Fairmount
Fire Protection District
Community Wildfire Protection
Plan

May 4, 2007

FAIRMOUNT
FIRE PROTECTION DISTRICT
COMMUNITY WILDFIRE PROTECTION PLAN

May 4, 2007

Prepared for: Jefferson County Emergency Management
800 Jefferson County Parkway
Golden, CO 80419
303-271-4900

Prepared by: _____
George A. Greenwood
Wildland Fire Specialist

Reviewed by: _____
Jerry R. Barker
Rangeland and Fire Ecologist

Submitted by

WALSH ENVIRONMENTAL SCIENTISTS AND ENGINEERS, LLC
4888 Pearl East Circle, Suite 108
Boulder, Colorado 80301
(303) 443-3282

WALSH Project Number: 7404-020

Community Wildfire Protection Plan
Fairmount Fire Protection District
Jefferson County, Colorado

May 21, 2007

Introduction

This *Community Wildfire Protection Plan* (CWPP) was developed for the Fairmount Fire Protection District with guidance and support from Jefferson County Division of Emergency Management, Colorado State Forest Service and the United States Forest Service. The CWPP was developed according to the guidelines set forth by Healthy Forest Restoration Act (2003) and the Colorado State Forest Service - Minimum Standards for Community Wildfire Protection Plans (November, 2004). This CWPP supplements the Jefferson County Annual Operating Plan and the Jefferson County Fire Plan.

Wildfire Prevention and Fire Loss Mitigation

The Jefferson County Division of Emergency Management, the Jefferson County Fire Council, and the Fairmount Fire Protection District support and promote Firewise activities as outlined in the Jefferson County Fire Plan.

Protection Capability

Initial response to all fire, medical and associated emergencies is the responsibility of the Fairmount Fire Protection District. Wildland fire responsibilities of local fire departments, Jefferson County, Colorado State Forest Service, United States Forest Service, Bureau of Land Management and the U.S. Fish and Wildlife Service are described in the current *Jefferson County Annual Operating Plan*. All mutual aid agreements, training, equipment, and response are the responsibility of the local fire department and the agencies listed above.

The following agencies have reviewed and agree to this *Community Wildfire Protection Plan*.

_____
Golden District, Colorado State Forest Service

_____
Jefferson County Division of Emergency

_____
Fairmount Fire Protection District

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LIST OF ACROYNMS AND ABBREVIATIONS

AFOP	Annual Fire Operating Plan
BLM	Bureau of Land Management
BTU	British Thermal Unit
CAPCD	Colorado Air Pollution Control Division
CDPHE	Colorado Department of Public Health and Environment
CSFS	Colorado State Forest Service
CWPP	Community Wildfire Protection Plans
ERC	Energy Release Component
FBFM	Fire Behavior Fuel Model
FEMA	Federal Emergency Management Agency
FFPD	Fairmount Fire Protection District
FPD	Fire Protection District
GIS	Geographical Information System
HFRA	Healthy Forests Restoration Act
HOA	Homeowners Association
ICT	Incident Command Team
IMT	Incident Management Team
JFDRS	Jefferson County Fire Danger Rating System
JEFFCO	Jefferson County
mph	miles per hour
NAIP	National Agricultural Imagery Program
NEPA	National Environmental Protection Act
NFDRS	National Fire Danger Rating System
NFPA	National Fire Protection Association
NWCG	National Wildfire Coordinating Group
RAWS	Remote Access Weather Station
USFS	US Forest Service
WALSH	Walsh Environmental Scientists and Engineers, LLC
WFU	Wildland Fire Use
WUI	Wildland-Urban Interface

LIST OF FIRE BEHAVIOR TERMS

Aerial Fuels	All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush.
Aspect	Direction toward which a slope faces.
Direct Attack	A method of fire suppression where actions are taken directly along the fire's edge. In direct attack, burning fuel is treated directly, such as by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.
Chain	A unit of linear measurement equal to 66 feet.
Crown Fire	The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.
Dead Fuels	Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.
Defensible Space	An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.
Fire Behavior	The manner in which a fire reacts to the influences of fuel, weather, and topography.
Fire Danger	The broad-scale condition of fuels as influenced by environmental factors.
Fire Front	The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smoldering combustion.
Fire Hazard	The presence of ignitable fuel coupled with the influences of terrain and weather.
Fire Intensity	A general term relating to the heat energy released by a fire.
Fire Return Interval	The historic frequency that fire burns in a particular area or fuel type, without human intervention.
Fire Regime	The characterization of fire's role in a particular ecosystem, usually characteristic of a particular vegetation and climatic regime, and typically a combination of fire return interval and fire intensity (i.e., high frequency low intensity/low frequency high intensity).
Fire Weather	Weather conditions that influence fire ignition, behavior and suppression.
Flaming Front	The zone of a moving fire where combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light

	fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front.
Fuel	Combustible material; includes, vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire. Not all vegetation is necessarily considered fuels; deciduous vegetation such as aspen actually serve more as a barrier to fire spread, and many shrubs are only available as fuels when they are drought-stressed.
Fuel Loading	The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.
Flame Length	The distance from the base to the tip of the flaming front. Flame length is directly correlated with fire intensity.
Fuel Model	Simulated fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
Fuel Type	An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.
Ground Fuel	All combustible materials below the surface litter, including duff, tree or shrub roots, punchy wood, peat, and sawdust that normally support a glowing combustion without flame.
Indirect attack	A method of fire suppression where actions are taken some distance from the active edge of the fire due to intensity, terrain, or other factors that make direct attack difficult or undesirable.
Intensity	The level of heat radiated from the active flaming front of a fire, measured in BTUs (British Thermal Units) per foot.
Ladder Fuels	Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.
Live Fuels	Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.
National Fire Danger Rating System (NFDRS)	A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.
Prescribed Fire	Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and National Environmental Protection Act (NEPA) requirements must be met, prior to ignition.
Rate of Spread	The relative activity of a fire in extending its horizontal dimensions. It is expressed as a rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in

	area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history. Sometimes it is expressed as feet per minute; one chain per hour is equal to 1.1 feet per minute.
Risk	The probability that a fire will start from natural or human-caused ignition.
Surface Fuels	Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.
Topography	Also referred to as "terrain." The parameters of the "lay of the land" that influence fire behavior and spread. Key elements are slope (in percent), aspect (the direction a slope faces), elevation, and specific terrain features such as canyons, saddles, "chimneys," and chutes.
Wildland Fire	Any fire burning in wildland fuels, including prescribed fire, fire use, and wildfire.
Wildland Fire Use	The management of naturally ignited wildland fires to accomplish specific prestated resource management objectives in predefined geographic areas outlined in Fire Management Plans.
Wildfire	A wildland fire that is unwanted and unplanned.

EXECUTIVE SUMMARY

The Community Wildfire Protection Plan (CWPP) is a strategic plan that identifies specific wildland fire risks facing communities and neighborhoods and provides prioritized mitigation recommendations that are designed to reduce those risks. Once the CWPP is finalized and adopted, it is the responsibility of the community or neighborhood to move forward and implement the action items. This may require further planning at the project level, acquisition of funds, or simply motivating individual home owners.

This CWPP is not a legal document. There is no legal requirement to implement the recommendations herein. However, treatments on private land may require compliance with county land use codes, building codes, and local covenants, and treatments on public lands will be carried out by appropriate agencies and may be subject to federal, state, and county policies and procedures such as adherence to the Healthy Forest Restoration Act (HFRA) and National Environmental Protection Act (NEPA).

The HFRA of 2003 provides the impetus for local communities to engage in comprehensive forest and wildfire management planning as well as incentive for public land management agencies to consider these recommendations as they develop their own strategic management plans. The HFRA provides communities with a flexible set of assessment procedures and guidelines that facilitate a collaborative standardized approach to identify wildfire risks and prioritize mitigation actions. The CWPP addresses such factors as:

- Stakeholder collaboration;
- Public agency and local interested party engagement;
- Mapping;
- Risk Assessment – fuels, historical ignitions, infrastructure, structural ignitability, local resources, and firefighting capability;
- Hazard reduction recommendations; and
- Strategic action plan.

This CWPP provides wildfire hazard and risk assessments for selected neighborhoods and subdivisions within the Fairmount Fire Protection District (FFPD), located at the western-most edge of the greater Denver metropolitan area, north of and adjacent to the city of Golden, Colorado. The FFPD serves approximately 24 square miles of primarily suburban and rural prairie interface. The district is characterized by rapid suburban growth into former rural agriculture and open prairie areas as well as a significant presence of commercial industrial enterprises. The Wildland-Urban Interface (WUI) is defined as the area where development encroaches on undeveloped areas and represents the zone of greatest potential for loss due to wildfire. WUI delineations within the FFPD focus on neighborhood margins that are adjacent to open space or rural developments that represent a common emergency response area with similar assets, risks, and hazards. Industrial infrastructure is significant within the district and includes Coors Brewing

facilities, Coors Technical Center, open pit aggregate mining operations, as well as a variety of commercial manufacturing and warehousing facilities. Supporting transportation infrastructure includes highway and rail.

While decades of aggressive fire suppression practices coupled with years of persistent drought have resulted in dense and weakened timber stands in the higher elevations to the west of the district, the occurrence of hazardous timber fuels within the district is very limited. Fire exclusion management practices have however negatively affected other vegetation types that are present within the district. Shrublands have grown dense and expanded into historical grasslands, and at the same time harbor significant amounts of potential surface fuels. In addition, the diversity of native grasses has succumbed to more aggressive non-native species and noxious weeds that are often associated with higher fire intensities. In some areas these ecosystems have grown unchecked by fire for more than a century. The net result is that despite the general lack of timbered fuels within the district, significant hazardous fuels are present in the forested lands adjacent to the western boundary and the potential for prairie wildfire within the district with higher than normal fire intensity is high.

Field surveys, interviews with public lands managers, and close collaboration with the FFPD and other stakeholders were utilized for data collection, hazard assessments, and treatment recommendations. All information was gathered, analyzed, and prepared in the CWPP format by Walsh Environmental Scientists and Engineers, LLC (WALSH). A project website (http://www.co.jefferson.co.us/emerg/index.htm) is maintained by the Jefferson County Division of Emergency Management that provides access to the draft CWPP report for public review, project updates, meeting notices, and related project information.

Public education, awareness and involvement are important components of any CWPP. Public meetings provide a means to share information about the assessment process and facilitate communication between the Core Team, stakeholders, and any interested parties. Meetings provide a collaborative forum through which hazards can be identified, discussed and prioritized. General receptiveness to mitigation recommendations may also be gauged. The first public meeting for the FFPD was held on February 7 at FFPD Station 2. The purpose of the first meeting was to introduce the CWPP process and overall project goals and objectives. The meeting introduced the CWPP Core Team and provided an opportunity for the public to participate in the overall project development process. The first meeting feedback was limited to the attending Core Team and stakeholders but productive in that the forum provided a collaborative setting for various agency representatives to review project goals and objectives and recommend modifications and additional areas of concern. The second meeting was held on April 4, 2007 at FFPD Station 2. The purpose of the second meeting was to present the survey results and treatment recommendations and to solicit additional public and stakeholder input for the final report.

