	2.4	5.5	9.4	13.8	18.6	18.8
	10.0	2.3	5.3	9.0	13.2	17.4	17.4
	12.0						

10-hr fuel 10%, 100 = 14%, woody fuel moisture = 122%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %		4.3	6.4	8.1	9.7	11.2	12.5
	2.0	3.9	5.8	7.4	8.8	10.1	11.4
	4.0	3.5	5.1	6.5	7.8	8.9	10.0
	6.0	2.6	3.8	4.9	5.8	6.7	7.5
	8.0	1.4	2.0	2.6	3.1	3.5	3.6
	10.0	1.2	1.8	2.3	2.8	3.2	3.2
	12.0						

FUEL MODEL 8

Figure 8. Lodgepole Stands



Characteristics

Hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Amounts of needle and woody litter are also low.

Common Types/Species

Closed canopy stands of short-needle conifers or hardwoods. Representative conifer types are white pine, lodgepole pine, spruce, fir, and larch.

Fire Behavior

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

FUEL MODEL 8

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	1.1	2.3	3.8	5.6	7.6	9.5
	4.0	0.9	1.8	3.1	4.5	6.2	6.5
	6.0	0.7	1.5	2.6	3.8	4.7	4.7
	8.0	0.6	1.3	2.2	3.3	3.7	3.7
	10.0	0.6	1.2	2.0	3.0	3.1	3.1
	12.0	0.5	1.1	1.8	2.7	2.7	2.7

10-hr fuel = 10%, 100-hr fuel = 14%, woody fuel moisture = 122%, slope = 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	0.9	1.3	1.6	1.9	2.2	2.5
	4.0	0.8	1.1	1.4	1.7	1.9	2.0
	6.0	0.7	1.0	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	1.0	1.2	1.3	1.3
	12.0	0.5	0.8	1.0	1.2	1.2	1.2

FUEL MODEL 10

Figure 9. Decadent Mixed Conifer Stands



Characteristics

This 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 down material is present. There is also a large amount of dead, down woody fuels. Reproduction may be present, acting as ladder fuels. This model includes stands of budworm-killed Douglas-fir, closed stands of ponderosa pine with large amounts of ladder and surface fuels, and stands of lodgepole pine with heavy loadings of downed trees. This model can occur from the foothills through the sub-alpine zone.

Common Types/Species

Many types of vegetation can occur in this model, but primary species are Spruce/fir, ponderosa pine, and lodgepole pine.

Fire Behavior

Fire intensities can be moderate to extreme. Fire moves through dead, down woody material. Torching and spotting are more frequent. Crown fires are quite possible.

FUEL MODEL 10

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	3.2	7.0	11.6	17.1	23.1	29.7
	4.0	2.8	6.2	10.3	15.2	20.5	26.4
	6.0	2.6	5.6	9.4	13.8	18.7	24.0
	8.0	2.4	5.2	8.8	12.9	17.4	22.4
	10.0	2.3	5.0	8.3	12.2	16.6	21.3
	12.0	2.2	4.8	8.0	11.7	15.9	20.4

10-hr fuel = 10%, 100 = 14%, woody fuel moisture = 122%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	3.5	5.0	6.3	7.5	8.7	9.7
	4.0	3.2	4.5	5.7	6.8	7.8	8.8
	6.0	2.9	4.2	5.3	6.3	7.3	8.2
	8.0	2.8	4.0	5.0	6.0	6.9	7.7
	10.0	2.7	3.8	4.8	5.8	6.6	7.4
	12.0	2.6	3.7	4.7	5.6	6.4	7.2

FUEL MODEL 11

Figure 10. Light Logging Slash



Characteristics

Partially cut slash residues from mixed conifers may be similar to closed timber with down woody fuels. Clearcut operations generally produce more slash than represented here. The less-than-3-inch (7.6-cm) material load is less than 12 tons per acre (5.4 t/ha). The greater-than-3-inch (7.6-cm) is represented by not more than 10 pieces, 4 inches (10.2 cm) in diameter, along a 50-foot (15-m) transect.

Common Types/Species

Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered.

Fire Behavior

Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential.

FUEL MODEL 11

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	3.2	6.2	9.4	12.8	16.3	19.9
	4.0	2.8	5.4	8.1	11.0	14.1	17.2
	6.0	2.5	4.9	7.4	10.0	12.8	15.6
	8.0	2.3	4.4	6.7	9.1	11.6	14.2
	10.0	2.0	3.9	5.9	8.0	10.2	12.5
	12.0	1.6	3.1	4.7	6.3	8.1	9.9

10-hr fuel = 10%, 100 = 14%, woody fuel moisture = 122%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	2.7	3.6	4.4	5.1	5.7	6.2
	4.0	2.5	3.3	4.0	4.6	5.1	5.6
	6.0	2.3	3.1	3.8	4.3	4.8	5.3
	8.0	2.2	2.9	3.6	4.1	4.6	5.0
	10.0	2.0	2.7	3.2	3.7	4.2	4.6
	12.0	1.6	2.2	2.7	3.1	3.5	3.8

FUEL MODEL 40

Figure 11. MPB infected lodgepole stands



Characteristics

This custom model was created to capture Mountain Pine Beetle infested lodgepole pine stands. The model has most of the characteristics of FM 8 with some modifications to better represent the effects of MPB on the stand. The 1 hour fuels are increased, to account for needle fall, as is the fuel bed depth. The Canopy Bulk Density has been reduced to better represent the loss of red needles. This is an attempt to model an average condition. In reality, some trees lose needles more quickly and some retain them longer. Trees are also in different stages of decline, depending on when they were infected.

Common Types/Species

Primary species is lodgepole pine.

Fire Behavior

Fire intensities can be moderate to extreme. Surface fires will have larger flame lengths and rates of spread with the continuous red needle layer. Transition from surface fire to torching and crowning is more likely because the needles on the trees are dead and more receptive. Some needles stay on the tree for several years and continue to create high potential for crown fire. Trees that have dropped some of the needles are more prone to torching than crowning.

FUEL MODEL 40

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	4.3	9.6	16.6	24.7	34	44.3
	4.0	3.5	7.8	13.4	20.1	27.6	35.9
	6.0	2.9	6.6	11.3	16.8	23.2	30.1
	8.0	2.5	5.7	9.8	14.6	20.1	26.1
	10.0	2.3	5.1	8.7	13	17.9	23.3
	12.0	2.1	4.6	8	11.9	16.4	21.3

10-hr fuel = 10%, 100 = 14%, woody fuel moisture = 122%, slope 10%

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	2.7	3.9	5	6	7	7.9
	4.0	2.3	3.3	4.3	5.2	6	6.7
	6.0	2	2.9	3.8	4.5	5.2	5.9
	8.0	1.8	2.7	3.4	4.1	4.7	5.3
	10.0	1.7	2.5	3.2	3.8	4.4	5
	12.0	1.6	2.3	3	3.6	4.2	4.7

REFERENCE WEATHER USED IN THE FIRE BEHAVIOR POTENTIAL EVALUATION

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

Porcupine Creek Site Information

Latitude (dd mm ss)	40 ° 05' 52 " N
Longitude (dd mm ss)	106 ° 40 ' 47 " W
Elevation (ft.)	8,880

Weather observations for a twenty-two year period (1985-2007) from the Porcupine Creek Remote Automated Weather Station (RAWS) were used to calculate these conditions. The average conditions class (16th to 89th percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed) using Fire Family Plus. This weather condition class most closely represents an average fire season day.

The extreme conditions class was calculated using 97th percentile weather data. In other words, the weather conditions on the most severe fire weather days (sorted by Spread Component) in each season for the twenty-two year period were used for this analysis. It is reasonable to assume that similar conditions exist on at least three to five 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**:

Average Weather Conditions	
Variable	Value
20 ft Wind speed up slope	17 mph
Herbaceous fuel moisture	101%
Woody fuel moisture	122%
100-hr fuel moisture	14%
10-hr fuel moisture	10%
1-hr fuel moisture	6%

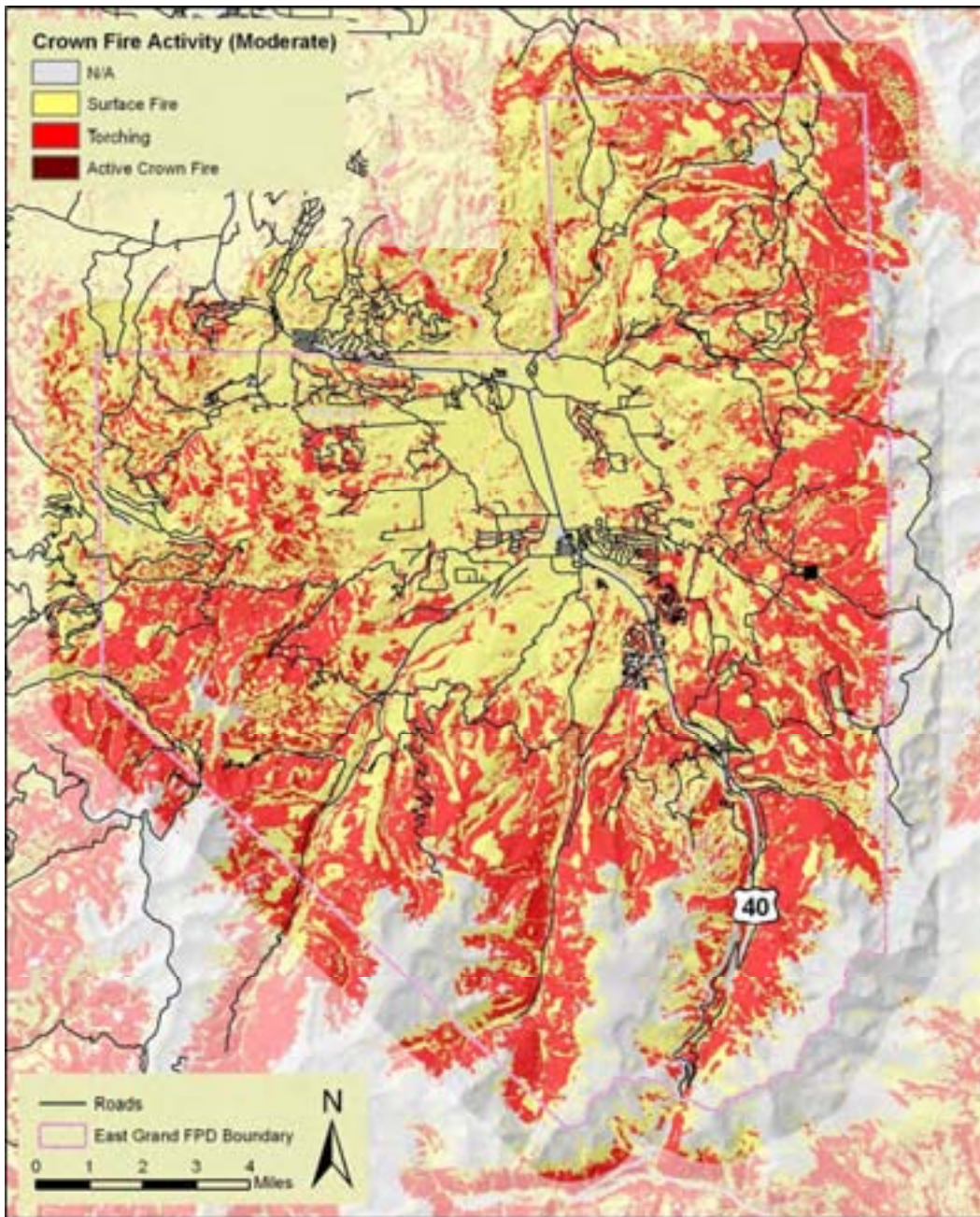
Extreme Weather Conditions	
Variable	Value
20 ft Wind speed up slope	30 mph
Herbaceous fuel moisture	42%
Woody fuel moisture	91%
100-hr fuel moisture	12%
10-hr fuel moisture	6%
1-hr fuel moisture	4%

(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 20-foot wind, adding one of the components necessary for extreme weather conditions.)

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 average and extreme weather conditions.

Figure 12. Predictions of Crown Fire Activity (Moderate Weather Conditions)



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

Figure 13. Predictions of Crown Fire Activity (Extreme Weather Conditions)

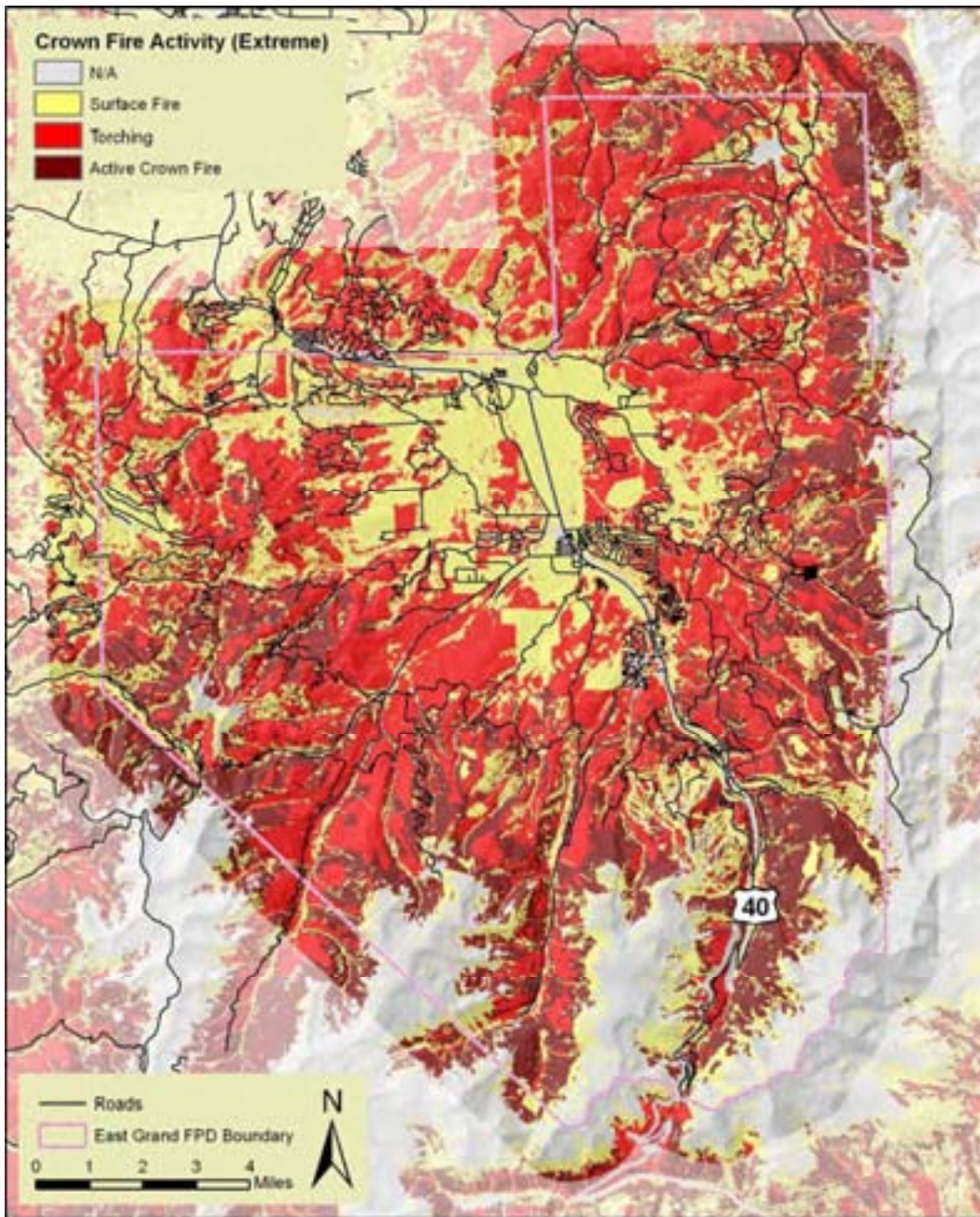
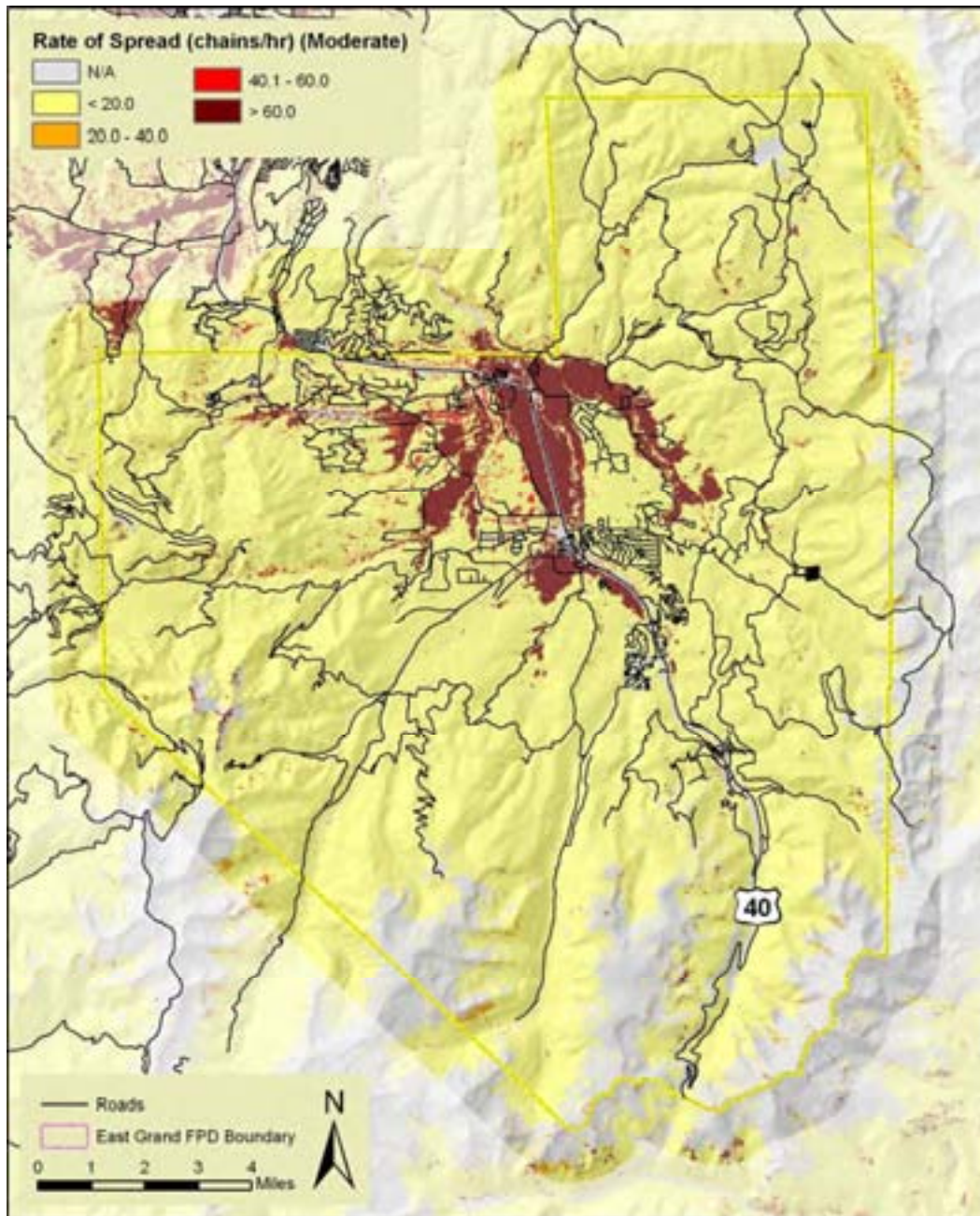


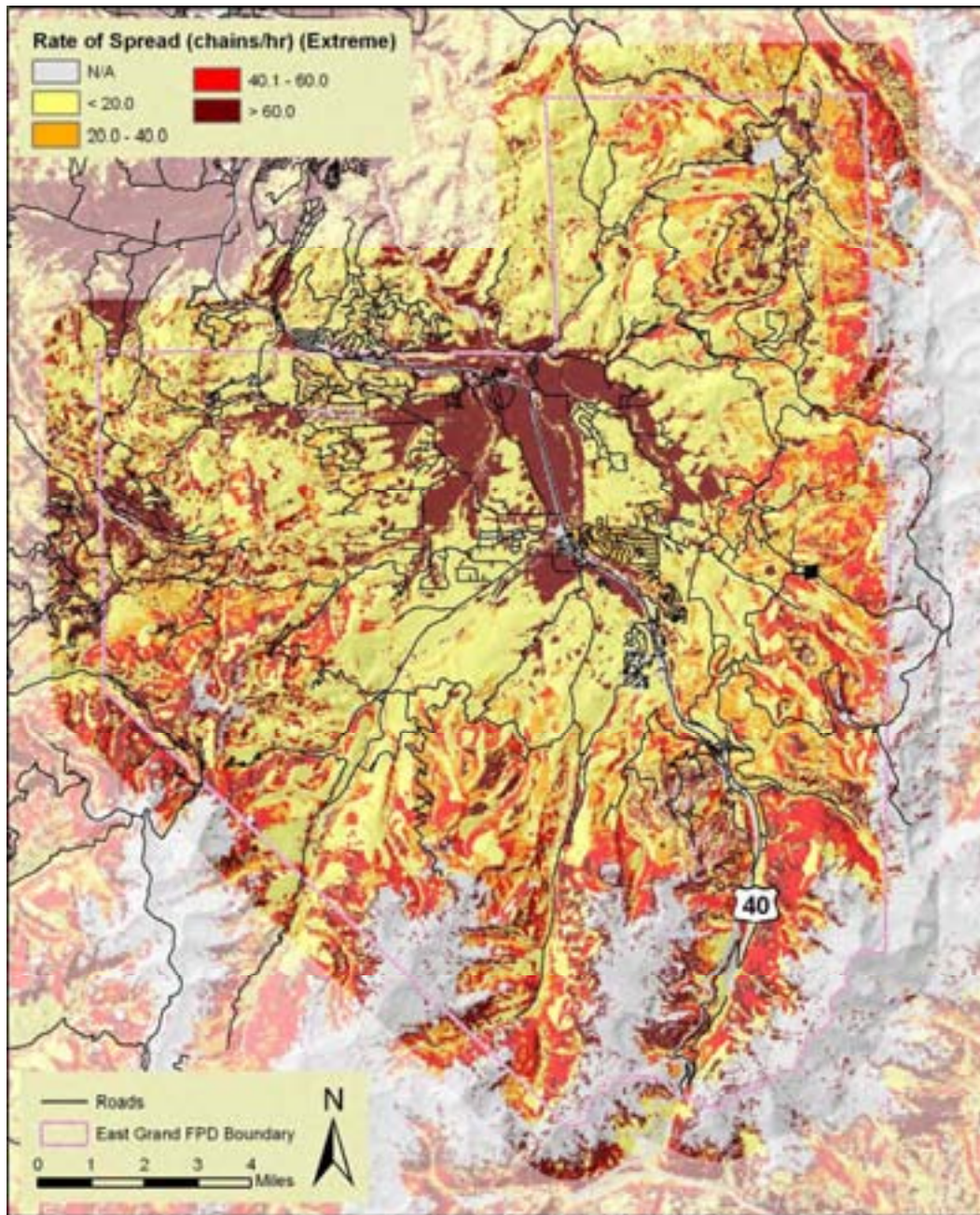
Figure14. Rate of Spread Predictions (Moderate Weather Conditions)



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

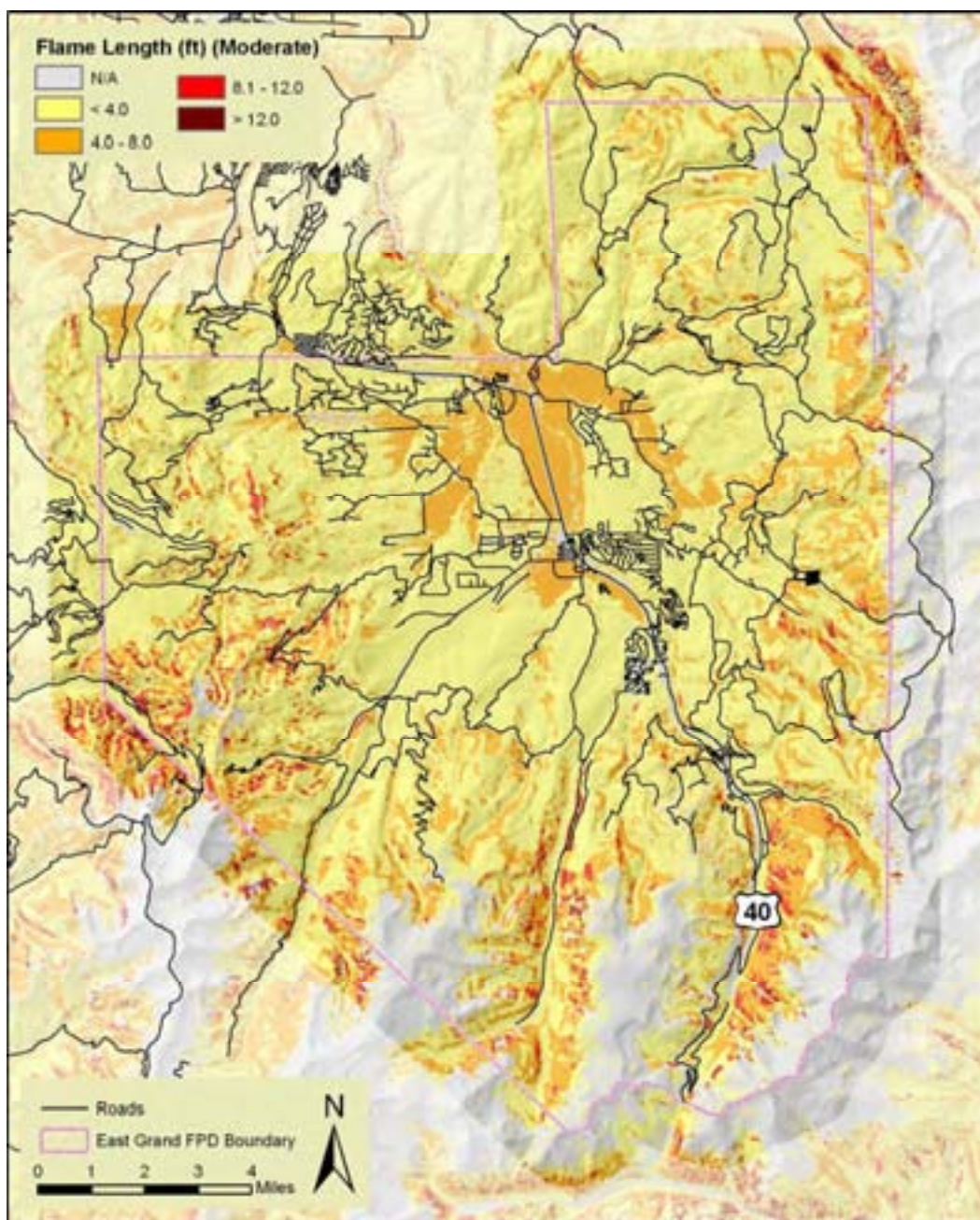
Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains. 1 ch/h equals approximately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

Figure 15. Rate of Spread Predictions (Extreme Weather Conditions)



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

Figure 16. Flame Length Predictions (Moderate Weather Conditions)



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

Figure 17. Flame Length Predictions (Extreme Weather Conditions)



Fire Behavior Modeling Limitations and Interpretation

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point-source ignition in every cell (each 10 x 10 meter area). It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability a wildfire will occur. It assumes an ignition occurrence for every cell. These calculations may be conservative (under predict) compared to observed fire behavior.