Questionnaires were distributed at both meetings in order to ascertain public opinion concerning the level of wildfire risk in the FFPD, evaluate values at risk, and assess

mitigation practices needed to reduce risk. Safety pamphlets and brochures explaining proper home construction and landscaping practices designed to reduce the risk of wildfire loss were also distributed. A draft report of the CWPP was posted on the County's emergency website to encourage public review and comment.

The National Fire Protection Association (NFPA) Form 1144, Standard for Protection of Life and Property from Wildfire 2002 Edition, was utilized to assess the level of risk and hazard to individual neighborhoods. Form 1144 provides a means to assess predominant characteristics within individual neighborhood communities as they relate to structural ignitability, fuels, topography, expected fire behavior, emergency response, and ultimately human safety and welfare. Scores are assigned to each element and totaled to determine the overall level of risk. Low, moderate, high, and extreme hazard categories are determined based on the total score. This methodology provides a standardized basis for wildfire hazard assessment and a baseline for future comparative surveys. Six subdivisions and neighborhoods identified by the FFPD as areas of concern and were surveyed according to NFPA Form 1144 protocols during February and March of 2007. A summary of the community hazard ratings are provided in Table ES-1.

Table ES-1. Community Hazard Ratings

Community	Hazard Rating
Indian Head	**High**
Pine Ridge	**Moderate**
Station 2	**Moderate**
53rd	**Moderate**
South Easley Way	**Moderate**
Table Rock	**Low**

In addition to the larger scale treatments recommended in this report, the most effective wildfire hazard reduction depends largely on the efforts of individual landowners making common sense modifications to their own homes and property. The creation of effective defensible space and the utilization of fire resistant construction materials will significantly reduce the risk of life and property loss in the event of a wildfire. When these common sense practices become the predominant model in a neighborhood the entire community benefits.

The predominant wildfire fuels in the FFPD are grass and shrubs. In neighborhood margins that interface with these habitats, effective hazard reduction can be as straight forward as establishing and maintaining a mowed perimeter between yards and prairie open space. Other priority action items should include:

- Replacing wood shake roofs;
- Utilizing fire resistant building materials for remodels or new construction;
- Implement neighborhood improvement oversight committees; and,
- Fire prevention education.

Familiarization and coordination with the Jefferson County Annual Operating Plan is also recommended. This provides important information concerning county and regional fire operations, policies and procedure definitions. Information may be available through the through the Jefferson County Office of Emergency Management web site.

The following Table ES-2 summarizes the proposed mitigation project schedule for the FFPD.

Table ES-2. Proposed Wildfire Mitigation Project Schedule

Year	Project	Actions
1	Annual spring outreach	▪ Contact and/or organize homeowners
	Annual spring mitigation (Defensible Space)	▪ Clean roofs and gutters ▪ Trim limbs/bushes within 3-5 feet of home ▪ Rake yard ▪ Help a neighbor ▪ Organize debris disposal
2	Annual spring outreach	▪ Contact and/or organize homeowners
	Annual spring mitigation (Defensible Space)	▪ Brush cleanup along property lines ▪ Repeat basic yard clean-up ▪ Organize debris disposal
3	Annual spring outreach	▪ Contact and/or organize homeowners ▪ Advise individual home owners on needed improvements to construction features
	Annual spring mitigation (Defensible Space)	▪ If necessary, coordinate defensible space efforts between homeowner groups who have created defensible space, and adjacent open space land managers.
4	Annual spring outreach	▪ Contact and/or organize homeowners ▪ Follow-up on construction feature recommendations
	Annual spring mitigation (Defensible Space)	▪ Complete any outstanding projects from previous years ▪ Begin maintenance phase ▪ Initiate construction feature improvements

The CWPP development process facilitates collaboration among community-based organizations, fire protection authorities, local governments, public land management agencies, and private landowners to identify and prioritize measures to reduce wildfire risk. Maintaining the momentum created by this process is critical to successful implementation and ongoing community wildfire hazard reduction. Ownership of this responsibility lies with each community, neighborhood, and homeowner association identified in the CWPP.

FAIRMOUNT FIRE PROTECTION DISTRICT COMMUNITY WILDFIRE PROTECTION PLAN

1 INTRODUCTION

1.1 CWPP Purpose

The Community Wildfire Protection Plan (CWPP) is a strategic plan that identifies specific wildland fire risks facing communities and neighborhoods and provides prioritized mitigation recommendations that are designed to reduce those risks. Once the CWPP is adopted, it is the community's responsibility to move forward and implement the action items. This may require further planning at the project level, acquisition of funds, or simply motivating individual home owners.

Decades of aggressive fire suppression practices in fire-adapted ecosystems have removed a critical natural cleansing mechanism from the vegetation regeneration cycle. Fire exclusion has altered historic forest and scrubland conditions and contributed to an unprecedented build-up of naturally occurring flammable fuels. Such management tactics have also led to an alteration of prairie habitats, supporting the invasion of aggressive and highly flammable noxious weeds and grasses that in many areas have entirely replaced naturally occurring species. In addition, years of persistent drought have resulted in a weakened forest infrastructure and regional epidemics of disease and insect infestation. At the same time, demographic trends have shifted the nation's population growth centers to western and southwestern states where these ecosystems are predominant. The region where human development is pushing into these stressed ecosystems is known as the Wildland-Urban Interface (WUI). This is the area where risk of loss due to wildfire is the greatest. The potential consequences are devastating and costly, and in recent years have drawn the attention of Congress in the pursuit of an effective solution.

Precipitated by over a decade of increasing wildfire activity, related losses, and spiraling suppression costs, the National Fire Plan was developed by the federal government in 2000. The Healthy Forests Restoration Act (HFRA) of 2003 helps implement the core components of the plan and provides the impetus for wildfire risk assessment and planning at the county and community level. HFRA refers to this level of planning as the CWPP. This empowers the participating community to take advantage of wildland fire and hazardous fuel management opportunities offered under HFRA legislation including a framework for hazard evaluation and strategic planning, prioritized access to federal grant funding supporting identified hazard reduction projects, and a basis for collaboration with local, state, and federal land management agencies.

1.2 Fairmount Fire Protection District's need for a CWPP

The Fairmount Protection District (FFPD) is located at the western margin of the greater Denver, Colorado metropolitan area (Map 1, Appendix A). Significant topographic features include North Table Mountain, and the Dakota Hogback on the district's western margin. The district is characterized by suburban expansion into rural agriculture and open prairie areas, as well as a significant presence of commercial industrial enterprises. Several neighborhood margins are directly adjacent to open prairie where potential fire behavior is characterized by rapid rates of spread. As is typical of Colorado Front Range WUI zones, neighborhoods often extend into foothill valleys, canyons, and mountain slopes with restricted access and limited emergency water supplies. In the FFPD, these neighborhoods are located on the district's western margins where topography, access, fuels, and available resources may impact suppression efforts in the event of a wind-driven wildfire ignition.

Figure 1. North Table Mountain

Historically, these prairie habitats experience a relatively higher frequency of naturally occurring wildfire than many forested ecosystems. Additionally, several significant potential sources of human-caused ignition are also present within the FFPD. State Highway 93 is a major north-south public transportation route that bisects the district and is a potential source of roadside ignitions. Railroad corridors also present significant ignition hazards throughout the Front Range. Several major rail lines are located in or adjacent to the FFPD and are known frequent ignition sources.

Weather plays a critical role in determining fire frequency and fire behavior. A dry climate and available fuels in an area prone to strong gusty winds can turn an ignition from a discarded cigarette or sparking railroad brake shoe into a major wildfire event in a matter of several minutes.

Figure 2. North Table Mountain Fire 7/2005

Despite the lack of a significant forested interface, the FFPD is characterized by several factors that typify a hazardous WUI; aggressive development into fire-adapted ecosystems, topography, frequency of natural and human-caused ignitions, available fuels, prolonged drought, and dry windy weather conditions. Each identified WUI neighborhood or subdivision represents a distinct response area with a unique combination of wildfire fuels, building construction, topography, access, and available resources (Map 2).

The CWPP provides a coordinated assessment of neighborhood wildfire risks and hazards and outlines specific mitigation treatment recommendations designed to make the FFPD a safer place to live, work, and play. The CWPP development process can be a significant educational tool for people who are interesting in improving the environment in and around their homes. It provides ideas, recommendations, and guidelines for creating a defensible space around the house and ways to reduce structural ignitability through home improvement and maintenance.

1.3 CWPP Process

The HRFA designed the CWPP to be a flexible process that can accommodate a wide variety of community needs. This CWPP is tailored to meet specific goals as identified by the Core Team, following the standardized steps for developing a CWPP as outlined in "Preparing a Community Wildfire Protection Plan, A Handbook for Wildland-Urban Interface Communities" (Society of American Foresters 2004) and the Colorado State Forest Service Minimum Standards for Community Wildfire Protection Plans (CSFS 2004), and as outlined in Table 1.

Table 1. CWPP Development Process

Step	Task	Explanation
One	Convene Decision Makers	Form a Core Team made up of representatives from local governments, fire authorities, and Colorado State Forest Service (CSFS).
Two	Involve Federal Agencies	Engage local representatives of the U.S. Forest Service (USFS) and other land management agencies as appropriate.
Three	Engage Interested Parties	Contact and encourage participation from a broad range of interested organizations and stakeholders.
Four	Establish a Community Base Map	Develop a base map of the district that provides a better understanding of communities, critical infrastructure, and forest/open space at risk.
Five	Develop a Community Risk Assessment	Develop a risk assessment that considers fuel hazards, community and commercial infrastructure, resources, and preparedness capability. Rate the level of risk and incorporate into the base map as appropriate.
Six	Establish Community Priorities and Recommendations	Use the risk assessment and base map to facilitate a collaborative public discussion that prioritizes fuel treatments and non-fuel mitigation practices to reduce fire risk and structural ignitability.
Seven	Develop an Action Plan and Assessment Strategy	Develop a detailed implementation strategy and a monitoring plan that will ensure long-term success.
Eight	Finalize the CWPP	Finalize the district CWPP and communicate the results to interested parties and stakeholders.

The initial step in developing the FFPD CWPP is to organize an operating group that serves as the core decision-making team (Table 2). At a minimum, the Core Team

consists of representatives from local government, local fire authorities, and the CSFS. In addition, the Core Team should include relevant affected land management agencies (Map 3) and active community and homeowner association (HOA) stakeholders. Collaboration between agencies and with communities is an important CWPP component because it promotes sharing of perspectives, plans, priorities, and other information that are useful to the planning process. Together these entities guide the development of the CWPP as described in the HFRA and must mutually agree on the plan's final contents.