This model can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other values at risk identification to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. This is sometimes referred to as a "values layer." One

possibility is to overlay the fire behavior potential maps with the community hazard map, in order to make general evaluations of the effects of the predicted fire behavior in areas of high hazard value (areas where there are concentrations of residences and other man-made values). However, one should remember that the minimum mapping unit used for fire behavior modeling is one acre, and therefore, fine scale fire behavior and effects are not considered in the model. Additionally, weather conditions are extremely variable and not all combinations are accounted for. The fire behavior prediction maps are best used for pre-planning and not as a stand-alone product for tactical planning. If this information is used for tactical planning, fire behavior calculations should 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.

Flame Length

Figures 16 and 17 display the flame length predictions for the two weather scenarios. Flame length is a proxy for fire intensity. It is important to note flame length is considered to be the entire distance from the base of the flame to the tip, irrespective of angle, and not simply the flame height above the ground. It is possible in high wind conditions to have very intense flames (high flame lengths) which are relatively close to the fuel bed. The legend boxes display flame length in ranges which are meaningful to firefighters. Flame lengths of four feet and less are deemed low enough intensity to be suitable for direct attack by hand crews, and therefore represent the best chances of direct extinguishment and control. Flame lengths of less than eight feet are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of eight to 12 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12 feet, the most effective tactics are fuel consumption ahead of the fire by burnouts, or mechanical methods. Although indirect fire line and aerial attack are also used for fires with flame lengths of greater than 12 feet, as flame lengths increase the effectiveness of these tactics decrease and their use is generally designed to slow rates of spread and reduce fire intensity, especially in areas where values at risk are concentrated.

In the moderate fire weather scenario, the model predicts that fires in most of the populated portions of the WUI could be attacked directly by either hand crews or equipment. It is interesting to note that significantly higher flame lengths (eight to 12 feet under moderate conditions and greater than 12 feet under extreme conditions) are predicted for portions of the Snow Mountain Ranch property. This prediction is in line with fire behavior observed on the 2007 “Y Fire.”

Under the extreme fire weather scenario, high to extreme flame lengths are predicted in most of the areas where the WUI communities are found, with the exception of a few communities, mostly located in the lower elevations of the central portion of the study area. Even in these areas, the predicted flame lengths indicate that fires are likely to be too intense for direct attack by hand crews. However, hand crews would be vital for structure preparation, triage and the construction of indirect fire line. Under extreme weather and fuel moisture conditions, fire intensity in many of the WUI communities could be a serious issue and control will be difficult to establish and maintain.

Rate of Spread

Figures 14 and 15 show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios respectively. Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by loggers and firefighters. It is equal to 66 feet. Therefore, one mile equals 80 chains. Rates of fire spread are influenced primarily by the wind, slope grade, fuel type/continuity, and fuel sheltering from the wind. Fire is the only force of nature which moves

faster uphill than downhill. When all other factors are equal, fire moves twice as fast uphill on a slope of 30% than it does on flat terrain. In areas where high to extreme rates of spread are predicted (ROS of >40 CPH or ½ mile per hour) it is possible fires could spread faster than humans can escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident.

In the moderate fire weather scenario, low to moderate rates of spread are predicted in the WUI communities where dense stands of conifer fuels are the dominant fuel. This effect is due primarily to sheltering of surface fuels from the wind. In areas where grasses are dominant with little or no sheltering overstory, rates of spread are predicted to be very high, even under moderate burning conditions.

In the extreme fire weather scenario, higher rates of spread are predicted in most of the WUI communities of the study area, because the sheltering effects of the canopy are overridden by more extreme fuel moisture conditions. The model shows that rates of surface spread can be expected to increase even in the dense canopy, making control efforts more difficult, and requiring control and suppression tactics to be implemented further ahead of the fire.

Crown Fire Activity

The Crown Fire Activity maps (**Figures 12 and 13**) display the potential for fires to move from the surface into the canopy of trees and shrubs. The likelihood of progression from the surface into the aerial fuels is displayed in four categories. N/A refers to areas where surface fires are unlikely to develop, due to the lack of combustible fuels. These would include any area lacking a combustible fuel bed such as rock, ice, snow fields, water, sand, or some urban landscapes. The surface fire category covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas where grass fuels without overstory plants are dominant fall into this category regardless of the energy produced by the fire, due to the lack of an aerial fuel bed. Areas covered by the torching category are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. In other words, individual or relatively small clusters of trees will be completely involved, but these fires lack the energy to initiate sustained horizontal movements (referred to as “runs” by fire fighters) through the crowns. The active crown fire category includes areas where sustained horizontal movements through tree crowns are expected. This category can be further subdivided into dependent or independent crown fire. Dependent crown fires rely on the presence of surface fires to support aerial burning. Independent crown fires develop when aerial burning is sustained without the need for associated surface fire. Independent crown fires are rare and are associated with the most extreme fire behavior conditions. Current fire behavior models do not have the ability to predict independent crown fire development. All crown fires, regardless of whether they are dependent or independent, represent extreme fire behavior conditions, and are notoriously resistant to typical methods of suppression and control.

It is interesting to note that torching should be expected in virtually all of the timbered areas of the WUI communities, even under moderate burning conditions. Under extreme conditions, active crown fires are expected to develop in Winter Park Highlands, the Winter Park and Mary Jane Resort areas, and in most of the higher elevations outside the central valley area, including significant portions of the Snow Mountain Ranch and Crooked Creek Ranch properties.

APPENDIX B

COMMUNITY IGNITABILITY ANALYSIS AND RECOMMENDATIONS



PURPOSE

The purpose of this appendix is to examine in greater detail the communities in the study area. Of the 31 WUI communities in The Upper Fraser Valley, four were found to represent an extreme hazard, four were rated as very high hazard, sixteen as high hazard, four as moderate hazard, and three as low hazard (see Figure1). 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.

Figure 1.

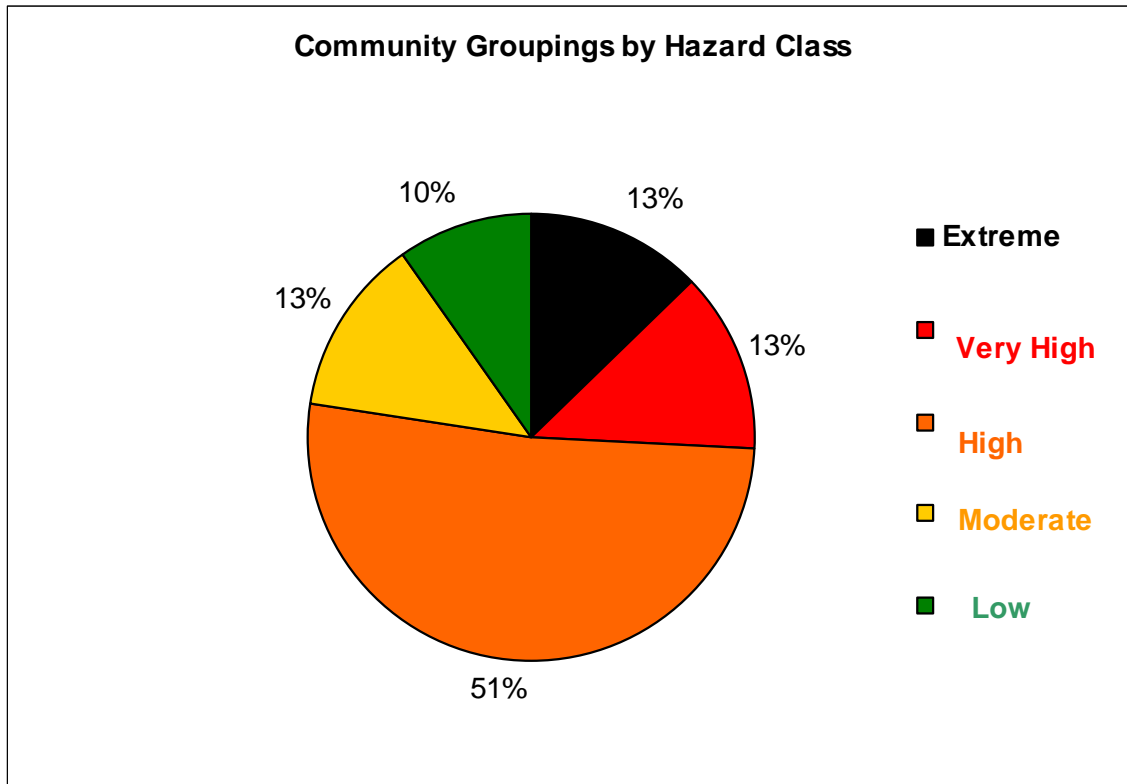


Figure 2.

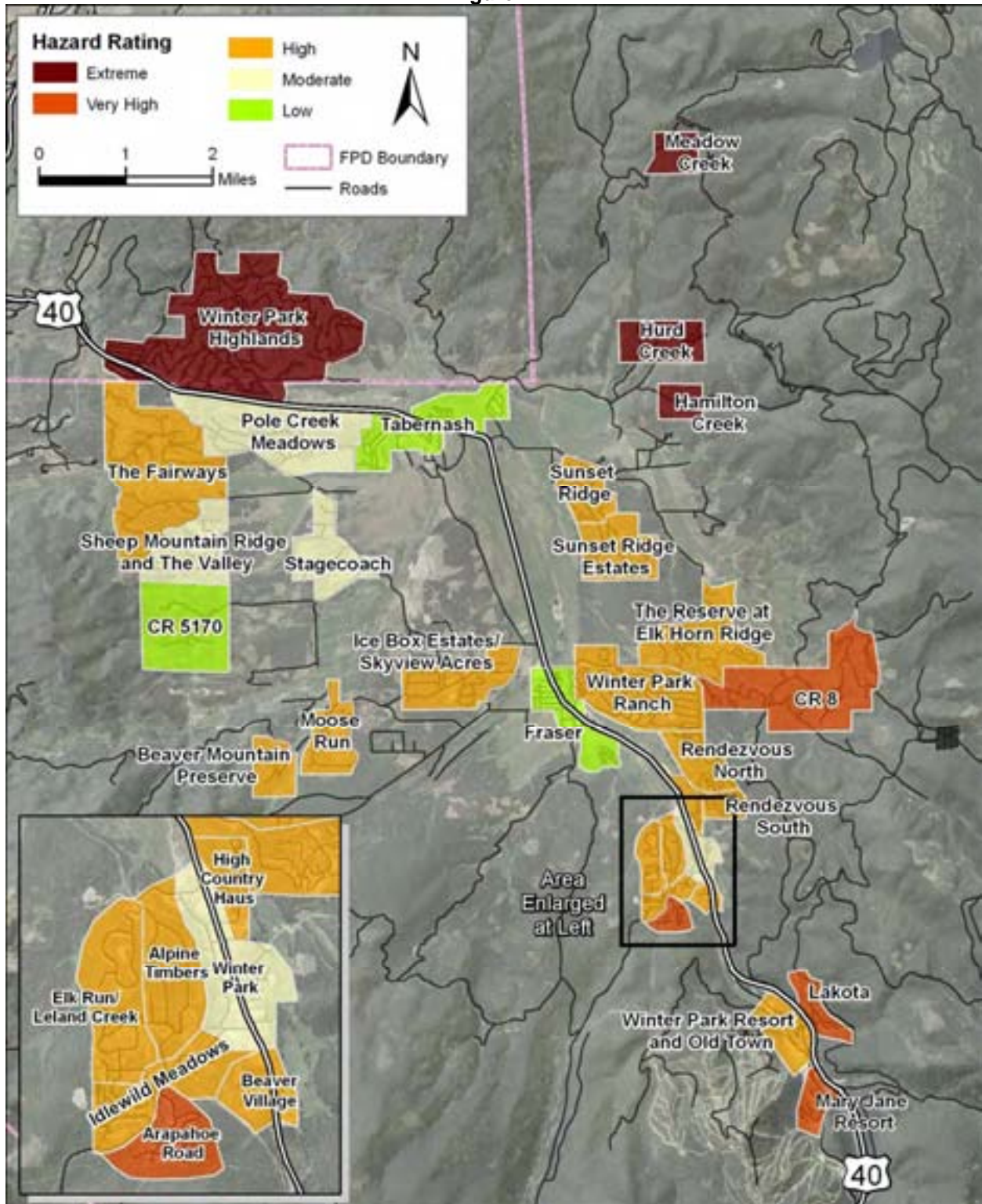
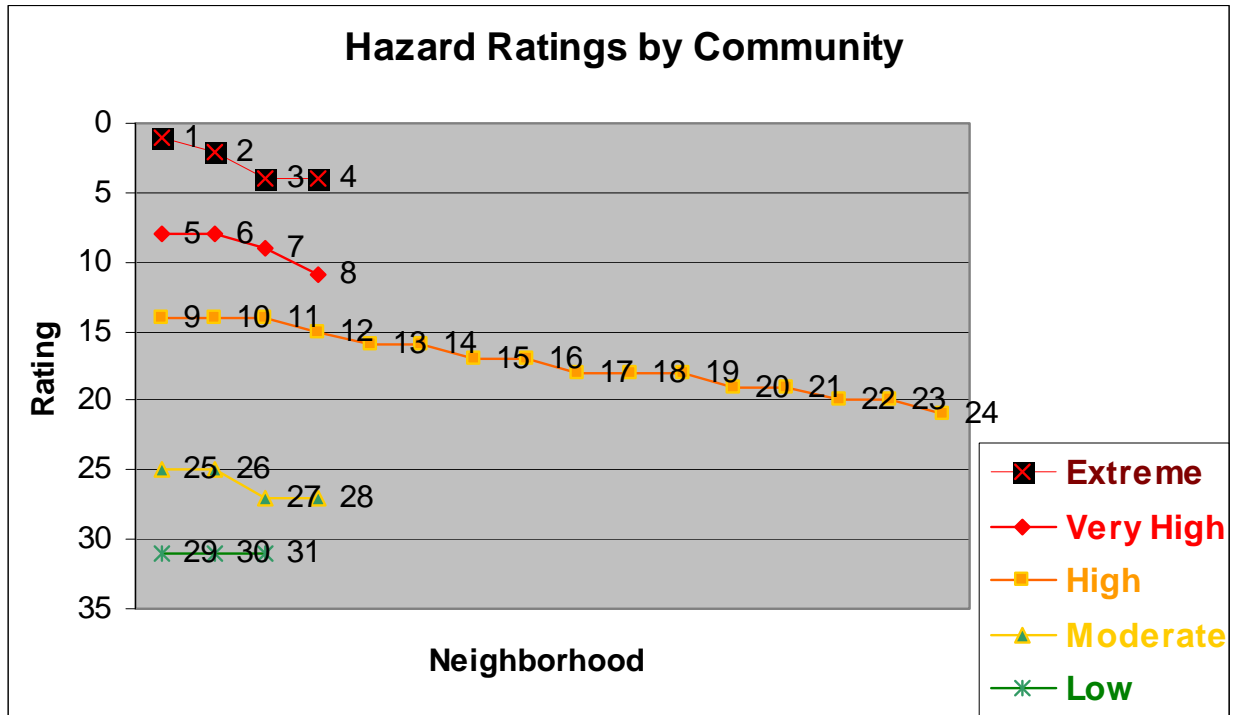