Table 2. FFPD CWPP Core Team Members

Team Member	Organization	Phone Number
Sam Parsons C.F.	FFPD	303-279-2928
Rocco Snart	Jefferson County Emergency Mgmt	303-271-4900
Allen Gallamore	Colorado State Forest Service	303-279-9757x 302
Randy Frank	Jefferson County Open Space	303-271-5925

As a strategic plan, the real success of any CWPP hinges on effective and long-term implementation of the identified objectives. The CWPP planning and development process must include efforts to build a stakeholder group that serves as an implementation team and will oversee the execution of prioritized recommendations and maintain the plan as the characteristics of the WUI change over time. Specific projects may be undertaken by individual homeowner associations, while larger scale treatments may require collaboration between multiple homeowner associations, local government, and public land management agencies, to. Original CWPP Core Team representatives may, but are not required to assist in the implementation of the CWPP action plan. Continued public meetings are recommended as a means to generate additional support and maintain momentum.

The successful CWPP utilizes all available geographical information (GIS) to develop a community base map. Comprehensive risk assessment is conducted at the neighborhood or community level in order to determine relative levels of wildfire risk to better address hazard treatment prioritization. A standardized survey methodology is utilized in order to create an addressable rating benchmark for comparative future assessments and project evaluations.

CWPP fuel treatment recommendations derived from this analysis are prioritized through an open and collaborative effort with the Core Team and stakeholders. Prioritized treatments target wildfire hazard reduction in these WUI communities and neighborhoods, including structural ignitability and critical supporting infrastructure. An action plan guides treatment implementation for high priority projects over the span of several years.

The finalized CWPP represents a strategic plan with Core Team consensus that provides prioritized wildfire hazard reduction treatment projects, preferred treatment methods, a base map of the WUI, defensible space recommendations, and other information relevant to the scope of the project.

1.4 Policy Framework

This CWPP is not a legal document. There is no legal requirement to implement the recommendations herein. Actions on public lands will be subject to federal, state, and county policies and procedures such as adherence to the HFRA and National Environmental Protection Act (NEPA). Action on private land may require compliance with county land use codes, building codes, and local covenants.

There are several federal legislative acts that set policy and provide guidance to the development of the CWPP for the FFPD:

- Healthy Forests Restoration Act (HFRA) (2003) – Federal legislation to promote healthy forest and open space management, hazardous fuels reduction on federal land, community wildfire protection planning, and biomass energy production.
- National Fire Plan and 10-year Comprehensive Strategy (2001) – Interagency plan that focuses on firefighting coordination, firefighter safety, post-fire rehabilitation, hazardous fuels reduction, community assistance, and accountability.
- Federal Emergency Management Agency (FEMA) Disaster Mitigation Act (2000) – Provides criteria for state and local multiple-hazard and mitigation planning.

The CSFS is a valuable resource that provides education and guidance to communities and individual landowners concerned with the threat of wildfire, as well as forest resource management in the WUI (http://csfs.colostate.edu/).

The Jefferson County Annual Fire Operation Plan (AFOP) provides an intergovernmental mutual aid agreement between all fire districts in the county, including the CSFS and USFS. This pre-plan provides emergency response infrastructure for any large incident support.

1.5 FFPD CWPP Goals and Objectives

Table 3 provides a brief summary of the primary goals and objectives for the CWPP process.

Table 3. FFPD CWPP Goals and Objectives

Goals	Objectives
Facilitate and develop a CWPP for FFPD	▪ Provide oversight to all activities related to the CWPP. ▪ Ensure representation and coordination among agencies and interest groups. ▪ Develop a long-term framework for sustaining CWPP efforts.
Conduct a wildfire risk assessment	▪ Conduct a district-wide wildfire risk assessment. ▪ Identify areas at risk and contributing factors. ▪ Determine the level of risk to structures that wildfires and contributing factors pose.
Develop a mitigation plan	▪ Identify and prioritize hazardous fuel treatment projects. ▪ Identify and prioritize non-fuels mitigation needs.
Manage hazardous	▪ Identify communities at highest risk and prioritize hazard reduction treatments.

Goals	Objectives
fuels	▪ Develop sustainable initiatives at the homeowner HOA level. ▪ Secure funding and assist project implementation.
Facilitate emergency planning	▪ Develop strategies to strengthen emergency management, response, and evacuation capabilities for wildfire. ▪ Build relationships among county government, fire authorities, and communities.
Facilitate public outreach	▪ Develop strategies to increase citizen awareness and action for Firewise practices. ▪ Promote public outreach and cooperation for all fuels reduction projects to solicit community involvement and private landowner cooperation.

2 WILDLAND FIRE MANAGEMENT PRIMER

Wildland fire is defined as any fire burning in wildland fuels and includes prescribed fire, wildland fire use, and wildfire. Prescribed fires are planned fires ignited by land managers to accomplish specific natural resource improvement objectives. Fires that occur from natural causes, such as lightning, that are then used to achieve management purposes under carefully controlled conditions with minimal suppression costs are known as wildland fire use (WFU). Wildfires are unwanted and unplanned fires that result from natural ignition, unauthorized human-caused fire, escaped WFU, or escaped prescribed fire. FFPD actively suppresses all wildfires as WFU is not authorized in the area.

Wildland fires may be further classified as ground, surface, or crown fire. Ground fire refers to burning/smoldering materials beneath the surface including duff, tree or shrub roots, punchy wood, peat, and sawdust that normally support a glowing combustion without flame. Surface fire refers to loose fuels burning on the surface of the ground such as leaves, needles, small branches, as well as grasses, forbs, low and medium shrubs, tree seedlings, fallen branches, downed timber and slash. Crown fire is a wildland fire that moves rapidly through the crowns of trees or shrubs independently of a surface fire.

2.1 Wildland Fire Behavior

Fire behavior is a description of the manner in which a fire reacts to the influences of fuel, weather and topography. Fire behavior is observed and assessed at the flaming front of the fire and described most simply in terms of fire intensity (in feet of flame length) and in rate of forward spread (Table 4). The implications of observed or expected fire behavior are important components of suppression strategies and tactics, particularly in terms of the difficulty of control and effectiveness of various suppression resources. Fire risk is the probability that wildfire will start from natural or human-caused ignitions. Fire hazard is the presence of ignitable fuel coupled with the influences of topography and weather, and is directly related to fire behavior. Fire severity, on the other hand, refers to the immediate effect a fire has on vegetation and soils.

Table 4. Fire Behavior Ratings

Adjective Rating	Flame Length (ft)	Implication
Low	0 - 1	Fire will burn and will spread; however, it presents very little resistance to control and direct attack with firefighters is possible
Moderate	1 - 3	Fire spreads rapidly presenting moderate resistance to control but can be countered with direct attack by firefighters
Active	3 - 7	Fire spreads very rapidly presenting substantial resistance to control. Direct attack with firefighters must be supplemented with equipment and/or air support.
Very Active	7 - 15	Fire spreads very rapidly presenting extreme resistance to control. Indirect attack may be effective. Safety of firefighters in the area becomes a concern.

Adjective Rating	Flame Length (ft)	Implication
Extreme	> 15	Fire spreads very rapidly presenting extreme resistance to control. Any form of attack will probably not be effective. Safety of firefighters in the area is of critical concern.

Stubbs T., 2005, Adjective Ratings for Fire Behavior

The nature of fuels, topography, and weather conditions combine to dictate fire behavior, rate of spread, and intensity. Wildland fuel attributes refer to both dead and live vegetation and include such factors as density, bed depth, continuity, density, vertical arrangement, and moisture content. Structures with flammable materials are also considered a fuel source.

When fire burns in the forest understory or through grass, it is generally a surface fire. When fire burns through the canopy of vegetation, or overstory, it is considered a crown fire. The vegetation that spans the gap between the forest floor and tree crowns can allow a surface fire to become a crown fire and is referred to as ladder fuel.

For fire to spread, materials such as trees, shrubs, or structures in the flame front must meet the conditions of ignitability. The conditions needed are the presence of oxygen, flammable fuel, and heat. Oxygen and heat are implicitly available in a wildland fire. But, if the potential fuel does not meet the conditions of combustion, it will not ignite. This explains why some trees, patches of vegetation, or structures may survive a wildland fire and others in the near vicinity are completely burned.

Potential surface fire behavior may be estimated by classifying vegetation in terms of fire behavior fuel models (FBFMs) and using established mathematical models to predict potential fire behavior under specific climatic conditions. In this analysis, FBFMs were determined through a combination of field evaluations and interpreting satellite images. Climatic conditions were derived from local weather station records.

Weather conditions such as high ambient temperatures, low relative humidity, and windy conditions favor fire ignition and high intensity fire behavior. Under no-wind conditions fire burns more rapidly and intensely upslope than on level terrain, but wind tends to be the driving force in fire behavior in the most destructive WUI fires. The “chinook” winds common along the Front Range may rapidly drive wildfire down slope.

2.2 History of Wildfire

Lightning-induced fire is a natural component of Jefferson County ecosystems, and its occurrence is important to maintaining the health of forest and open space ecosystems. Native Americans used fire as a tool for hunting, improving wildlife habitat and land clearing. As such, many of the plant species and communities are adapted to recurring fire through phenological, physiological, or anatomical attributes. Some plants, such as lodgepole pine and western wheatgrass, require reoccurring fire to exist.

European settlers, land use policy, and changing ecosystems have altered fire behavior and fuels accumulation from their historic setting. Euro-American settlers in Jefferson

County changed the natural fire regime in several interrelated ways. The nature of vegetation (fuel) changed because of land use practices such as homesteading, livestock grazing, agriculture, water development, and road construction. Livestock grazing reduced the amount of fine fuels such as grasses and forbs, which carried low-intensity fire across the landscape. Continuous stretches of forest and open space fuels were broken up by land-clearing activities. The removal of the natural vegetation facilitated the invasion of non-indigenous grasses and forbs, some of which create more flammable fuel beds than their native predecessors.

In addition, more than a century of fire-suppression policy has resulted in large accumulations of surface and canopy fuels in western forests and brushlands. Fuel loads also increased as forests and brushlands encroach into grasslands as a result of fire exclusion. This increase in fuel loading and continuity has created hazardous situations for public safety and fire management, especially when found in proximity to communities. These hazardous conditions will require an array of mitigative tools, including prescribed fire and thinning treatments.

2.3 Prescribed Fire

Prescribed fire may be used as a resource management tool under carefully controlled conditions. This includes pre-treatment of the fuel load and close monitoring of weather and other factors. Prescribed fire ultimately improves wildlife habitat, helps abate invasive vegetation, reduces excess fuel loads, and lowers the risk of future wildfires in the treatment area. These and other fuels management techniques are employed to protect human life, economic values, and ecological values. The use of prescribed fire in the WUI is carefully planned, enacted only under favorable weather conditions, and must meet air quality requirements of the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (CAPCD).

Prescribed fire may be conducted either in a defined area, as a broadcast burn, or in localized burn piles. Broadcast burns are used to mimic naturally occurring wildfire but only under specific weather conditions, fuel loads, and expert supervision. Burn piles are utilized to dispose of excess woody material after thinning if other means of disposal are not available or cost-prohibitive. Acceptable burn days are determined in consultation with Jefferson County.

2.4 Wildand-Urban Interface (WUI)

The WUI is the zone where communities and wildland interface and is the central focus of this CWPP. Every fire season catastrophic losses from wildfire plague the WUI. Homes are lost, businesses are destroyed, community infrastructure is damaged, most tragically, lives are lost. Precautionary action taken before a wildfire strikes often makes the difference between saving and losing a home. Creating a defensible space around a home is an important component in wildfire hazard reduction. Effective defensible space can be as basic as pruning trees, applying low flammability landscaping, and cleaning up surface fuels and other fire hazards near the home. These efforts are typically concentrated within 0 to 75 feet of the home to increase the chance for structure survival or create an area for firefighters to work in the event of a wildfire.

While reducing hazardous fuels around a structure is very important to prevent fire loss, recent studies indicate that, to a great extent, the attributes of the structure itself determines ignitability. Experiments suggest that even the intense radiant heat of a crown fire is unlikely to ignite a structure that is more than 30 feet away as long as there is no direct flame impingement. Studies of home survivability indicate that homes with noncombustible roofs and a minimum of 30 feet of defensible space had an 85 percent survival rate. Conversely, homes with wood shake roofs and less than 30 feet of defensible space had a 15 percent survival rate.

2.5 Hazardous Fuels Mitigation

Wildfire behavior and severity are dictated by fuel type, weather conditions, and topography. Because fuel is the only variable of these three that can be practically managed, it is the focus of many mitigation efforts. The objectives of fuels management may include reducing surface fire intensity, reducing the likelihood of crown fire initiation, reducing the likelihood of crown fire propagation, and improving forest health. These objectives may be accomplished by reducing surface fuels, limbing branches to raise canopy base height, thinning trees to decrease crown density, and/or retaining larger fire resistant trees.

By breaking up vertical and horizontal fuel continuity in a strategic manner, fire suppression resources are afforded better opportunities to control fire rate of spread and contain wildfires before they become catastrophic. In addition to the creation of defensible space, fuelbreaks may be utilized to this end. These are strategically located areas where fuels have been reduced in a prescribed manner, often along roads. Fuelbreaks may be strategically placed with other fuelbreaks or with larger area treatments. When defensible space, fuelbreaks, and area treatments are coordinated, a community and the adjacent natural resources are afforded an enhanced level of protection from wildfire.

Improperly implemented fuel treatments can have negative impacts in terms of forest health and fire behavior. Aggressively thinning forest stands in wind prone areas may result in subsequent wind damage to the remaining trees. Thinning can also increase the amount of surface fuels and sun and wind exposure on the forest floor. This may increase surface fire intensity if post-treatment debris disposal and monitoring are not properly conducted. The overall benefits of properly constructed fuelbreaks are however, well documented.

3 FAIRMOUNT FIRE PROTECTION DISTRICT PROFILE

3.1 County and District Setting

Jefferson County was established in 1861 as one of the original 17 counties created by the Colorado Territorial Legislature with a land base of 774 square miles. The county population is currently estimated at 529,401 people with approximately 184,640 people living in the incorporated areas.

The FFPD is located at the western-most edge of the greater Denver metropolitan area, north of and adjacent to the City of Golden, Colorado. Significant topographic features include North Table Mountain, and the Dakota Hogback on the district's western margin. The district is characterized by rapid suburban growth into former rural agriculture and open prairie areas as well as a significant presence of commercial industrial enterprises. As such, much of the district's infrastructure is not at significant risk for loss due to wildfire. WUI delineations focus on neighborhoods and neighborhood margins that are adjacent to open space or rural developments that represent a common emergency response zone with similar assets, risks and hazards. Of the six identified WUI response areas within the district, two were found with limited ingress/egress with single primary access. One of these was as single lane unpaved road with areas of moderate grade. Both of these subdivisions were gated requiring coded entry or "Knox-Box" emergency keyed access.

The FFPD serves approximately 24 square miles of primarily suburban and rural interface. The district is bounded by the City of Arvada to the northeast, Wheat Ridge to the east, and the City of Golden to the south. Open foothills extend past the western district boundary. Elevation ranges from 5,500 to 7,000 feet. North Table Mountain, managed by Jefferson County Open Space, dominates the central portion of the district, covering over 2,100 acres at its base and over 1,000 acres of summit plateau. Short to mid-grass prairie with native shrubs on higher slopes are the predominant vegetation. Deciduous species are found in riparian drainages and ponderosa stands are found only along the district's higher western boundary.

North Table Mountain Water district serves the suburban extent of the FFPD west to Highway 93. As a municipal water supply, residential and commercial fire hydrants are a required component of community and commercial infrastructure.

Major industrial infrastructure includes Coors Brewing facilities, Coors Technical Center, open pit aggregate mining operations, as well as a variety of commercial manufacturing and warehousing facilities. Supporting transportation infrastructure includes highway and rail.

3.2 Climate

The FFPD climate is relatively dry with the majority of precipitation occurring with spring rains and summer monsoons (Table 5). The area receives more than 240 days of sunshine per year and receives an average of 17 inches of annual precipitation. Winter

high temperatures are typically in the mid 40s and summer highs in the mid 80s. The low precipitation months are typically December, January, and February. Fire weather conditions are discussed in Section 4.2.

Table 5. Average Monthly Climate Summary for FFPD (National Oceanic and Atmospheric Administration data for Golden, CO)

Climate Attribute	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (F^o)	44	47	53	59	68	80	86	84	76	65	51	45	63.2
Average Total Precipitation (inches)	0.48	0.46	1.37	2.08	2.59	2.17	1.87	1.83	1.95	1.02	1.14	0.6	17.06

3.3 Topography

Topography and elevation play an important role in dictating existing vegetation, fuels, and wildland fire behavior. Topography also dictates community infrastructure design, further influencing overall hazard and risk factors. The majority of the communities served by the FFPD are situated on what was once open rolling prairie and historic Clear Creek bottom lands. North Table Mountain dominates the central portion of the district, covering over 2,100 acres at its base and over 1,000 acres of summit plateau. At the western district margin the Dakota Hogback rises out of the plains, forming a north-south trending valley on its west slope. Lower Front Range foothills dominate the topography to the west.

3.4 Wildland Vegetation and Fuels of the Assessment Area

Fuels in the district are dominated by open expanses of short to mid-grass prairie that give way on the western margin to slopes of shrub and open ponderosa stands with grass and/or shrub understory. Higher elevation north-facing slopes west of the district, but within the assessment area, are characterized by denser stands of ponderosa and mixed conifer. Dead and down timber and timber litter tend to mix with grass and shrub understory in these heavier timber stands. Deciduous riparian zones along creek beds are present throughout the area. In the central portion of the district these riparian areas wind through subdivisions and tend to be bounded by community open space. Cottonwood and scrub willow favor these areas. To the west, riparian zones are restricted to canyons and larger drainages. Chokecherry, alder and willow scrub are a common overstory in these areas and as understory in mature stands of cottonwood and willow.

Map 4 illustrates existing ground cover vegetation that was derived from the National Agricultural Imagery Program (NAIP) archive and analyzed and classified using remote sensing techniques that recognizes specific reflected spectral signatures of vegetation and other ground cover types. Vegetation classification is also field surveyed and photo-documented to verify remote sensing results and to further classify the characteristics of

the understory surface fuels, a critical component in characterizing the FBFMs that are used in determining potential fire behavior.

Understanding the fire behavior characteristics of particular fuel types facilitates effective fuels treatment strategies on a local, as well as landscape level. Predictive fire modeling is an important component in a variety of strategic and tactical applications including risk and hazard assessments, pre-attack planning, initial attack, extended suppression, prescribed fire planning, and predictive modeling of active wildfires.

BehavePlus Fire Behavior Prediction and Fuel Modeling software was utilized for this assessment. By inputting several user-defined parameters including FBFM, fuel moisture, weather, slope, expected rates of spread associated flame lengths and fire intensity can be determined. These are important factors in any tactical or strategic fire management decision. Fire behavior analysis is detailed in Section 4.2.

There are several systems for classifying fuel models. This CWPP utilizes the most commonly used fuel modeling methodology as developed by Hal E. Anderson (1982). Thirteen FBFMs presented in four fuel groups; grasslands, shrublands, timber, and slash. Each group comprises three or more fuel models. Of these 13 fuel models, four are most prevalent in the FFPD (Table 6).

Table 6. Fuel Models Common to the District

Group	FBFM Number	Description
Grass	1	Short grass (1 foot)
	2	Timber, grass and understory
Brush	3	Tall grass (2.5 feet)
	4	Chaparral (6 feet)
	5	Brush 2 feet)
	6	Dormant brush, hardwood slash
Timber Litter and Understory	7	Southern rough
	8	Closed timber litter (short-needle)
	9	Hardwood timber, long-needle litter
	10	Timber, litter and understory (heavy understory)
Logging Slash	11	Light Slash; closed timber with down woody fuel
	12	Medium slash; 35 ton/acre
	13	Heavy slash; 200 tons/acre

(See Anderson, 1982, for a more detailed description of each fuel model)

Grasslands, FBFM 1 and 2

Grass fuels in the FFPD are most closely associated with short to mid-grass prairie ecosystems. This is a drier environment than grassland fuel models at higher elevations to the west. Yucca (*Yucca glauca)* is commonly dispersed through native grasses such as western wheatgrass (*Pascopyrum smithii)*, buffalograss (*Buchloe dactyloides)*, blue grama (*Bouteloua gracillis)*, and little bluestem (*Schizachyrium scoparium)*. These

bunching grasses are common in the open prairie but may also be found as the understory in open conifer or shrub stands. Historical fire return interval for these drier grassland fuel types is in the 0-35 year range. This relatively frequent disturbance by wildfire removes dried biomass before it becomes excessive surface fuels and returns needed nutrients to the soil without severe damage to root systems, seeds, and soil biomass.

Smooth brome (*Bromus inermis)* is a non-native perennial grass that is commonly used in pasture seeding for grazing. It poses an invasive threat to native prairie grasses, is very drought resistant, and tends to increase surface fire intensity where aggressive growth has occurred.

In the absence of these periodic fires, the excessive accumulation of thatch and woody material may lead to higher intensity, higher severity wildfires. Fire exclusion also encourages shrub and noxious grass and weed encroachment. Cheatgrass (*Bromus tectorum),* also know as downy brome is an aggressive invasive grass species that is now common throughout the state and the region. It exhibits higher fire intensity than other native grasses and despite its early growth and rich color, cheatgrass is unpalatable to livestock, which tend to overgraze native plants when it begins to prevail.

Though brush and timber fires are known for more intense fire behavior than grass fuels, the potential impact of grass fires should not be underestimated. These light, flashy fuels can be very resistant to suppression, producing incredibly rapid rates of spread and flame lengths in excess of 10 feet. They can pose a very real risk to firefighter safety and a serious threat to untreated homes.

Open prairie, grassy slopes, and irrigated meadows are characterized as FBFM 1. Open conifer stands with a grassy understory that would carry a surface fire are defined as FBFM 2.