Figure 3.



1. Hurd Creek	17. Sunset Ridge
2. Winter Park Highlands	18. The Fairways
3. Meadow Creek	19. Elk Run/Leland Creek
4. Hamilton Creek	20. Ice Box Estates/Skyview Acres
5. CR 8	21. Alpine Timbers
6. Arapahoe Road	22. Sunset Ridge Estates
7. Lakota	23. Moose Run
8. Mary Jane Resort	24. High Country Haus
9. Winter Park Ranch	25. Stagecoach
10. Beaver Village	26. Sheep Mountain Ridge & The Valley
11. Winter Park Resort and Old Town	27. Pole Creek Meadows
12. Reserve at Elk Horn Ridge	28. Town of Winter Park
13. Beaver Mountain Preserve	29. Tabernash
14. Rendezvous North	30. Fraser
15. Idlewild Meadows	31. CR 5170
16. Rendezvous South	

GENERAL RECOMMENDATIONS

A combination of adequate access, ignition-resistant construction, and fuels management will help create a safe environment for emergency service personnel and will provide reasonable protection to structures from a wildfire. These techniques should 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. Stay aware of the current fire danger in the area.
2. Clean your roof and gutters at least twice 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 rated as extreme to high hazard level were recommended for a parcel-level analysis. In the moderate level communities a parcel-level analysis was recommended only if the evaluator found that a significant number of homes had no, or ineffective, defensible space or a significant number of hazards near homes was detected. In short, the recommendation was made if the evaluator felt information gathered by a parcel-level analysis could be used to generate a noticeable improvement in the community's defensibility.

TECHNICAL TERMS

The following definitions apply to terms used in the “Description” and “Comments and Mitigation” 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. Zone 1 is defined as the area 15 to 30 feet (depending on the reference source) from the structure. Flammable vegetation is generally removed entirely in Zone 1. The Zone 2 treatment area varies with slope and focuses on fuels modifications such as limbing and thinning.

Extended Defensible Space (also known as Zone 3): In this defensible space zone treatment is continued beyond the recommended minimum boundary for Zone 1 and Zone 2 defensible space. This zone focuses on forest management with fuels reduction being a secondary function.

Shelter-in-Place Areas: There are several ways to protect the public from an advancing wildfire. One of these methods is evacuation, and involves relocation of the threatened population to a safer area. Another is to instruct people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to hazardous materials incident response, where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia, where fast moving, non-persistent fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed pre-plan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior. For a more complete discussion of the application and limitations of Shelter-in-Place concepts see *Areas of Special Interest FMU* in the main report.

Citizen Safety Zone: An area that can be used for protection by residents 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 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 and surface fuel loading. The higher the community scores, 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 the position and numbering of the communities within each of these groupings should not be used as an indicator of relative hazard. The numeric rating score is not sufficiently precise to allow hazard sorting beyond the group adjective rating, and should not be used to draw conclusions about greater or lesser hazards among communities within a group.

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. Hurd Creek

Figure 4.



Hazard Rating:	Extreme
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	1, 5, 8, 10
Water supply:	None
Hazards:	Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, propane tanks, wooden roofs

Description: This is a community of approximately 15 homes built along the Hurd Creek drainage. Most of the structures are small cabins on moderate size lots. There are also some newer homes in this community. The dominant construction type is older log or wood siding with asphalt or shake roofs. Homes are built along the drainage bottom and mid-slope on the steep slopes above the bottom. None of the homes have defensible space and most have heavy vegetation growing right up to the structure. Flammable yard clutter is a hazard at some homes. Most homes do not have address markers and those that do have wooden, non-reflective markers. Access is poor with one way in and out on a narrow dirt road. There are steep, narrow driveways and very few pullouts or turnarounds for apparatus. There is no water for fire suppression, although it may be possible to draft from Hurd Creek in some spots. This community is a long way from the nearest fire station (Station 2) and poor road conditions would most likely result in extended response times. Fuels vary from tall-grass meadows to riparian shrubs and hardwoods to heavy loads of mixed conifer. The topography varies from flat along the creek bottom to very steep up both sides of the drainage.

HURD CREEK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs and tar paper roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (see *Home Mitigation FMU* in the main report).
- Thin vegetation along the access road and driveways. This is especially important for narrow driveways and road segments (see *Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of improving and widening Hurd Creek Road.
- Add reflective addressing to all driveways and homes.
- Consider adding one or two large cisterns (30,000 gallons or greater) in this community for fire suppression use.
- Consider creating a shelter-in-place plan that includes a preplanned citizen safety zone. This area should be cleared of all fuels and maintained on an annual basis, and should be large enough for citizens to be able to survive a fire event without special equipment or training. This area should be accessible even if the main access road is compromised by fire. This tactic is recommended only as last resort if evacuation becomes impossible due to the dangerous fuels and topography in this community.

2. Winter Park Highlands

Figure 5.



Hazard Rating:

Extreme

Does the neighborhood have dual access roads?

Yes

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

No

Average lot size:

1-5 Acres

Fuel models found in the neighborhood:

6, 10

Water supply:

None

Hazards:

Steep slopes, ravines, inadequate roads, no water supply, propane tanks, power lines, wooden roofs

Description: This is a large community of small to medium sized homes on moderate size lots. The dominant construction is wood siding with a mix of asphalt and wood shake roofs. Most of the homes are built mid-slope or above steep slopes and ravines. Few homes have any defensible space. Many yards have flammable clutter and fuels growing right up to the structure. Access is poor, with narrow, steep roads and few turnarounds for apparatus. Some homes do not have any address marker and of those that do, most are low visibility and non-reflective. There is no water supply for fire suppression in this community and the nearest water source would be ponds and a cistern near Hwy 40. There are overhead power lines and propane tanks (some overgrown with vegetation) which may be a hazard to firefighters. Fuels are generally heavy loads of mixed conifer with substantial insect mortality. Stands have plentiful ladder fuels and significant surface loads of dead and down materials. There is a railroad line that runs along the bottom of steep slopes below this community which is an additional ignition hazard. The topography in this community is steep and complicated by ravines and drainages.

WINTER PARK HIGHLANDS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for most homes due to the dangerous topography and heavy fuel loads in and adjacent to this community.
- Discourage the use of combustible materials for decks, siding, and roofs, especially where homes are upslope from 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 fuels.
- Clean leaf 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes; never downhill.
- 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 (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding two or three large cisterns (30,000 gallons or greater) in this community for fire suppression use. At least one cistern should be located in the isolated northern portion of this community.
- Add reflective addressing to all driveways and homes.

3. Meadow Creek

Figure 6.



Hazard Rating:

Extreme

Does the neighborhood have dual access roads?

No

Are there road grades > 8%?

Yes

Are all access roads of adequate width?

No

Average lot size:

1-5 Acres

Fuel models found in the neighborhood:

10

Water supply:

None

Hazards:

Steep slopes, inadequate roads, no water supply, wooden roofs, power lines, propane tanks

Description: This is an isolated community of 10-15 homes, some of which are seasonal cabins, located in a national forest in-holding. Homes are small to moderate size on moderate size lots. At least five homes are located on a poorly marked common driveway. The dominant construction type is older log or wood siding construction with an asphalt or metal roof, although there are a few newer homes. Some homes have cluttered yards and flammable decks, projections and/or outbuildings. There are no defensible spaces and most homes have vegetation growing right up to the structure. Some homes do not have address markers and some only have home-made signs on trees or wooden posts. There is only one way in and out and the access is a rough dirt road that is narrow in some spots. Most of the homes are located on narrow dirt driveways and private roads with few pullouts or turnarounds for apparatus. There is no water for fire suppression in this community. Overhead power lines and propane tanks exist, which may represent a hazard to firefighters. Fuels are heavy loads of mixed conifer with substantial insect mortality, broken by a few meadows. The topography is steep and complex.

MEADOW CREEK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or on ridge tops and summits) with heavy fuel loads near or below the home.
- 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. Mow grasses away from homes and outbuildings for at least 30 feet. Clear flammable vegetation away from power lines near homes.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes; never downhill.
- Clear vegetation away from flammable outbuildings and mow grasses within 15 feet.
- 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 (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- A large community cistern (30,000 gallons or greater) is highly recommended for this community. The cistern should be located for easy access by fire apparatus.
- The “totem pole” of home-made address markers at the entrance to the community driveway should be replaced with reflective markers that indicate the proper road fork, where applicable, for each address. This system should be repeated at every place where the driveway divides and an individual driveway leaves the community driveway.
- Add reflective addressing to all driveways and homes.

4. Hamilton Creek

Figure 7.



Hazard Rating:	Extreme
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8, 10
Water supply:	Draft from creek
Hazards:	Steep slopes, ravines, inadequate roads, inadequate water supply, power lines, propane tanks

Description: Hamilton Creek Road (CR 848) is a dead end fork off Hurd Creek Road. Homes and lots are generally larger than in Hurd Creek, but some are probably seasonal residences. The dominant construction type is older log or wood siding with asphalt or metal roofs, but there are some newer wood siding homes mixed in. There are no defensible spaces and most homes have vegetation growing right up to the structure. There are also some residences with large quantities of flammable yard clutter. Some homes do not have address markers and others only have non-reflective markers on the structure. One reflective address marker was noted at the junction of a driveway and Hamilton Creek Road. There is only one way in and out and Hamilton Creek Road is a narrow dirt road with heavy vegetation encroaching in many spots. It becomes a rough rutted two-track above the intersection with CR 841. The other roads and driveways are dead ends and there are few turnarounds for apparatus. There is no water for fire suppression except for Hamilton Creek, and finding an adequate drafting site would be difficult if not impossible. Fuels are heavy loads of mixed conifer with riparian shrubs and hardwoods along the creek. This community has overhead power lines which may be a hazard to fire apparatus. The topography varies from flat along the creek bottom to very steep up both sides of the drainage.

HAMILTON CREEK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or on ridge tops and summits) with heavy fuel loads near or below the home.
- 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes; never downhill.
- 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 (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- A large community cistern (30,000 gallons or greater) is highly recommended for this community. The cistern should be located for easy access by fire apparatus.
- Add reflective addressing to all driveways and homes.

5. CR 8

Figure 8.



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:

8, 10, 2

Water supply:

None

Hazards:

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

Description: This community is adjacent to the Devil's Thumb Ranch and consists of widely spaced exclaves of primarily large custom homes on large lots. Wood siding or log construction with an asphalt roof is dominant. Although most of the homes are surrounded by heavy timber, there has been fire mitigation work done in some areas, especially along High Lonesome Trail, and some homes have defensible space. There are, however, still many homes with vegetation too close to the structure. There is only one way in and out of this community and access is along narrow dirt roads that are rough and overgrown with flammable vegetation in many areas. There are few turnarounds and pullouts for apparatus. Access is confusing with dead-end roads, driveways, and few markers. Most homes do not have address markers, and those that do exist are generally non-reflective markers on trees or wooden poles. There is no water for fire suppression and most of the homes in this community are a long way from the nearest fire station. Fuels consist of heavy loads of mixed conifer with significant understory vegetation and dog-hair stands of lodgepole pine. The topography varies from nearly flat to steep and complex.

CR 8 RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see *Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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 weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see *Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (see *Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of long driveways and dead-end roads.
- Pullouts for apparatus should be added wherever possible on CR 809.
- At least three large community cisterns (30,000 gallons or greater) should be added in this community. At a minimum, one cistern should be located on CR 8, one on CR 809 and one on High Lonesome Trail.
- Due to the confusing network of spurs and long driveways, roads should be marked at every intersection and all homes should have reflective address markers at the point where the driveway leaves the access road. Community driveways should be marked with reflective markers indicating all of the addresses accessed by that driveway and the proper road fork, where applicable, for each address. This system should be repeated at every place where the driveway divides and an individual driveway leaves the community driveway.
- Add reflective addressing to all driveways and homes.

6. Arapahoe Road

Figure 9.



Hazard Rating:	Very High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	8, 10
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, inadequate roads, power lines, wooden roofs

Description: This community is built on the steep western aspects to the east of Vasquez Creek. Homes are moderate to large structures built on small lots, mixed with a few multi-family complexes. Most are newer construction (many are custom homes) with wood siding, some with rock wainscoting, and asphalt roofs. Many of the homes are built mid-slope in heavy fuels, and few, if any, have any defensible space. Roads surfaces are generally good, but roads are narrow in spots and cross heavy fuels mid-slope. There is only one way in and out of this community. There are dead ends and a one one-way loop. Most homes have address markers, but generally they are not reflective and may be hard to locate at night or in fire conditions. There is a hydrant network in this community. Fuels are heavy loads of mixed conifers. The general topography is moderate along the Vasquez Creek drainage, increasing rapidly to steep slopes near the top of this community.

ARAPAHOE ROAD RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Turnarounds should be constructed at the end of long driveways and dead-end roads.
- Investigate the possibility of constructing a shaded fuelbreak along Arapahoe Road to protect the only access to this community.
- Add reflective addressing to all driveways and homes.

7. Lakota

Figure 10.



Hazard Rating:	Very 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:	<1 Acre
Fuel models found in the neighborhood:	8, 10
Water supply:	Hydrants
Hazards:	Ravines, steep slopes

Description: Lakota is a newer community with a mix of multi-family buildings and moderate sized single-family homes built on small lots. This community is built on the southwest facing slopes across US 40 from Winter Park Resort and most of the homes are located mid-slope. Lakota is still being built out and will be a high-density community. Most structures are wood siding or heavy timber, some with rock wainscoting and asphalt roofs. Most homes have some defensible space, but more thinning should be done in some areas. There are some homes with flammable vegetation too close to the structure. Address markers are generally present on the structure, but not at the street—and most of the markers are not reflective. Access is generally good, but there are some steep narrow driveways with poor turnarounds for apparatus. There are also cul-de-sacs and dead ends. The Denver Water Board Road is a potentially important secondary emergency access for Lakota. There is a good hydrant network in this community. Fuels are moderate to heavy loads of mixed conifer, primarily lodgepole, and aspen with shrubs and regeneration in the understory. Topography is moderate to steep and complicated by ravines and drainages.

LAKOTA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- A shaded fuelbreak is recommended along the Denver Water Board Road from Lakota to the intersection with US 40.
- Turnarounds should be constructed at the end of long driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

8. Mary Jane Resort

Figure 11.



Hazard Rating:	Very High
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 Acre
Fuel models found in the neighborhood:	10, 1
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, inadequate roads

Description: The Mary Jane base area has year-round employee housing in wood siding buildings with metal roofs. The Bridger's Cache development is also located near the base area and has approximately ten large custom homes on small lots. The private Arlberg Club is located above the base area and accessed by a gated road, but the only residents are seasonal (winter) employees. In Bridger's Cache the most common construction type is wood siding or heavy timber with rock wainscoting and asphalt roofs. Most homes have some defensible space, but there are some with flammable vegetation (primarily ornamental plantings) too close to the structure. There are no apparent Zone 2 or Zone 3 defensible space treatments and no thinning has been done other than what is necessary for construction. The entrance to Bridger's Cache is very narrow and may eventually be gated. The access road is also gated and does not have pullouts or an adequate turnaround for apparatus. Most homes have address markers, but they are generally non-reflective and inconsistently located. There is hydrant coverage in Bridger's Cache and at the employee housing at the base area. Fuels are heavy loads of mixed conifer with heavy ladder fuels and moderate dead and down broken by some meadows, parking lots and ski runs. Topography is moderate to steep.

MARY JANE RESORT RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways especially along the gated road that accesses the Arlberg Club (*see Access Route Fuels Modification Recommendations* in the main report).
- Improve the turnaround at the end of the access road in Bridger's Cache to be suitable for large apparatus.
- Add reflective addressing to all driveways and homes.

9. Winter Park Ranch

Figure 12.



Hazard Rating:	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	8, 10
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, power lines, wooden roofs

Description: This is a mixed community of apartments, condos and single-family homes. Most of the buildings are on small to moderate size lots. Wood siding and asphalt roofs are the dominant construction type, but there are some shake roofs in this community. There are few conforming defensible spaces and many homes have vegetation growing right up to the structure. Roads are generally adequate, but there are some narrow road segments and driveways with vegetation encroaching on the driving surface. Some homes do not have address markers, and those that do are generally not reflective and inconsistent in type and placement. There are hydrants in this community, but some homes are not within 1,000 feet of the nearest one. Fuels consist primarily of heavy mixed conifer and lodgepole pine stands broken by some large meadows. Thinning has been done in several spots within this community. Topography varies from flat benches to steep slopes complicated by ravines and drainages. There are some parts of this community with substantial slopes beneath the homes.

WINTER PARK RANCH RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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. 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

10. Beaver Village

Figure 13.



Hazard Rating:

High

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 Acre

Fuel models found in the neighborhood:

8, 10

Water supply:

Hydrants

Hazards:

Steep slopes, power lines

Description: Most of the residences in Beaver Village are older condominium buildings. Multi-story wood siding construction with asphalt roofs is dominant. Irrigated green belt and parking lots provide a break in the fuels continuity in some areas, but most buildings have flammable vegetation planted too close to the structure. Many of the buildings are built above slopes with heavy fuels. Some mitigation work has been done in Beaver Village, but none of the buildings have conforming defensible space. All of the buildings have non-reflective, but visible, numbers, but the individual condo numbers are only marked on the door and are non-reflective. Road surfaces are generally good and the main access road is of adequate width, but this community is one way in and out with several loops. There is a hydrant network in Beaver Village. Fuels are heavy loads of lodgepole-dominated mixed conifer broken by occasional parking lots and irrigated grasses. Topography is generally low slope but complicated by ravines and drainages. This community has a history of fires. There is a railroad track nearby that has sparked several fires.

BEAVER VILLAGE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all buildings (*see Home Mitigation FMU* in the main report for details).
- 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes; never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and buildings. A reflective marker should be posted on each building showing which unit numbers are located in that building.

11. Winter Park Resort and Old Town

Figure 14.



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, 8, 10
Water supply:	Hydrants
Hazards:	Steep slopes, inadequate access roads, wooden roofs

Description: The Winter Park Resort base area consists of a number of multi-family buildings (condos) and hotels. There is a mix of new and older construction and most of the buildings are wood siding constructions with asphalt or metal roofs. Roads are narrow and access is difficult in the congested base area. A one-way road results in a single access. Most of the buildings in the base area have defensible space to the native fuels, but structural extension could be a problem. In the Old Town area, newer multi-family units (condos and apartments) are mixed in with older single family homes. Most of these residences have wood siding construction with an asphalt or metal roof, but there are some wooden roofs in this area. Most of the older structures do not have defensible space and there are many with vegetation growing against the structure. There are some homes with wood piles and flammable yard clutter close to the structure. There are some USFS lease cabins in this community. Streets are narrow and there are few pullouts and turnarounds for apparatus. Addressing is poor with many residences missing markers. Where address markers are present, they are generally not reflective and inconsistently placed. There is a hydrant network in this community. Fuels are heavy loads of mixed conifers broken by ski runs and parking lots. The general topography is flat to moderately steep, but most of the residences are built along the bottom of 20% to 30% slopes.

WINTER PARK RESORT AND OLD TOWN RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Preplan using the one-way road as a secondary access for apparatus during emergencies.
- A detailed evacuation plan is recommended for this congested community.
- Consider creating a shelter-in-place plan including preplanned escape routes that can be used to evacuate residents from homes with flammable construction types to buildings designated as last resort shelter-in-place areas within the community, in the event that access out of the community becomes blocked by heat, smoke or other factors.
- Add reflective addressing to all driveways and homes.

12. The Reserve at Elkhorn Ridge

Figure 15.



Hazard Rating:	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8, 10
Water supply:	One dry hydrant, ponds and authorization to use one hydrant on CR 8
Hazards:	Steep slopes, ravines, homes in saddles

Description: This is a community of moderate to large homes on moderate size lots. Most of the construction is newer, and wood siding, some with rock wainscoting and asphalt roofs is dominant. There are also a few ignition-resistant homes in this community. Some mitigation work has been completed, but there are few conforming defensible spaces and most homes have flammable vegetation too close to the structure. Most homes do not have address markers at the street, and the street signs are non-reflective wood markers on a wooden post. The dirt and gravel access roads are generally wide enough with good surfaces, but there are some steep, narrow, dirt driveways with no turnarounds. There is a secondary access to this community from the Devil's Thumb Ranch. This access is gated, but there is a Knox Box for firefighter access. Thinning work has been done along this access. A dry hydrant fed by a creek is located in the north end of this community, and The Reserve is authorized to use one municipal hydrant on CR 8 for fire protection. Although some mitigation work has been done in this community, there is still a relatively heavy and continuous fuel bed of lodgepole and mixed conifer in this community. Terrain varies from flat to moderate slopes.

THE RESERVE AT ELKHORN RIDGE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants *for ornamental plantings, especially within 30 feet of homes (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Supplement or replace the existing wooden street signs with reflective, non-combustible signs on non-combustible mountings.
- Add reflective addressing to all driveways and homes.

13. Beaver Mountain Preserve

Figure 16.



Hazard Rating:

High

Does the neighborhood have dual access roads?

No

Are there road grades > 8%?

No

Are all access roads of adequate width?

No

Average lot size:

> 5 Acres

Fuel models found in the neighborhood:

10

Water supply:

One cistern (10,000 gallons)

Hazards:

Ravines, steep slopes, inadequate roads

Description: Beaver Mountain Preserve is a gated community with approximately 15 lots. Only three or four homes have been built. These are all large homes on large lots. All of the existing homes are ignition-resistant or heavy timber construction with an asphalt or metal roof. Although the existing homes have all had mitigation work done and have some defensible space, most still have vegetation growing too close to the structure and/or need additional Zone 2 treatment. There are no address markers at the road and most driveways are long. The dirt roads are narrow and have vegetation encroaching in spots. There are also some long, narrow driveways. There is only one way in and out of this community. The only water supply for fire suppression is a 10,000 gallon cistern near the entrance, but it may be possible to draft additional water from one of the beaver ponds. Fuels are heavy loads of sage, lodgepole, and mixed conifer with heavy undergrowth, especially in the southern end of this community. The general topography is steep and complex.

BEAVER MOUNTAIN PRESERVE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Prohibit the construction of any new shake roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants *for ornamental plantings, especially within 30 feet of homes (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add a 5" to 2.5" adapter to the existing cistern to make that water available for fire apparatus that do not have a 5" connection.
- Consider adding an additional large cistern (30,000 gallons or greater) for fire suppression use in the southern end of this community.
- Consider creating a shelter-in-place plan including preplanned escape routes that can be used to evacuate residents from homes with flammable construction types to buildings designated as last resort shelter-in-place areas within the community, in the event that access out of the community becomes blocked by heat, smoke or other factors. Concentrate thinning on any heavy fuels on slopes below these shelters.
- Add reflective addressing to all driveways and homes.

14. Rendezvous North

Figure 17.



Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, inadequate roads, homes in saddles

Description: The north side of Rendezvous is dominated by large homes on moderate size lots. This area is still being built out and many lots do not have structures on them. Most of the homes are custom construction wood siding, some with rock wainscoting, asphalt roofs, and interior fire sprinklers. There are several homes with flammable decks and projections. Many homes have some defensible space, but most still have flammable vegetation too close to the structure. Roads are paved but narrow and have some tight turns. There are many dead ends and few pullouts and turnarounds for apparatus. There is only one way in and out. Most homes have an address marker on the structure, but few are marked at the street and most of the existing markers are non-reflective. There is a good hydrant network in Rendezvous and this community is close to East Grand Fire Station 1. Fuels are heavy to moderate, loads of lodgepole and mixed conifer stands, however the stand density and continuity has been reduced by thinning for construction and mitigation. The topography is moderate to steeply sloping, and most of the homes are constructed mid-slope. There are some homes constructed in saddles or other dangerous terrain features.

RENDEZVOUS NORTH RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Prohibit the construction of any new shake roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants *for ornamental plantings, especially within 30 feet of homes (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

15. Idlewild Meadows

Figure 18.