Shrublands, FBFM 4 and 6

Mountain mahogany *(Cercocarpus montanus Raf.)* is the dominant shrub species in the district. It is common on low slopes in isolated stands although it may dominate entire slopes at slightly higher elevations. Deciduous riparian zones along creek beds and slope drainages are present throughout the area and also support shrub growth. Cottonwood (*Populus angustifolia)* and scrub willow *(Salix spp.)* favor creek beds in lower elevations in the central and eastern portions of the district. To the west, riparian zones are restricted to canyons and slope drainage where chokecherry (*Padus virginiana ssp. Melanocarpa),* alder (*Alnus tenuifolia)* and willow scrub are common.

Shrub stands in the FFPD are generally classified as FBFM 6.

It should be noted that shrub vegetation is typically a higher moisture woody plant associated with low to moderate fire behavior. However, prolonged drought, such as been seen in recent years, lowers the live fuel moisture content in plant stems, producing extreme fire behavior under favorable weather conditions.

Timber, FBFM 9

Forest composition along the Front Range is strongly influenced by slope, aspect, and elevation. The majority of the FFPD is located east of the 1st Front Range hog back and is relatively conifer-free. The lower foothill slopes on the western margin of the district support some stands of ponderosa (*Pinus ponderosa)* on saddles and north and west facing slopes. Further west at slightly higher elevation ponderosa stands dominate north facing slopes and typically are dense with some mixed Douglas-fir (*Pseudotsuga menziesii).* Here dead and down woody surface fuels intermingle with the grass and shrub understory. In these higher elevation stands west of the district boundary, where surface fuels are influenced by long needle timber litter, FBFM 9 may dominate expected fire behavior. In the lower elevation stands, grassy understory would likely carry the fire as a FBFM 2.

3.5 Fire Behavior Fuel Model Classifications of the FFPD

The following pages detail the predominant FBFMs observed in the FFPD, their unique characteristics and expected fire behavior (Anderson 1982). These pages can be used as a pull-out section for field reference.

Fire Behavior Fuel Mode1 1 – Short Grass

Figure 3. FBFM 1

Characteristics: Grassland and savanna vegetation are dominant (Figure 3). Very little shrub or timber overstory is present, generally less than 30 percent of the area. Western perennial and annual grasses such as western wheatgrass, buffalograss, blue grama, and little bluestem that characterize short to mid-grass prairie are common. Cheatgrass, medusahead, ryegrasses, and fescues are common at slightly higher elevations. Grass-shrub combinations that meet the above criteria are also represented.

Fire behavior: Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires burn as surface fires that move rapidly through the cured grass and associated material.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, <3-inch dead and live	0.74	tons/acre
Dead Fuel Load, 0 - ¼ inch	0.74	tons/acre
Live Fuel Load, foliage	0.0	tons/acre
Fuel Bed Depth	1.0	feet

Fire Behavior Fuel Model 2 – Grass with Timber/Shrub Overstory

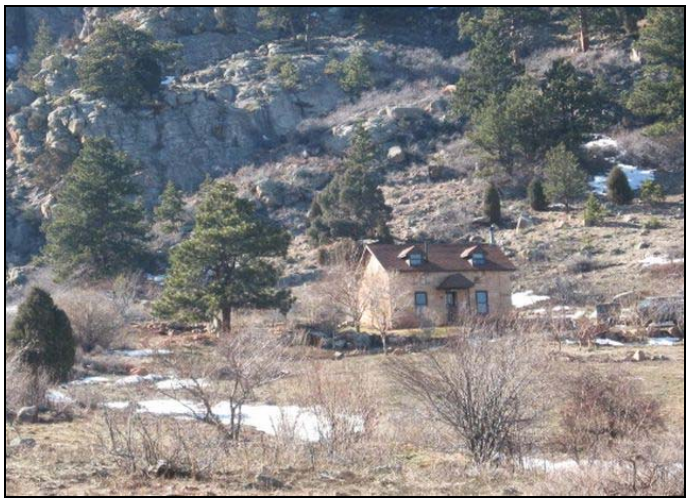


Figure 4. FBFM 2

Characteristics: FBFM 2 defines surface fuels found in open conifer, shrub or riparian stands (Figure 4). Ground cover generally consists of grasses, needles, and small woody litter. Conifers are typically mature and widely spaced. Limited shrub or regeneration may be present. This model favors mature conifer in the foothill to montane zones. Open shrub land, pine stands, or Rocky Mountain Juniper that cover ⅓ to ⅔ of the area may generally fit this model. Such stands may include clumps of fuels that generate higher fire intensities that may produce fire brands (embers that stay ignited and aloft for great distances).

Fire Behavior: Fire is spread primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stem wood from the open shrub or timber overstory, contribute to the fire intensity.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, <3-inch dead & live	4.0	tons/acre
Dead Fuel Load, 0 - ¼ inch	2.0	tons/acre
Live Fuel Load, foliage	0.5	tons/acre
Fuel Bed Depth	1.0	feet

Fire Behavior Fuel Model 6 – Intermediate or Dormant Brush

Figure 5. FBFM 6

Characteristics: Shrubs in FBFM 6 are not as tall as in FBFM 4, nor do they contain as much fuel as FBFM 4. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, mountain mahogany, and juniper shrublands (Figure 5).

Fire Behavior: Fires carry through the shrub layer where the foliage is more flammable than FBFM 5 but this requires moderate winds (> 8mph @ midflame height). Fire will drop to the ground at low wind speeds or breaks in continuous stands.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, <3-inch dead & live	6.0	tons/acre
Dead Fuel Load, 0 - ¼ inch	1.5	tons/acre
Live Fuel Load, foliage	0.0	tons/acre
Fuel Bed Depth	2.5	feet

The shrub group has a wide range of fire intensities and rates of spread (Table 7). With 5 miles per hour (mph) winds, dead fuel moisture content of 8 percent, and live fuel moisture content of 100 percent, shrub fuel models have the following values.

Table 7. Brush Fuel Rates of Spread

Fuel Model	Rate of Spread in Chains per hour	Rate of Spread in Feet per Minute	Flame Length in Feet
4	75	82.5	19
5	18	19.8	4
6	32	35.2	6

Fire Behavior Fuel Model 9 – Long Needle or Hardwood Timber Litter – Moderate Ground Fuel Load

Figure 6. FBFM 9

Characteristics: Both long-needle conifer and hardwood stands, especially the oak-hickory types are characterized by FBFM 9 (Figure 6). Closed stands of long needled pine like ponderosa pine are grouped in this model.

Fire Behavior: Fires run through the surface litter faster than in FBFM 8 and have longer flame lengths. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling or blowing embers and fire brands. Concentrations of dead-down woody material will contribute to possible torching, crowning, and spotting.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, <3-inch dead & live	3.5	tons/acre
Dead Fuel Load, 0 - ¼ inch	2.9	tons/acre
Live Fuel Load, foliage	0.0	tons/acre
Fuel Bed Depth	0.2	feet

Table 8 summarizes fire rates of spread for timber fuels group.

Table 8. Timber Fuel Rates of Spread

Fuel Model	Rate of Spread in Chains per hour	Rate of Spread in Feet per Minute	Flame Length in Feet
8	1.6	1.75	1.0
9	7.5	8.25	2.6
10	7.9	8.7	4.8

FBFMs present in the district are summarized in Table 9.

Table 9. Fire Behavior Fuel Models of FFPD

Fire Behavior Fuel Model	Description
1 - Short Grass	**Grass Group** – Fire spread is determined by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. These 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 cover of the area. Annual and perennial grasses occur in this model. Fire rate of spread can exceed 300 chains per hr with flame lengths greater than 8 ft.
2 - Grass Understory of Open Timber or Shrub	**Grass Group** – Fire spread occurs through cured dead herbaceous fuels. These are surface fires where downed woody-debris from the shrub and tree component adds to fire intensity. Open shrub lands, pine stands, or oakbrush stands that cover from one-third to two-thirds of the area generally fit this model.
6 - Dormant Brush	**Shrub Group** – Fire spreads though the shrub layer with flammable foliage but requires moderate winds to maintain the foliage fire. Fire will drop to the ground in low wind situations. Shrubs are mature with height less than 6 ft. These stands include oakbrush and mountain mahogany less than 6 ft tall. Fire rate of spread can be rapid with flame lengths of 6 to 10 ft.
9 - Long-Needle Timber Litter	**Timber Group** – Fires run through the surface litter faster than in FBFM 8 and have longer flame lengths. These are semi-closed to closed canopy stands of long-needle conifers, such as ponderosa pine. The compact litter layer is mainly needles and occasional twigs. Concentrations of dead-down woody material will contribute to tree torching, spotting, and crowning. Fire rate of spread is up to 27 chains per hr with flame lengths of 5 ft.

Anderson (1982)

3.6 Water Resources

The entire FFPD response area east of Highway 93 is served by residential and commercial hydrants supplied from the North Table Mountain Water District. Hydrant spacing is based on existing building codes of 1,000 feet for residential and 300 feet for commercial. West of Highway 93 all extended emergency water resources must be supplied by tender.

Figure 7. A gravity-fed hydrant from a 10,000 gallon buried cistern at the end of Lone Pine Road

A seasonal dry hydrant was noted on upper Indian Head Road. A gravity fed hydrant from a 10,000-gallon buried cistern was noted at the end of Lone Pine Road (Figure 7).

Several large reservoirs are located in the northwestern portion of the district. Tender access is available to the Blunn Reservoir but limited to Ralston Reservoir. Both are free of overhead hazards for helicopter dip operations. It is recommended that standing agreements be obtained from the governing water board to secure emergency access to these municipal water supplies.

3.7 Fire Protection District

Emergency fire, medical, and rescue services for the district are provided by the FFPD which is mixed organization of career and volunteer firefighters. Of the 77 firefighters on Fairmount's active roster, 12 are career and 65 are volunteers. FFPD maintains two fully equipped stations.

- Station 1 4755 Isabell St., Golden, CO 80403
  - 2 Type 1 Engines
  - 1 Type 3 Engine
  - 1 Type 6 Engine
  - 1 Ladder
- Station 2 18208 West 58th Dr. Golden, CO 80403
  - 1 Type 1 Engines
  - 1 Type 2 Tender
  - 1 Type 3 Engine
  - 1 Type 6 Engine

Mutual aid agreements for FFPD are governed by the Denver-wide mutual aid agreement as well the Jefferson County AFOP which provides an intergovernmental Mutual Aid agreement between all fire districts in the county, including the CSFS and USFS. Jefferson County maintains a certified Type 3 Incident Management Team (IMT) for additional overhead support in the event of a large-scale incident.