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 Acres
Fuel models found in the neighborhood:	8, 10
Water supply:	Hydrants
Hazards:	Power lines, propane tanks, ravines, wooden roofs

Description: This is an older development (1940s-1950s) of primarily small single-family homes on small lots with a few multi-family units mixed in. Most structures are wood siding construction with asphalt or metal roofs. Although some homes have irrigated lawns, most have flammable vegetation, both native and ornamental, too close to the structure. There are power lines, propane tanks and some homes with wood piles and other flammables too close to the structure. Most streets are paved but narrow, and pull-outs and turnarounds for apparatus are rare. Some homes do not have address markers and the existing markers vary widely in type and placement. This community has a hydrant network. Fuels are primarily heavy loads of lodgepole stands and mixed conifer with riparian shrubs in the drainages. Fuels are broken in some areas by irrigated lawns. There are power lines and propane tanks that could be hazardous to firefighters. Idlewild Meadows is built in a flat area along Vasquez Creek, but there are steep slopes adjacent to this area. Slopes increase to the southwest but the general topography within Idlewild Meadows is flat to low slope. The topography is complicated by ravines, drainages, and drop-offs below some homes.

IDLEWILD MEADOWS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including roofs on outbuildings, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

16. Rendezvous South

Figure 19.



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:	<1 Acres
Fuel models found in the neighborhood:	1, 8, 10
Water supply:	Hydrants
Hazards:	Ravines, inadequate roads

Description: The southern portion of Rendezvous is much higher density than the northern section. Homes here are primarily multi-family buildings and small homes close together on small lots. This is a newer development and is still being built out. The dominant construction type is wood siding with an asphalt roof. Many of the homes have good defensible space, but some have grasses and trees too close to the structure. Most of the multi-family buildings have flammable projections and decks, and some have flammable items stored underneath. Roads are paved, but narrow with few pullouts and turnarounds for apparatus. When this community is fully built out, the combination of high density, narrow roads, and one way access in and out will make rapid evacuation difficult. Most homes have some type of address marker, but few, if any, are reflective. There is a hydrant network in Rendezvous. Fuels inside this community have been heavily thinned and now consist of moderate to light loads of lodgepole with a grass understory. This community is bordered by a conservation easement with heavy loads of decadent lodgepole and mixed conifer with heavy insect mortality. Topography consists of generally moderate slopes, but some steeper slopes exist and the topography is complicated by ravines and drainages. Most of the homes are located mid-slope on south and west-facing aspects.

RENDEZVOUS SOUTH RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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. Mow grasses around homes for a distance of at least 30 feet.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Wherever possible, vegetation should be thinned along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

17. Sunset Ridge

Figure 20.



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:	<1 Acre
Fuel models found in the neighborhood:	8
Water supply:	None
Hazards:	Inadequate water supply, ravines, power lines, wooden roofs

Description: Small to moderate size homes on small lots. Most of the homes are older wood siding construction with asphalt roofs, but there is at least one wooden roof in this community. Although thinning has been done in this community, there are few homes with defensible space. Most homes have flammable vegetation, wood piles or other flammables too close to the structure. The dirt access roads are generally of adequate width, but there are some narrow sections and there are several narrow driveways with no pullouts or turnarounds for apparatus. While there are technically two entrances to this community, they come out approximately 100 yards apart on the same access road. Some homes do not have address markers at all, and where markers are present, they are typically non-reflective and difficult to locate. Many of the markers that do exist are wooden signs mounted on a tree or wooden pole. There is no water for fire suppression in this community. The nearest water source is a dry hydrant on a pond near US 40 (approximately two to three miles from the entrance to this community). Fuels are heavy loads of lodgepole and other conifers, with light to moderate surface loads and regeneration. Mitigation work has reduced the fuel load in some parts of this community, but the fuel bed as a whole is still fairly continuous. Topography is flat to gently sloping, but complicated by ravines.

SUNSET RIDGE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding 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.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Consider adding one or two large cisterns (30,000 gallons or greater) to create a water supply for this community and Sunset Ridge Estates. Additional water supply is a critical need in this community.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

18. The Fairways

Figure 21.



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:

1-5 Acres

Fuel models found in the neighborhood:

1, 8, 10

Water supply:

Draft ponds

Hazards:

Ravines, inadequate water supply

Description: This is a community of large homes on large lots with a golf course running through the middle. Most homes are newer construction, and while there are some ignition-resistant homes, most residences are wood siding or log veneer, some with rock wainscoting, with asphalt roofs. There are several homes with defensible space and irrigated lawns, but there are also many homes with flammable vegetation too close to the structure. Flammable decks and projections are common. Roads are paved but narrow in spots. There are many narrow driveways with few pullouts and turnarounds for apparatus. Address markers are generally present, but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to locate. Most address markers and street signs are wooden mounted on wood poles. The only water for fire suppression is from ponds located on the golf course. However, a large cistern is planned for installation in the north side of this community. Fuels are mixed conifer and lodgepole stands which have been thinned in some areas and are broken by the golf course. The general topography is moderate, but steep in some areas. Many homes are built on slopes with fuels below them. The topography is complicated by ravines and drainages. This community backs up to the YMCA of the Rockies property, which has a recent fire history.

THE FAIRWAYS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU in the main report for details*).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding 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. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU in the main report)*.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations in the main report*).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider constructing a large cistern (30,000 gallons or greater) in the southern portion (south of the golf course) to compliment the one being installed in the northern portion of this community.
- Consider constructing a shaded fuelbreak between this community and the YMCA property (*see Landscape Scale Fuels Modification Recommendations in the main report*).
- Add reflective addressing to all driveways and homes.

19. Elk Run/Leland Creek

Figure 22.



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:

8, 10

Water supply:

Hydrants

Hazards:

Steep slopes, inadequate roads

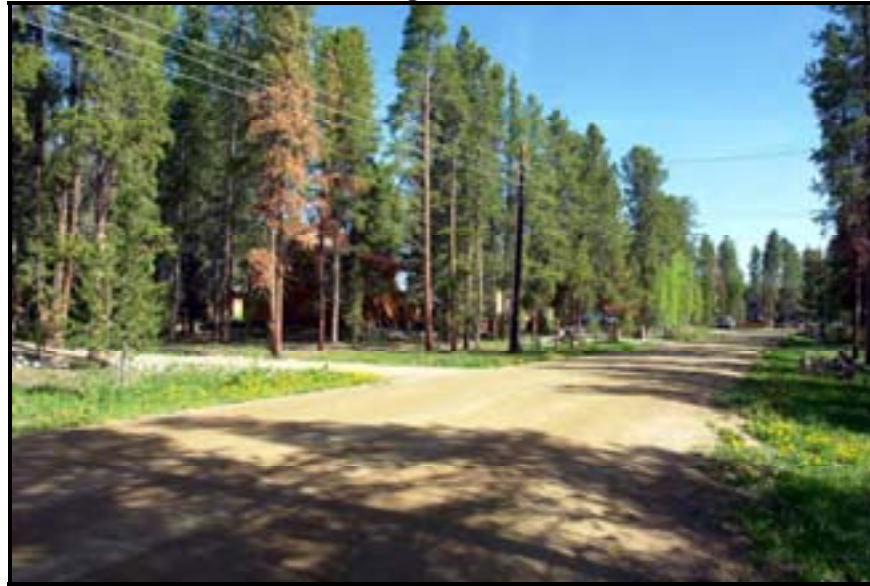
Description: Moderate to large homes on moderate size lots. Most of the construction is newer and custom homes are common. Multi-family buildings are mixed in with single-family homes, especially in the southern end of this community. The dominant construction type is wood siding, some with rock wainscoting, and asphalt roofs. Although some mitigation work has been done, especially in the newer areas of this community, most homes do not have adequate defensible space. Flammable vegetation too close to structures is common throughout this community. Several homes do not have address markers at the driveway and few markers, if any, are reflective. Access roads are narrow in some areas and there are few pullouts or turnarounds for apparatus. This community has a hydrant network, but the hydrants are known to have low pressure. Fuels are heavy loads of lodgepole-dominant conifer stands. The general topography is low to moderate slope, but there are some areas where homes are built above steep slopes. The topography is complicated by ravines and drainages. There is a railroad track near the eastern end of this community that is a potential ignition source.

ELK RUN/LELAND CREEK RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- 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. Mow grasses for a distance of at least 30 feet from homes.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of improving the hydrant pressure.
- Add reflective addressing to all driveways and homes.

20. Icebox Estates/Skyview Acres

Figure 23.



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:	1-5 Acres
Fuel models found in the neighborhood:	8
Water supply:	None
Hazards:	Inadequate water supply, power lines, wooden roofs

Description: This is a community of small to moderate size older homes on small to moderate size lots. Wood siding with asphalt roofs is the most common construction type, but there are several homes with shake roofs and flammable decks, and projections are common. Although thinning has been done in this community, there are few homes with defensible space. Most homes have flammable vegetation, wood piles or other flammable yard clutter close to the structure. Slash piles from mitigation work are present in many yards, creating jackpots of fuel. Many homes do not have address markers at the street and most that do only have a non-reflective wooden sign on a tree or wooden pole. Marker placement is inconsistent and some markers are hard to locate. Access roads are dirt, but most are flat and of adequate width. This is a difficult area to navigate because the streets are marked only with County road numbers, and not the street name. There are few pullouts and turnarounds for apparatus, and there are some long, narrow driveways. Power lines exist which may be a hazard to firefighters. There is no water supply for fire suppression in this community. Fuels are heavy loads of lodgepole with substantial insect mortality. The topography is generally flat.

ICEBOX ESTATES/SKYVIEW ACRES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding roofs, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding one or two large cisterns (30,000 gallons or greater) to create a water supply for Icebox Estates and Skyview Acres. Additional water supply is a critical need in this community.
- Investigate the possibility of improving rough/rutted sections of the dirt access roads.
- Add reflective addressing to all driveways and homes.

21. Alpine Timbers

Figure 24.



Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	8, 10
Water supply:	Hydrants
Hazards:	Inadequate roads, railroad track through heavy fuels

Description: Alpine Timbers is a high-density community of older homes and condo buildings with some newer fill-in homes. Although lots are still available and new homes are being built, the dominant construction type is older wood siding homes and multi-family buildings with asphalt roofs. Most homes are small to moderate size on small lots. In spite of the fact mitigation work has been done in this community, most homes do not have adequate defensible space. Flammable vegetation growing too close to the structure is common. Many homes have flammable projections and decks and some have old slash piles in the yard. There are few address markers at the street. On most of the homes that have an address marker the marker is mounted on the house where it is difficult to read because of heavy vegetation in yards throughout this community. Most of the roads are paved and flat, but they are narrow and there are few turnarounds and pullouts for apparatus. Fortunately most of the driveways are short. There is a hydrant network in Alpine Timbers. Fuels are heavy loads of lodgepole-dominant conifers growing in “dog-hair” stands. The topography near the homes is generally flat to moderate slope. A railroad track runs through this community which is a potential ignition source.

ALPINE TIMBERS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU in the main report for details*).
- 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. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU in the main report)*.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations in the main report*).
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

22. Sunset Ridge Estates

Figure 25.



Hazard Rating:	High
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:	>5 Acres
Fuel models found in the neighborhood:	1, 8, 10
Water supply:	One dry hydrant on a pond
Hazards:	Ravines, inadequate water supply, power lines

Description: Unlike neighboring Sunset Ridge this community is composed of moderate to large homes on large lots with most lots still undeveloped. There are some older homes here and the dominant construction type is wood siding with an asphalt roof. Some lots have been heavily thinned, but most of the existing homes still do not have adequate defensible space. Most of the roads are dirt or gravel, but are of adequate width; however long, narrow driveways are common and there are few pullouts and turnarounds for apparatus. There is only one way in and out of this community. Residents would have to drive through the Sunset Ridge community to evacuate. Addressing is generally poor, with few homes marked at the street. Address markers are generally non-reflective, inconsistently located and may be difficult to find. Wooden street signs on wooden poles have been supplemented at most intersections with reflective metal signs mounted on non-combustible poles. This practice should be extended to all of the communities in the study area where wooden street signs exist. The nearest water source is a dry hydrant on a pond near US 40 (several miles from the entrance to this community). Topography is low to moderate slope with some drainages and ravines.

SUNSET RIDGE ESTATES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- 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. Mow grasses for a distance of at least 30 feet from 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* (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Consider adding one or two large cisterns (30,000 gallons or greater) to create a water supply for this community and Sunset Ridge. Additional water supply is a critical need in this community.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

23. Moose Run

Figure 26.



Hazard Rating:	High
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:	8
Water supply:	Draft pond
Hazards:	Inadequate water supply

Description: This relatively new community consists of approximately 40 moderate sized lots, but only a few homes have been constructed. These homes have wood siding or heavy timber construction with asphalt roofs, and some have flammable decks and projections (primarily open stairways). Most of the homes have some defensible space, but there are still homes with flammable vegetation too close to the structure. There is only one way in and out, but most of the roads have a good surface and are of adequate width. Unlike most of the study area, some of the existing homes have been built with adequate turnarounds for apparatus (see **Figure 26**). Driveways on the existing homes are generally short. Street signs are metal, but mounted on wooden poles. Most homes need an address marker at the street. The nearest water for fire suppression is from a pond at the Timberline Lodge. Although this area has had a significant amount of thinning, there is still a relatively continuous fuel bed. Fuels are moderate to heavy loads of lodgepole and mixed conifers. Some portions of this community have significant surface and ladder fuels, but thanks to mitigation efforts, surface and ladder fuel loads are significantly lighter near the existing homes. The general topography is flat to low slope. If the current trends of fuels reduction and defensible space continue and an adequate water supply can be established, this area may warrant a lower hazard rating in the future.