3.8 Values at Risk

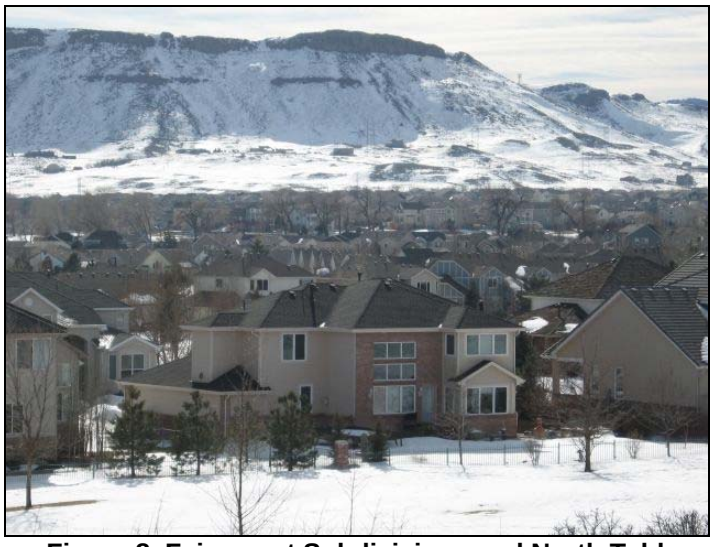


Figure 8. Fairmount Subdivisions and North Table Mountain

In any hazard and risk assessment, human life and welfare are the most important resource to protect. Homes, businesses, aesthetics, cultural, and ecological resources are all important factors and certainly influence any recommendation, but the safety and welfare of residents and emergency responders remains the top priority. The WUI has inherent risks: residential and commercial development in areas historically prone to fire, hazardous fuels, limited access, just to name a few. The FFPD is characterized by dense suburban development pushing at the fringes of prairie and forested wildlands (Figure 8). Neighborhood margins are the WUI buffer.

Resources at risk include:

- Homes
- Businesses
- Local economy
- Municipal water supply
- Community infrastructure
- Wildlife and aquatic habitat
- Wildlife and aquatic habitat
- Watersheds
- Water quality
- Air quality
- Natural vegetation communities
- Viewshed

Catastrophic wildfire has a severe and long-term impact on all natural resource and ecological values that we have come to take for granted. The actions recommended in this CWPP are geared towards lowering the wildfire risk to neighborhoods, as well as economic and ecological resources.

4 WILDFIRE RISK ASSESSMENT

4.1 Approach to the Wildfire Risk Assessment

A comprehensive wildfire risk assessment takes into account a variety of factors that ultimately result in an accurate hazard ranking of the neighborhoods and subdivisions that have been collaboratively identified and determined to be the primary areas of concern within the assessment area. Hazard rankings provide quantifiable guidance in the determination of mitigation treatment project prioritization.

To better understand the nature and scope of the wildfire threat that faces the FFPD, a full spectrum of factors that influence fire behavior are evaluated including vegetation and fuels, topography, weather, potential fire behavior, and historical fire frequency. Community infrastructure is evaluated in terms of emergency response, defensibility, and structural flammability. Analyzing the relationship between expected fire behavior in the wildlands and the placement and design of neighborhoods and subdivisions proximate to those areas is at the core of an effective community wildfire risk assessment. From this process targeted mitigation recommendations are developed that directly address the identified hazards and, if implemented, will greatly reduce the risk of loss from a wildfire for each homeowner as well as the community as a whole.

The primary assessment area for this CWPP is defined by the boundaries of the FFPD. Several neighborhoods within the district were identified as areas of critical concern and surveyed in detail using a standardized methodology. Vegetation was mapped 1 mile into surrounding regions utilizing overhead imagery, ground verified, and converted to FBFMs (Map 4).

In the wildland fire vernacular, fire hazard refers to vegetation or wildland fuel in terms of its contribution to problem fire behavior and its resistance to control. Risk is the probability of ignition of wildland fuels. Values-at-risk include infrastructure, structures, improvements and natural resources that are likely to suffer long-term damage from the direct impacts of a wildfire.

As part of the assessment, a concerted effort was made to solicit and include input from the public and local experts in fire and natural resource issues. Public meetings were convened on February 7 and April 4, 2007 at 7:00 p.m. at FFPD Station No. 2. The purpose of the first meeting was to introduce the CWPP concept and overall project goals and objectives. The meeting introduced the CWPP Core Team and provided an opportunity for the public to participate in the process, review the findings and comment on proposed mitigation possibilities. First meeting feedback was limited to the attending Core Team but productive in that it provided a collaborative setting for public agencies to review project goals and objectives and identify potential mutual areas of concern. The purpose of the second meeting was to present the findings and recommendations of the CWPP Core Team and to further solicit public input for the final report.

Questionnaires (Appendices B and C) were distributed at the meetings to obtain public opinion information concerning the perceived level of wildfire risk in the FFPD, understand public values at risk, and assess tolerance for mitigation practices that may be recommended to reduce risk. WUI safety pamphlets and brochures that explained home construction and landscaping practices designed to reduce the risk of wildfire loss were also distributed. A draft report of the CWPP was posted on the County's Emergency Services website to encourage public participation and input.

4.2 Fire Behavior Analysis

Fire behavior is defined as the manner in which a fire reacts to the influences of fuel, weather, and topography. Two key measures of this behavior are the rate of spread and the intensity. Rate of spread is often expressed in chains per hour. A chain is 66 feet, and one chain per hour will be very close to a spread rate of 1.1 feet per minute. Fire line intensity is reflected by flame length at the flaming front; it does not account for continued burning of fuels once the main fire front has passed.

BehavePlus (Andrews et al. 2005) is software that was used to assess potential fire behavior given the identified FBFMs, local topography and local weather conditions. The predicted fire behavior represents surface fire behavior only. Fire moving through the forest canopy (crowning) and other types of extreme fire behavior are not represented in this analysis.

Topography

The majority of the communities served by the FFPD are situated on what was once open rolling prairie and Clear Creek bottom lands. North Table Mountain dominates the central portion of the district, covering over 2,100 acres at its base and over 1,000 acres of summit plateau. At the western district margin, the Dakota Hogback rises out of the plains, forming a north-south trending valley on its western slope. Lower Front Range foothills dominate the topography further to the west. Elevation ranges from 5,500 to 7,000 feet. For fire behavior modeling, a 30 percent slope was used for grass and brush while forest fuels were modeled at 45 percent, representative of the steep north facing slopes that it favors. Grass was also modeled at 10 percent to represent conditions on rolling prairie and the North Table Mountain mesa summit.

Fire Weather

Average and severe case weather and fuel moisture conditions were determined using records from local remote access weather stations (RAWS) during the summer wildfire season. The Corral Creek, Bailey, and Sugarloaf stations were selected based on proximity, elevation, and available data (Table 10). There are closer weather stations that were not used because of their lack of historical data (see Section 4.6). Experimentation with modeling fire behavior using individual station data and a variety of time periods from the last twenty years had minimal effect on predicted fire behavior outputs.

Table 10. Remote Access Weather Stations Utilized

Station Name	Elevation	Location Relative to Golden	Years of Data
Corral Creek	7,844 feet	15 mi. west-southwest	1970-1985, 2001-2006
Bailey	7,982 feet	25 mi. southwest	1970-1992, 2000-2006
Sugarloaf	6,733 feet	20 mi. northwest	1977-1992, 1994-2006

Percentile refers to historic occurrences of specified conditions. 90th percentile conditions means that within the weather data examined from the RAWS stations, only 10 percent of the days had more extreme conditions. Fiftieth percentile is about average with half the records exceeding and half the records below recorded conditions. Weather was calculated for the typical summer fire season of June through August based on data from 1970 through 2006 (Table 11). Mid-flame wind speeds of 8 mph and 4 mph were used for the modeling of 90th and 50th percentile conditions respectively.

Table 11. Average and Severe Case Fire Weather and Fuel Moisture Conditions for June – August, 1970 - 2006

	Max Temp	Relative Humidity	1 hr Fuel Moisture	10 hr Fuel Moisture	100 hr Fuel Moisture	Herbaceous Fuel Moisture	Woody Fuel Moisture
50th Percentile	79ºF	35%	7%	9%	12%	95%	123%
90th Percentile	87ºF	16%	3%	4%	7%	31%	80%

Additional important fire and weather related resources include:

- Fort Collins Interagency Wildfire Dispatch Center Web index for Fire Intelligence, Fire Weather, Fire Danger/Severity, Remote Access Weather Stations – http://www.fs.fed.us/r2/arnf/fire/fire.html
- RAWS Station index for the Rocky Mountain Geographic Coordinating Area – http://raws.wrh.noaa.gov/cgi-bin/roman/raws_ca_monitor.cgi?state=RMCC&rawsflag=2
- National Fire Weather Page – http://fire.boi.noaa.gov/

Potential Fire Behavior

Fire behavior is defined as the manner in which a fire reacts to the influences of fuel, weather, and topography. Two key measures of this behavior are the rate of spread and the intensity. Rate of spread is here expressed in feet per minute, rather than chains per hour as commonly used in the wildland fire profession. Fireline intensity is reflected by flame length at the flaming front.

Fire behavior simulations were conducted for average (50th percentile) and severe (90th percentile) conditions for the critical months of the fire season, June through August (Table 12). Grass fuels were modeled on 10 percent and 30 percent slopes to represent

the range of terrain that the grasslands occupy. Brush fuels were modeled on 30 percent slopes, representative of the steeper terrain that mountain mahogany favors in this area. Timber was modeled on a 45 percent slope, typical of the steep north facing terrain on which it is locally found.

BehavePlus software was used to generally illustrate the potential surface fire behavior given the prevailing fuel types, local topography, and local weather conditions. While any number of variables and assumptions will affect the modeled outputs, there are several significant general principles to focus on:

- The differences in fire behavior under 50th and 90th percentile conditions (drier fuels, windier conditions) are most pronounced in brush and grass fuels.
- This increase in fire behavior is approximately two fold for flame length and five fold for rate of spread.
- Fire behavior for most fuel types under 90th percentile conditions exceeds the 4-foot flame lengths generally considered appropriate for direct line construction with hand crews.
- If FBFM 9 converts into the denser FBFM 10, the increase in fire behavior is pronounced and conducive to the initiation of crown fire.

Table 12. BehavePlus Predictions of Fire Behavior

Fire Behavior Fuel Model	Flame Length, (ft) Average Conditions	Rate of Spread (feet/min)[1] Average Conditions	Flame Length, (ft) Severe Conditions	Rate of Spread (feet/min)[1] Severe Conditions
1 Short Grass, 10% slope	4	59	8	309
1 Short Grass, 30% slope	4	72	9	327
6 Intermediate Brush, <6 ft	6	28	10	90
9 Long-Needle Timber Litter	3	9	6	32
10 Timber with Heavy Understory	5	8	9	26

Approximated from chains per hr
1 chain = 66 feet

4.3 Wildfire Occurrence

Short to mid-grass prairie, shrublands, and lower elevation ponderosa pine dominate the FFPD. These are fire-adapted ecosystems that benefit from relatively frequent, lower intensity wildfires. Historically, naturally occurring fire return intervals are estimated to range from 0 to 35 years (Map 5). As a comparison, historic natural fire return in some forested regions is estimated to be over 200 years.

The characteristics of wildfire and wildfire ignitions have changed drastically since the era of these historical projections. Today, a majority of wildfire ignitions can be traced to human causes and in order to protect values at risk, full suppression is the guiding fire management policy.

Call records for the FFPD recorded 177 wildfire ignitions since 1995. This is an average of 14 to 15 wildfire starts per year. Most of these were contained and suppressed during the initial attack phase. Incident data detailing the specific nature of the calls was not available. In addition to incidents within the district, the FFPD responds as mutual aid to surrounding districts in the event of an extended attack. Wildfires impacting local resources with similar fuel models as found in the assessment area are listed in Table 13.

Table 13. Significant Wildfires in the local Wildland-Urban Interface
(Gallamore, CSFS, 2007)

Fire	Month/Year	Acres Burned	Location
Murphy Gulch	Sep 1978	3,300	Inter-Canyon
North Table Mountain	Sep 1988	2000	Fairmount
Coal Creek	Sep 1988	42	Coal Creek
Carpenter Peak	Jul 1994	45	West Metro
Chatfield	Jul 1994	23	West Metro
Rooney Rd	Dec 1994	185	West Metro
Green Mountain	Mar 1999	200	West Metro
Red Rocks	Mar 2000	50	West Metro
Silver Bullet	Jun 2000	20	Golden
US 6	Apr 2002	50	Golden
Blue Mountain	Aug 2002	35	Coal Creek
Leyden	Jan 2005	300	Fairmount
North Table Mountain	Jul 2005	300	Fairmount
Plainview	Jan 2006	2,700	Coal Creek
Rocky Flats	Apr 2006	1,200	Rocky Flats
Ralston Creek	Jun 2006	26	Fairmount

See Appendix L for a comprehensive wildfire history of the Colorado State Forest Service, Golden District.

4.4 Jefferson County Fire Danger Rating System and Local Weather Information

The Jefferson County Fire Danger Rating System (JFDRS) is based on the National Fire Danger Rating System (NFDRS) implemented in 1978. The JFDRS uses both RAWS and

independent weather stations that are monitored with the data available from the internet. Jefferson County limits the Fire Danger Rating to NFDRS fuel model C (Pine-Grass Savanna) and G (Short-Needle (Heavy Dead). The RAWS stations supply all necessary data used for fire danger rating; however, the independent stations require manual inputs to calculate fire danger such as state of the weather and calculation of 1-hour fuel moisture. After the weather data is collected the fire danger is calculated with an NFDRS calculator provided in the Fire Family Plus software. The energy release component (ERC) is then compared to the rating chart developed for Jeffco and an adjective fire danger value (Extreme, Very High, High, Moderate, Low) is assigned. Evergreen Fire Dispatch faxes completed forms for the RAWS and independent weather stations to Jefferson County (Jeffco) Sheriff, Colorado State Forest Service, and local fire agencies for distribution. The completed form with various components of the NFDRS was used for responders and an adjective fire danger for the public.

4.5 Wildfire Risk to Communities

FFPD assessment and neighborhood hazard and risk surveys were conducted during February/March 2007. Near-record snow cover delayed actual neighborhood surveys until the first week March 2007. FFPD identified six neighborhoods and subdivisions as primary areas of concern (Table 14). Each neighborhood represents a specific response area with unique characteristics, resources, and identifiable hazards and risks. The remainder of the district is characterized as outlying homes, commercial enterprises, or suburbs with no direct WUI.

Table 14. Assessment Area Summary Information

Community	Location/Access	Dominant Fuels/Topography
Indian Head	Single gated unpaved access to Highway 93. Upper road is single lane.	Broad open prairie approach to small isolated open timbered hogback. Mix of mountain mahogany and grass understory on upper east slope. Grass understory on west slope, saddle and east slope of second hogback. Thick expanse of mountain mahogany on west facing southern portion of hogback.
Pine Ridge	Western district margin. Subdivision is dispersed along north-south striking hogback valley. North section is gated with mansion homes on large lots.	Short to mid-grass prairie mix on slopes. Some mountain mahogany present. Valley is generally grazed and dominated by meadow grasses. Trees are limited to ornamentals planted by homes. Heavier mountain mahogany on western side of valley with dispersed ponderosa pine.
Station 2	North aspect of North Table Mountain. Two subdivisions separated by irrigation ditch/open space. Bisected by narrow riparian corridor. Multiple accesses to 58th and 60th	Short-grass prairie and grazed meadow grass. Some riparian cottonwood and scrub willow.

Community	Location/Access	Dominant Fuels/Topography
53rd	East to north aspect of North Table Mountain. Lower homes single and dual access to Easley Way. Upper homes single access through 53rd.	Short to mid-grass prairie, yucca, rabbit brush intermixed. Third year post-fire regeneration. Heavy grazing on some private lots. Located at base and lower slopes of mesa. Homes on 0 percent to 10 percent slope.
South Easley Way	South aspect North Table Mountain. Lower homes dual access to Easley Way, upper homes single access.	Short to mid-grass prairie, yucca, rabbit brush intermixed. 10 percent to 15 percent mountain mahogany. Located at base of chimney, homes on 0 percent to 30 percent slope.
Table Rock	Northwest aspect of North Table Mountain. Upper homes on lower mesa slopes. Under construction. Duel access to 58th and HWY 93.	Short to mid-grass prairie, yucca, rabbit brush intermixed. 25 percent to 50 percent. Mountain mahogany on upper slopes. Third year post-fire regeneration Located at base of mesa with homes on 0 percent to 15 percent slope.

A standardized survey process defined by the NFPA was utilized to assess the relative level of wildfire risk and hazard for each neighborhood – the NFPA Form 1144 *Standard for Protection of Life and Property from Wildfire* (Appendix B). Surveys assess predominant characteristics within individual communities and subdivisions as they relate to structural ignitability, fuels, topography, expected fire behavior, emergency response, and ultimately human safety and welfare. Scores are assigned to each element and then totaled to determine the community's relative level of risk. Low, moderate, high, and extreme hazard ratings may be assigned based on the total community score (Table 15). Detailed observations and survey results are detailed in Appendix C.

Table 15. Community Hazard Rating and Contributing Factors

Community	Hazard Rating	Contributing Factors
Indian Head	High	▪ (+) broad prairie expanse bisected by major irrigation canal on approach; cistern/pond and dry hydrant located near ends of both primary roads. ▪ (-) Single ingress/egress, unpaved, narrows to single lane with moderate slope; above ground utilities; ponderosa encroachment onto roadway; restricted turnaround on saddle with heavy FBFM 6 below in chimney. Fire-return frequency.
Pine Ridge	Moderate	▪ (+) South subdivision; dual access paved 2-way ingress/egress; good road condition, low slope/grade; no predominant construction mixed low grade for building slopes; turnaround present. ▪ (+) North subdivision; paved 2-way access; good road condition, low slope/grade; low grade for building slopes; stucco and class A roofing; turnaround present; buried utilities; grazed meadow or mowed yards. ▪ (+) Prairie grasses, yucca, grazed meadow grasses; some mountain mahogany. Open ponderosa west

Community	Hazard Rating	Contributing Factors
		side of valley; FBFM 1 and 6. ▪ (-) South subdivision; no water supply; above ground utilities. North subdivision; no emergency water supply; single gated ingress/egress. Fire return frequency
Station 2	Moderate	▪ (+) Dual access paved 2-way ingress/egress; good road condition, low slope/grade; Predominant mixed brick/siding 2 story; hydrants; low grade for building slopes; turnarounds present; buried utilities. ▪ (+) Prairie and meadow grasses; grazed; some riparian deciduous zones. FBFM 1 and FBFM 6. ▪ (-) Wood sided 3 story multi-family attached housing present at interface margin. Fire return frequency
53rd	Moderate	▪ (+) Lower subdivision; dual access paved 2-way ingress/egress; good road condition, low slope/grade; predominant mixed brick/siding 2 story; hydrants; low grade for building slopes; turnarounds present. ▪ (+) Upper subdivision; 2-way paved access; stucco and class A roofing predominant construction; hydrants; buried utilities; turnarounds present. Low to moderate grade for building slopes < 10 percent. ▪ (+) Prairie grasses, yucca, some mountain mahogany. FBFM 1 and 6. ▪ (-) Lower subdivision above ground electric utilities, <60% wood shake roofing. Upper subdivision; dead end ingress/egress. Fire return frequency
South Easley Way	Moderate	▪ (+) Lower subdivision; dual paved 2-way ingress/egress, good road condition, low slope/grade, predominant brick single story asphalt roof construction. Hydrants ▪ (+) Prairie grasses, yucca, some mountain mahogany. FBFM 1 and FBFM 6. ▪ (+) Upper subdivision; 2-way paved access; stucco and class A roofing predominant construction; hydrants; buried utilities; turnaround present. ▪ (-) Lower subdivision above ground electric utilities. Upper subdivision; dead end ingress/egress, road grade ~ 10 percent, building sites > 30 percent slope. Fire return frequency
Table Rock	Low	▪ (+) Lower subdivision; dual access paved 2-way ingress/egress; good road condition, low slope/grade; predominant mixed brick/siding 2 story; hydrants; low grade for building slopes; turnarounds present; buried utilities. ▪ (+) Prairie grasses, yucca, some mountain mahogany. FBFM 1 and FBFM 6. ▪ (-) Fire return frequency

These comprehensive community assessments provide the basis for effective identification, prioritization, and implementation of specific mitigation and hazard reduction recommendations.

5 WILDFIRE MITIGATION PLAN

5.1 Approach to Mitigation Planning

Wildfire mitigation may be defined as those actions taken to reduce the likelihood of loss due to wildfire. Effective wildfire mitigation can be accomplished through a variety of methods including wildland fuels management, creating strategic fuel breaks, utilizing fire resistant building materials and defensible space landscaping for homes, improving emergency preparedness and response capabilities, upgrading current infrastructure, and developing programs that foster community awareness and neighborhood activism.

Specific mitigation treatment recommendations for the FFPD were identified through community surveys with the fire protection district (FPD), detailed neighborhood hazard assessments, remote sensing and GIS analysis, as well as interviews with affected public land managers and county emergency services. Projects were identified and prioritized based on expressed concerns of stakeholders and FFPD personnel, known fire behavior patterns based on past experience, and practicality of implementation (Appendix C).

5.2 Suggested Actions to Achieve Desired Results

Recommended action items are divided into a number of fuels mitigation and non-fuels related categories (Table 16). Hazardous fuels reduction actions include defensible space implementation and improvements around homes, strategic shaded fuelbreak construction along primary and secondary evacuation routes, and large area fuel reduction treatments. Non-fuels related actions include community education and outreach, Firewise building upgrades, enhancements to emergency response, primary access/egress upgrades, and the improvement/establishment of secondary evacuation routes where needed. Projects will require the support and coordination of the fire department, implementation team or other governmental entity, as well as external funding, additional planning and oversight.