MOOSE RUN RECOMMENDATIONS

- A parcel-level analysis is recommended when this community reaches at least 50% maximum build out.
- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Prohibit the construction of shake roofs and encourage the use of 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. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Add a minimum of two large cisterns (30,000 gallons or greater) to create a water supply for this community. Additional water supply is a critical need in Moose Run.
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.
- Supplement the existing street signs with reflective metal signs on a non-combustible pole, or mount the current signs on non-combustible poles.

24. High Country Haus

Figure 27.



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, 5, 8, 10
Water supply:	Hydrants
Hazards:	Inadequate access roads, power lines

Description: This community is composed of primarily older multi-family buildings. This is a high density area near downtown Winter Park. The buildings are primarily wood siding construction with asphalt roofs. Most of the buildings have flammable decks and/or projections. Although this area has been heavily thinned, there are still some buildings with flammable vegetation too close to the structure. The heavy fuel beds to the north and west have been greatly reduced by the development of Rendezvous. There is still, however, enough vegetation to carry fire from building to building under severe burning conditions. Currently the greatest threat to this community would be fire spreading through structural extension (a structure fire becoming the ignition source for a wildland fire) within this high density area. The buildings are marked, but the individual units are only marked with non-reflective numbers at the door. Although there are two ways into this community, the main entrance is over a narrow bridge. Roads are dirt and are narrow in spots. There are hydrants and flows should be adequate. Fuels are a mixture of grasses and conifer stands with riparian shrubs and hardwoods occurring in the drainages. The topography is flat.

HIGH COUNTRY HAUS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all buildings (*see Home Mitigation FMU* in the main report for details).
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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* (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Due to the high density and narrow access an evacuation pre-plan is recommended for this community.
- Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

25. Stagecoach

Figure 28.



Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	1, 2, 5, 8
Water supply:	Pond with a dry hydrant
Hazards:	Inadequate water supply

Description: This community consists of primarily newer homes, but only a small portion of the available lots have been built out. Most of the existing homes are located on five-acre lots. The dominant construction type is wood siding or heavy timber with an asphalt roof, but some ignition-resistant homes have also been built in Stagecoach. Stagecoach has prohibited the use of shake roofs, so only ignition resistant roofs will be built here. This community has been heavily thinned and many homes have defensible space, but some homes still have flammable vegetation too close to the structure. Street surfaces are all paved and most are of adequate width. There are a few cul-de-sacs, but turnarounds are generally good (see **Figure 28**) and there are pullout easements for apparatus in this community. Street signage is generally good, reflective metal signs on metal mounts, but most homes have non-reflective wooden address markers and some homes are not marked at the street. Although CR 5 is the only way in and out of Stagecoach, it is possible to escape to the north or south making this community dual access for the purposes of evacuation planning. The only water for fire suppression is from a draft hydrant on a pond located at the entrance to this community. Fuels are heavy to moderate loads of lodgepole stands broken by meadows and thinning, however there are some relatively continuous fuel beds of sage in other parts of this community. Stagecoach has an active forestry committee; forest cleanup and fuels management are ongoing. The topography is flat to gently rolling. The historic stage stop buildings in this community are considered a cultural site.

STAGECOACH RECOMMENDATIONS

- Adequate defensible space is recommended for all buildings (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. The use of shake roofs has been prohibited in Stagecoach.
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes (the use of junipers has already been banned). Encourage the use of fire- and drought-tolerant plants *for ornamental plantings, especially within 30 feet of homes* (*see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Consider adding at least two large cisterns (30,000 gallons or greater) to supplement the water supply in Stagecoach. Additional water supply is a critical need in this community and will be even more important as additional homes are built.
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads except where turnout easements already exist.
- Add reflective addressing to all driveways and homes.

26. Sheep Mountain Ridge/The Valley

Figure 29.



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:	8, 10
Water supply:	Hydrants
Hazards:	Ravines, some steep slopes

Description: Sheep Mountain Ridge Estates is a relatively new community of moderate to large size homes on moderate to large lots (2.5 to 7 acres). This area is still being built out and many lots do not have structures. The dominant construction is wood siding or heavy timber with an asphalt roof. Although there has been a significant amount of thinning in this community, there are still homes with flammable vegetation too close to the structure. The adjacent subdivision (The Valley at Winter Park) has few homes built, but many lots have been prepared. Lots are of similar size to those in Sheep Mountain Ridge Estates and the fuels and topography are similar. Roads in Sheep Mountain Ridge Estates are paved and of adequate width. Roads in The Valley are also of adequate width, but most have dirt surfaces. Although most homes do not have an adequate turnaround for apparatus, driveways are generally short. Street signs are wood (non-reflective) on wooden posts. Most homes have an address marker on the structure, but only some have address markers at the street. Few, if any, of the address markers are reflective. Sheep Mountain Ridge Estates has a hydrant network, but the only water for fire suppression in The Valley is one dry hydrant on a pond. Fuels are heavy to moderate loads of lodgepole-dominant mixed conifers. Although there has been substantial thinning, especially near the existing homes, there are still heavy, continuous fuel beds in this community. The topography is generally gently rolling. However, there are steep slopes below some homes.

SHEEP MOUNTAIN RIDGE/THE VALLEY RECOMMENDATIONS

- Adequate defensible space is recommended for all buildings (see *Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. The use of shake roofs should be prohibited.
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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* (see *Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (see *Access Route Fuels Modification Recommendations* in the main report).
- Consider adding at least two large cisterns (30,000 gallons or greater) to supplement the water supply in The Valley at Winter Park. Additional water supply will be important as additional homes are built.
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

27. Pole Creek Meadows

Figure 30.



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:

8, 10

Water supply:

Dry hydrant on a pond

Hazards:

Inadequate water supply, power lines

Description: Large to moderate size homes on moderate to large size lots. There are some ignition-resistant homes in this community, but the dominant construction type is wood siding or heavy timber with asphalt roofs. There are many homes with flammable decks and projections. Most of the homes are newer construction and several have some defensible space. Although there has been a significant amount of thinning in this community, there are still many homes with flammable vegetation too close to the structure. The homeowner's association has been active in mitigation work in this community. Roads are generally good, but there are some steep, narrow driveways. There are few pullouts and turnarounds for apparatus. Street signs are wood (non-reflective) on wooden posts. Most existing address markers are non-reflective, and only some homes have an address marker at the street. The only water for fire suppression is one dry hydrant on a pond. Fuels are heavy to moderate loads of lodgepole-dominant mixed conifers with heavy ladder fuels and surface fuel loads broken by some meadows. Although there has been substantial thinning work done, there are still heavy, continuous fuel beds in this community. The topography is low to moderate slope, but complex with multiple aspects and ravines.

POLE CREEK MEADOWS RECOMMENDATIONS

- Adequate defensible space is recommended for all buildings (see *Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. The use of shake roofs should be prohibited.
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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* (see *Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (see *Access Route Fuels Modification Recommendations* in the main report).
- Consider adding one or two large cisterns (30,000 gallons or greater) to supplement the water supply in Pole Creek Meadows. Additional water supply is a critical need in this community.
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

28. Winter Park

Figure 31.



Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	1, 5, 10
Water supply:	Hydrants
Hazards:	Power lines

Description: Downtown Winter Park is composed of primarily commercial properties along Highway 40, but there are single family homes and condos in this area, especially on the west side of Highway 40. Most of the homes and multi-family buildings are older construction and most homes are small on small lots. The dominant construction is wood siding with an asphalt or metal roof. There are many homes with flammable decks and projections. Although some homes have defensible space, most have flammable vegetation too close to the structure. There are wood piles and other flammables too close to the structure in many yards. Roads are generally good, but there are some narrow driveways. Address markers are inconsistent and most are non-reflective. Winter Park has hydrants and good access to fire resources. Fuels are moderate loads of lodgepole-dominant mixed conifers, grassy meadows and riparian shrubs in the drainages and along watercourses. Although fuels are broken by development and irrigated lawns they do extend through town in both directions. Winter Park is built in a valley between mountain slopes and the general topography is flat.

WINTER PARK RECOMMENDATIONS

- Adequate defensible space is recommended for all buildings (*see Home Mitigation FMU* in the main report for details).
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

29. Tabernash

Figure 32.



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 Acre
Fuel models found in the neighborhood:	1, 5, 10
Water supply:	Hydrants
Hazards:	Wood roofs, power lines

Description: Most of the homes in Tabernash are small on small lots. The main area, that surrounds Highway 40, as well as Junction Creek Ranch, are primarily older construction. Coyote Creek has newer homes and this area is still being built out. The dominant construction is wood siding with an asphalt roof, but there are some flammable roofs, especially in the older parts of this community. There are some homes with flammable decks and projections. Although most homes have defensible space, especially in the newer areas, there are some homes with flammable vegetation too close to the structure. There are also wood piles and other flammables too close to the structure in some yards. Roads are generally of adequate width with good surfaces, but there are a few narrow driveways and some homes without adequate turnarounds for apparatus. Address markers are inconsistent and most are non-reflective. Tabernash has hydrants and East Grand Fire Station 2 is located in this community. Fuels are light to moderate loads of shrubs and grasses with some lodgepole-dominated conifer stands growing in stringers and patches. Fuels are broken by development and irrigated lawns. The general topography is flat.

TABERNASH RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- 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. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

30. Fraser

Figure 33.



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 Acre
Fuel models found in the neighborhood:	1, 5, 10
Water supply:	Hydrants
Hazards:	Wood roofs, power lines

Description: The town of Fraser is composed of primarily commercial properties along Highway 40, with residential streets along the east and west sides of the highway. Residential properties are a mix of town homes, condos, and single-family homes. Most homes are small on small lots. The dominant construction is wood siding with asphalt or metal roofs. There are many homes with flammable decks and projections. Although most homes have defensible space, there are a few homes with flammable vegetation too close to the structure. There are also wood piles and other flammables too close to the structure in some yards. Roads are generally of adequate width with good surfaces, and most driveways are short, but there are a few long narrow driveways, and some homes without adequate turnarounds for apparatus. Address markers are inconsistent and most are non-reflective. Fraser has hydrants and East Grand Fire Station 1 is located in this community. Fuels are light to moderate loads of shrubs and grasses with some lodgepole-dominated conifer stands growing in stringers and patches. Fuels are broken by development and irrigated lawns. The general topography is flat.

FRASER RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (*see Home Mitigation FMU* in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. The use of shake roofs should be prohibited.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU* in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments (*see Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

31. CR 5170

Figure 34.



Hazard Rating:	Low
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 Acre
Fuel models found in the neighborhood:	1, 2, 8
Water supply:	One cistern
Hazards:	Inadequate water supply, inadequate roads

Description: This area is a relatively new development and few homes have been built, but extensive mitigation has resulted in the removal of most of the timber fuels. The existing homes are newer construction of moderate to large size and all of the lots are large. The dominant construction is wood siding and rock wainscoting with asphalt roofs. As a result of the extensive mitigation work, the existing homes have defensible space. This community currently has only one way in and out. A secondary access has been planned, but not implemented. The dirt access roads have good surfaces, but are narrow with few pullouts and turnarounds for apparatus. Most of the driveways are long and narrow. The existing street signs are wood on wooden posts and are hard to read. Most of the existing homes do not have address markers at the street. The only water supply for fire suppression is a 10,000 gallon cistern on private property. Fuels are light loads of grasses and lodgepole stands that have been thinned to open canopy with a grass understory. While opening the formerly heavy stands of lodgepole has greatly reduced the possibility of crown fire, the remaining trees are more susceptible to blow down. The general topography is flat.

CR 5170 RECOMMENDATIONS

- Adequate defensible space is recommended for all future homes (see *Home Mitigation FMU* in the main report for details). All existing homes should maintain their defensible spaces.
- Discourage the use of combustible materials for decks, siding and roofs. The use of shake roofs should be prohibited.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials. Flammable materials should not be stored on or under flammable decks and projections.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses for a distance of at least 30 feet from 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 (see Home Mitigation FMU in the main report)*.
- Keep vegetation thinned along access roads and driveways. This is especially important for narrow driveways and road segments (see *Access Route Fuels Modification Recommendations* in the main report).
- Wherever possible, on any driveway or private road longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- The planned secondary access should be completed as soon as possible.
- Consider adding at least two large cisterns (30,000 gallons or greater) to supplement the existing cistern. Additional water supply will be important as additional homes are built.
- Add reflective addressing to all driveways and homes.

APPENDIX C

UPPER FRASER VALLEY CWPP STRUCTURAL TRIAGE AND PREPARATION

Size Up Considerations

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

Fire Fighter Safety

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

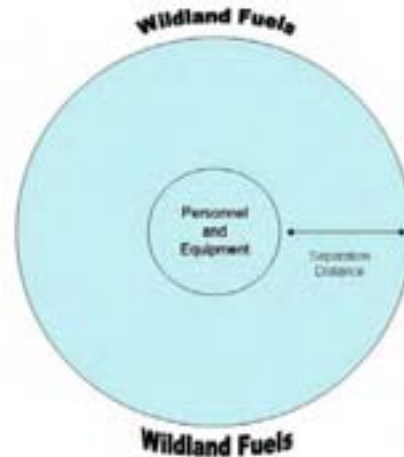
Safety Zone Guidelines

- Avoid locations that are downwind from the fire.
- Avoid locations that are in chimneys, saddles, or narrow canyons.
- Avoid locations that require a steep uphill escape route.
- Take advantage of heat barriers such as lee side of ridges, large rocks, or solid structures.
- Burn out safety zones prior to flame front approach.
- For radiant heat only, the distance separation between the firefighter and the flames must be at least four times the maximum flame height. This distance must be maintained on all sides, if the fire has ability to burn completely around the safety zone. **Convective heat from wind and/or terrain influences will increase this distance requirement.**

Flame Height	Distance Separation (firefighter to flame)	Area in Acres
10 feet	40 feet	1/16 acre
20 feet	80 feet	1/4 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]

CALCULATIONS ASSUME NO SLOPE AND NO WIND



Distance Separation is the radius from the center of the safety zone to the nearest fuels. When fuels are present that will allow the fire to burn on all sides of the safety zone, this distance must be doubled in order maintain effective separation in front, to the sides, and behind the firefighters. Area in Acres is calculated to allow for distance separation on all sides for a three person engine crew. One acre is approximately the size of a football field or exactly 208 feet x 208 feet.¹

Structural Triage Categories

Sort structures into 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

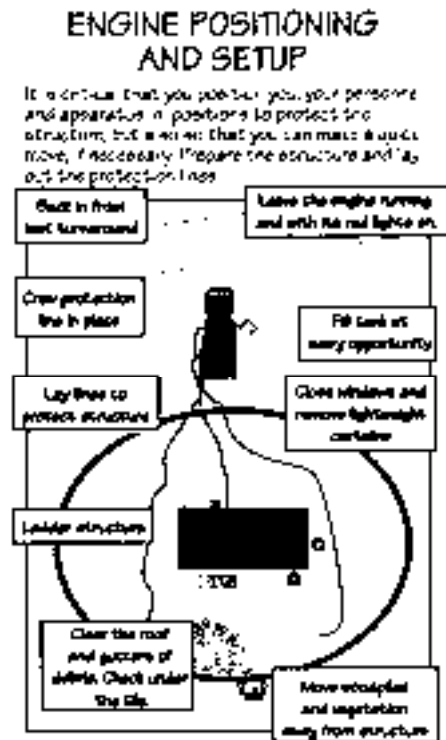
¹ <http://www.nwccg.gov/pms/pubs/nfes1077/nfes1077.pdf>

- 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

Common Ignition Points (remember, in windy conditions, firebrands can enter almost any opening)

- 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
- Openings under porches or patio covers

Apparatus Placement Considerations



2

APPENDIX D

UPPER FRASER VALLEY CWPP ACCESS AND WATER SUPPLY RECOMMENDED GUIDELINES

Introduction

This appendix has been designed with public education in mind and is intended to 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.

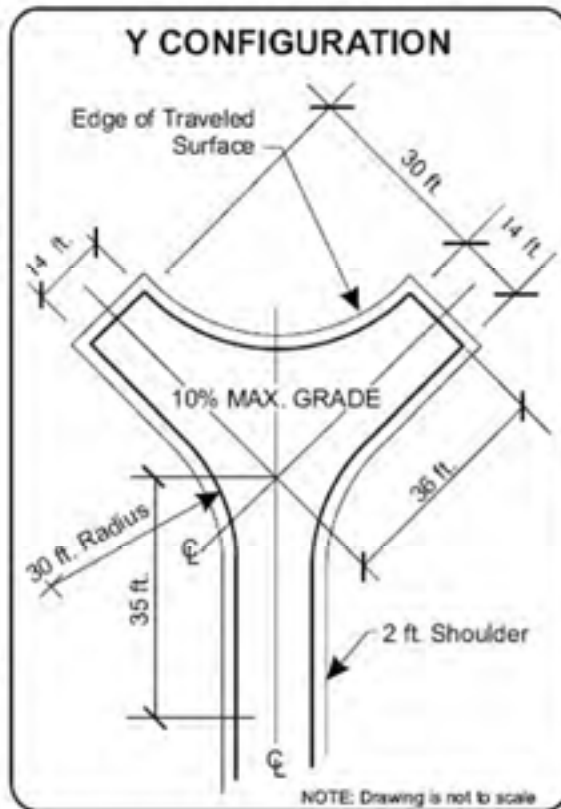
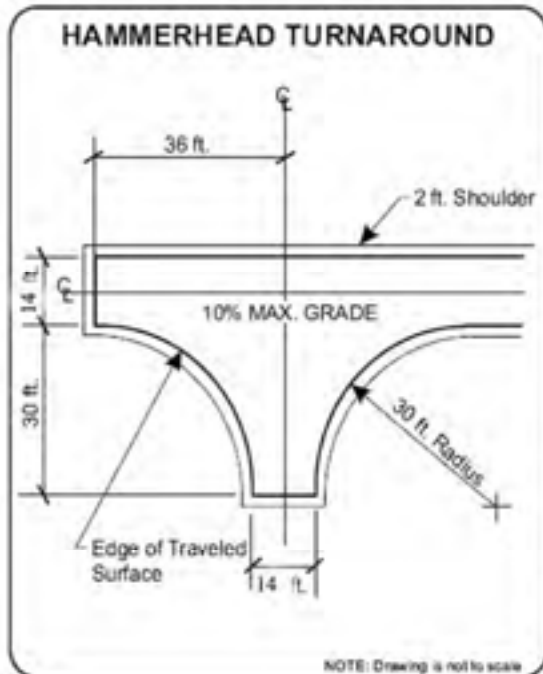
Access Guidelines

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.

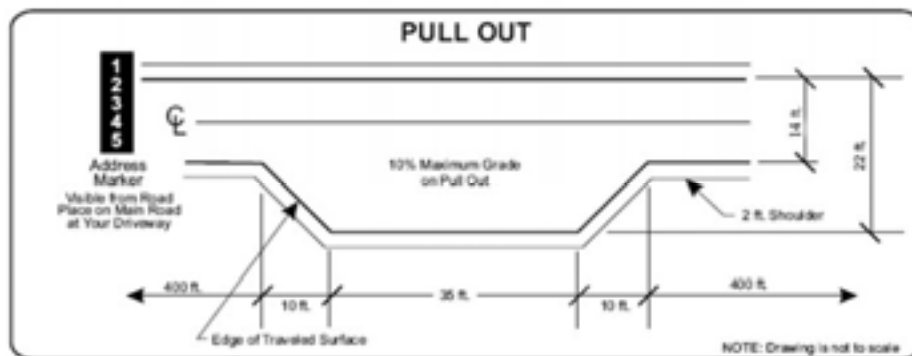
Driveway Width and Height

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



Driveway Pullouts

Driveway pullouts are designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400-foot 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 residences accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate to simply mark addresses on a common pole in the center of the fork. Residential homes should have an additional reflective address marker permanently attached to the home in clear view of the driveway or access road. Homes that are marked by lot number while under construction should have the lot number removed and a permanent address marker posted before granting a certificate of occupancy.

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.

Rural Water Supply for Creditable Storage

In the study area, like many of the mountainous areas of Colorado, water is a critical fire suppression issue. 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 rural water supply for creditable storage has been included to provide information regarding 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 *Water Supply FMU* in the main report.

Since 1985 East Grand Fire has been working to improve fire suppression capabilities in the rural portions of the Fraser Valley and has earned an ISO Class 4 rating on properties within five miles of their stations. Among the many things the District has been required to do to maintain this rating, working to improve the water supply for fire suppression has been critically important. Water is the major component of fighting fires the Fire District does not directly control. Water supplies are developed and maintained by a variety of providers including individuals, home owner's associations (HOAs), Water and Sand Districts, town governments and others. Water supplies for fire suppression vary from millions of gallons to the basic minimum creditable supply (30,000 gallons). The past few years have seen many impacts to our water supplies for firefighting including some which have dried up entirely. To avoid concerns over the availability of water in the future the Fire District has proactively set minimum requirements for creditable water supplies for new developments or upgrades to existing supplies. The following is a list of the minimum requirements for a creditable water supply:

- All supplies must be offline and not subject to call during low water flow years.
- All supplies are to be covered or underground tanks or cisterns protected from freezing and not subject to buildup of sediment or plant growth.
- All supplies are to gravity feed to a location where a Fire District engine can take supply with at least a minimum pressure to avoid drafting.
- All supplies should be built in supply from a dedicated exempt fire well, a feed from an approved domestic source, or other approved system. Refill shall be automatic or

by a Fire District approved manual control. An approved system to indicate the supply is full will also be required.

- A Fire Department hose fitting of 4.5 inch NST male threads for supplying a minimum flow from the system of 1,000 gallons per minute (GPM) and a recirculator return line of 2.5 inch NST female threads adequate to flow 250 GPM are required. These fittings and lines must be protected from freezing and supplied with suitable caps.
- The supply should be available year-round from an all weather road surface. Adequate markings to allow the location of attachment points and to prevent blockage by vehicles is required.
- The minimum volume required for Fire District operations is 30,000 gallons of water for single family dwellings that may be shared. That is calculated as 250 GPM for two hours to provide a creditable supply. This is a minimum capacity and larger developments may require additional sites located no greater than 1.5 miles from structures. Developments with large buildings will require larger supplies as calculated from the NFPA 1142 standard.
- Long term maintenance is a critical component of a water supply system and an approved plan is required to insure proper maintenance.
- Ponds, lakes, river crossings and other natural water sources may be used as additional water sources, but are not suitable for primary use.

APPENDIX E

UPPER FRASER VALLEY CWPP 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) and the Bureau of Land Management (BLM) to consider the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. In the case of the Upper Fraser Valley, significant tracts of federal land are found within and bordering the study area. Therefore, a CWPP became desirable to comply with the HFRA initiative.

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 principle stakeholders used internal budgets in combination with a BLM grant to complete a district-wide hazard and risk assessment and the resultant CWPP. Stakeholders who provided the majority of the funding for this project include East Grand Fire, the towns of Fraser and Winter Park, the Denver Water Board, Sunset Ridge HOA (through a separate BLM grant), and Intrust Corporation (see **Table 1**).

Community education and private landowner assistance will be coordinated through East Grand Fire. East Grand Fire will continue to be instrumental in public education related to wildfire hazard reduction and will continue to work with state and federal land managers to identify mitigation projects and develop funding for implementation. Homeowner cooperation and permission for projects on private land is more likely if there is an East Grand Fire representative overseeing the details in partnership with BLM, USFS and Colorado State Forest Service (CSFS) representatives. This collaborative management structure allows for more effective implementation of cross-boundary projects.

Table 1. CWPP Funding Contributors

Date	Organization	Amount
2/14/2007	Town of Fraser	\$20,000
2/20/2007	Town of Winter Park	\$20,000
6/19/2007	Denver Water Board	\$20,000
2/5/2007	East Grand Fire	\$10,000
7/30/2007	Intrawest/Winter Park Operations Corporation	\$10,000
8/14/2007	Bureau of Land Management	\$10,000
12/2007	Sunset Ridge HOA (through a BLM-funded grant)	\$ 6,000
4/25/2007	Young Life-Crooked Creek Ranch	\$ 750

Inter-Agency Collaboration

Roles and Responsibilities

To be successful, wildfire mitigation in the interface must be a community-based, collaborative effort. Landowners and East Grand Fire will have the greatest responsibility for implementing the recommended mitigation projects. The BLM, USFS and CSFS will also be valuable participants in addressing cross-boundary projects throughout the district. Many of the recommendations in the CWPP affect private land or access roads to private land. As such, their success will be largely dependent on the participation of landowners. East Grand Fire is committed to encouraging the participation of as many interested landowners as possible. There are also mitigation recommendations for individual structures which are the responsibility of the homeowner. Homeowners will, however, need a point of contact—most likely a member of East Grand Fire or the CSFS—to help them implement these recommendations. The best defensible space will be created with oversight and expert advice from fire department and or government forestry personnel. One-on-one dialog will strengthen the relationship-building process with community members. This level of involvement will allow agencies to keep track of progress and update this plan to reflect the latest modifications at the community level. The East Grand Fire web site is <http://www.eastgrandfire.com/default.html>. 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.”

In addition to private stakeholders, seven federal, state, and local governmental agencies participated in the Upper Fraser Valley CWPP. These agencies are:

- East Grand Fire
- Grand County
- The Town of Fraser
- The Town of Winter Park
- The Bureau of Land Management
- The United States Forest Service
- The Colorado State Forest Service

The collaborative process was initiated with an initial meeting to discuss GIS and other technical requirements for the project. This meeting took place in February of 2007. Two additional meetings were conducted in April of 2007—a stakeholder meeting and a public meeting. The purpose of the stakeholder meeting was to bring all past, current, and future efforts and needs to the table. The primary focus of the group was the identification and delineation of communities, areas of concern, and values at risk. Best practices and anticipated “roadblocks” were identified. The group was encouraged to make use of existing GIS mapping to refine their areas of concern and their recommendations for mitigation projects. The purpose of the public meeting was to familiarize residents with the CWPP process and request their input. As a result of these meetings, thirty-one communities were delineated and analyzed for hazard and risk.

Two additional meetings were conducted in November of 2007 following the release of the draft CWPP by Anchor Point to the stakeholder group. A stakeholder meeting was convened to discuss any issues and initial comments related to the draft product. A public meeting was held the same evening to reveal the findings of the draft document to the general public and begin the process of collecting their input. These meetings marked the start of a two-week review period of the draft CWPP, during which public and stakeholder comments were collected by Anchor Point regarding the document. At the close of this period, Anchor Point reviewed all the comments collected and revised the draft document in consultation with the stakeholder group. This revised document was shipped to the client as a final CWPP in December of 2007.

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