Table 16. Recommended Projects

Project	Actions
Outreach / Public Education	▪ Annual neighborhood outreach/organization ▪ Fire department public education program
Defensible Space	▪ Basic yard clean-up ▪ Property line clean-up ▪ Defensible buffer mowing ▪ Coordination with open space ▪ Debris disposal ▪ Maintenance

Project	Actions
Firewise Building Improvements	▪ Replace shake roofs ▪ Enclose exposed decks and gables ▪ Screen vents and chimneys ▪ Other actions as needed
Shaded Fuelbreaks	▪ Timber and vegetation thinning along all access roads
Supporting Actions	▪ Grant funding ▪ Revisions to county statutes addressing defensible space requirements for home sales/upgrades
Fire Department Preparedness	▪ Emergency water supply improvements ▪ Continued recruitment, training and certification ▪ Continued Apparatus, facility, and PPE upgrades ▪ GIS updates and run book upgrades ▪ Tactical pre-suppression tactical planning

Outreach and Public Education: The most effective means to initiate local action is through community education and public outreach. The purpose of a district-wide education program is to: 1) identify wildfire hazards and risks; 2) introduce the benefits of defensible space and Firewise construction principals; 3) urge homeowners to take action on their own property and influence neighbors, friends, and homeowner associations; 4) initiate creation of oversight group to drive CWPP implementation and grant application; 5) increase awareness of current forest conditions and how hands-on management practices can help restore forest health and reduce wildfire risk; and 6) create awareness of the historical role fire played in our regional ecosystem and forest and rangeland health.

Some parcels within subdivisions may be undeveloped and/or owned by absentee owners. A lack of fuels management on these lots can impact the entire community. An effort should be made to contact these landowners and determine how to address their concerns and overcome potential obstacles to conducting hazard fuel mitigation on their land.

Action Item: An annual community meeting in the spring can spur action on the part of neighborhoods and individuals. This can be a forum for presentations by experts in the field and allow for coordination of "clean-up" efforts within the community. Firewise materials and postings should be made available to the public at each fire station, post office, HOA, and elementary school on a regular basis. A disposal method for yard waste should be coordinated every spring. This may be coordinated with HOA spring clean-up activities and may include the coordination of a central disposal site, mobile chipping services, or a hauling service. See Section 5.4 for potential funding opportunities.

An example is the scheduling of annual "Slash Day" taking place every 1st Saturday in October, for instance. A community, HOA, or neighborhood would hire a contractor by the hour to chip the slash stacked along the main road by homeowners in front of each

residence. Each landowner would pay for the time it took to chip his/her slash but the equipment and scheduling costs would be carried/distributed among all participating landowners.

Defensible Space: An action that can be taken immediately to improve community hazard ratings is the implementation of defensible space around individual homes. It is recommended that defensible space be created following the CSFS guidelines as set forth in *Creating Defensible Space Zones*, *Bulletin No.6.302* (Dennis 2003) (Appendix G), which are consistent with Jefferson County regulations.

Action Item: This is the primary recommendation for hazard fuels mitigation within the FFPD. It is suggested that the above outreach efforts be used to coordinate and spur implementation and debris disposal at the neighborhood level. Many homes with the highest needs for defensible space directly abut city or county open space and may wish to coordinate defensible space actions with vegetation management activities on public land. Jefferson County Open Space may wish to consider formalizing a procedure whereby a group of homeowners who has established defensible space on their own land may petition for fuels management on adjacent open space.

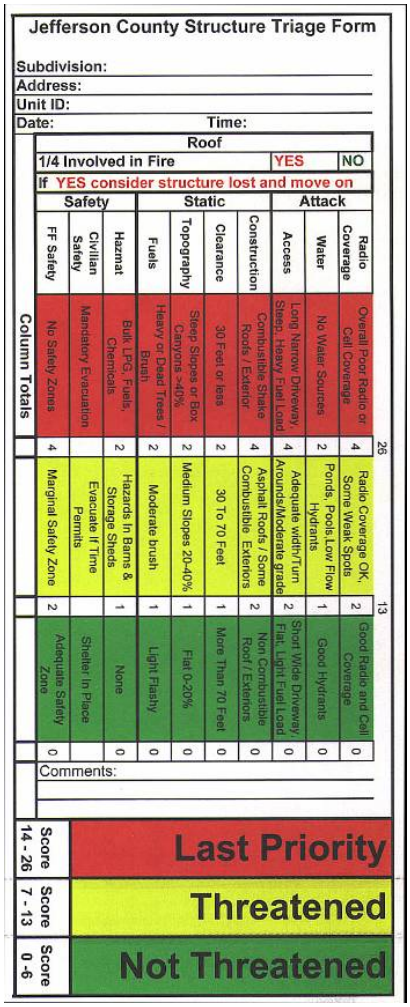


Figure 9. Jefferson County Structure Triage Tag for prioritizing structure defense in the event of an advancing wildfire

Effective defensible space consists of a fuel-free zone adjacent to the home, a treated secondary zone that is thinned and cleaned of surface fuels, and if the parcel is large enough, a transitional third zone that is basically a managed wildland or forest area. These components all work together in a proven and predictable manner. Zone 1 keeps fire from burning directly to the home; Zone 2 reduces the adjacent fire intensity and the likelihood of torching, crown fire, and ember production; and Zone 3 does the same at a broader scale, keeping the fire intensity lower by maintaining a more natural, historic condition, which in turn reduces the risk of extreme/catastrophic fire behavior.

When this principal of defensible space is combined with fire resistant construction and some common sense, the risk of structure loss is greatly reduced. When these principals are consistently applied across a neighborhood, everybody benefits. Additionally, in the event of a wildfire, homes and neighborhoods with defensible space are much more likely to be assigned structure defense crews than those without (Figure 9).

Zone 1 (0-15 feet from structure): Within 3-5 feet of the structure, decorative rock or mowed, irrigated grass is recommended (Figure 10). Well-spaced and pruned low flammability plants are acceptable if the structure has noncombustible siding. In the remainder of Zone 1, trees' lower branches should be pruned 5-10 feet above the ground (not to exceed ⅓ of the tree height). Dead wood, tall grass, and ladder fuels (low limbs, small trees and shrubs that may carry fire into tree crowns) should be removed from this area. Leaves and overhanging branches should be removed from the roof and gutters. The 30-foot area should be irrigated as appropriate. Woodpiles should be removed and stored in Zone 2.

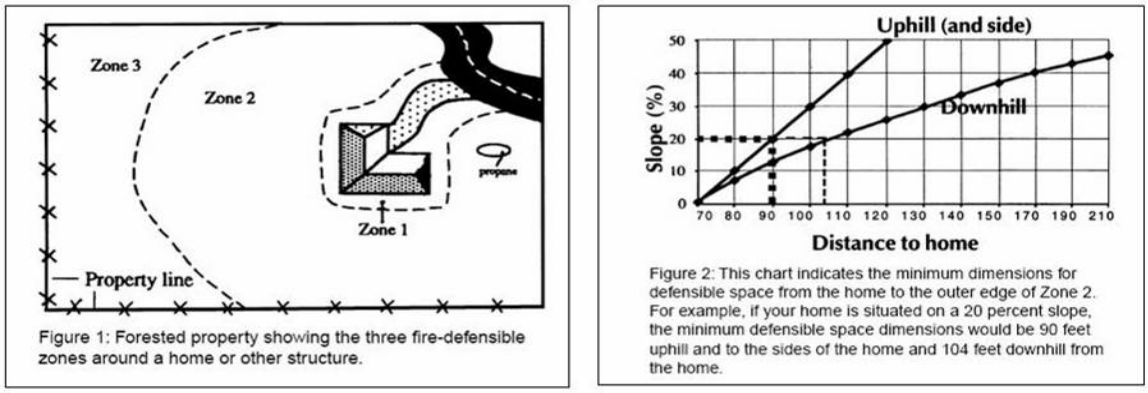


Figure 10. CSFS Defensible Space Guidelines and Standards

Zone 2 (greater than 30 feet from structure or to the property line): The size of this zone is dependent upon slope. Treatment of ground fuels and ladder fuels is generally the same as Zone 1. Trees (or small groups of trees) and shrubs should be thinned to provide 10 feet of clearance among crowns. Grasses should be mowed as they dry in late summer.

Zone 3 (Beyond Zone 2 to property line): This area outside of Zone 2 should be managed for the appropriate land use objectives, such as forest health, aesthetics, recreation and wildlife habitat (Figure 9).

See Appendix K, or visit csfs.colostate.edu/library.htm for information on fire resistant plants and grasses that can augment defensible space efforts.

Efforts can be encouraged and coordinated annually through community meetings, planned spring cleanups and organized disposal efforts. Although most of the work can be accomplished by individual homeowners in a phased approach over time, neighborhood cooperation and support is essential to help those who are unable, or to provide access to critical hazardous areas. Table 17 outlines a manageable phased implementation schedule.

Table 17. Proposed Wildfire Mitigation Project Schedule

Year	Project	Actions
1	Annual spring outreach	▪ Contact and/or organize homeowners
	Annual spring mitigation (Defensible Space)	▪ Clean roofs and gutters ▪ Trim limbs/bushes within 3-5 feet of home ▪ Rake yard ▪ Help a neighbor ▪ Organize debris disposal
2	Annual spring outreach	▪ Contact and/or organize homeowners
	Annual spring mitigation (Defensible Space)	▪ Brush clean-up along property lines ▪ Repeat basic yard clean-up ▪ Organize debris disposal
3	Annual spring outreach	▪ Contact and/or organize homeowners ▪ Advise individual home owners on needed improvements to construction features
	Annual spring mitigation (Defensible Space)	▪ If necessary, coordinate defensible space efforts between homeowner groups who have created defensible space and adjacent open space land managers.
4	Annual spring outreach	▪ Contact and/or organize homeowners ▪ Follow-up on construction feature recommendations
	Annual spring mitigation (Defensible Space)	▪ Complete any outstanding projects from previous years ▪ Begin maintenance phase ▪ Initiate construction feature improvements

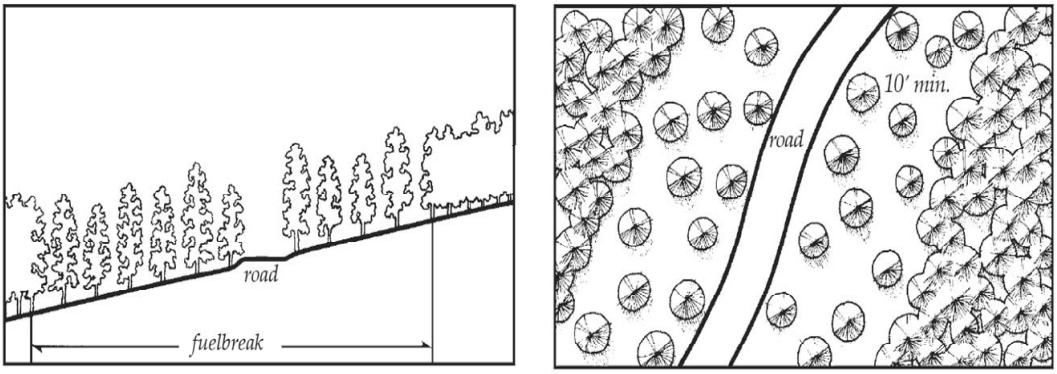
Building Improvements: Improving the fire resistant characteristics of a structure goes hand-in-hand with the development of defensible space. Extensive recommendations may be found in CSFS publications available at http://csfs.colostate.edu/library.htm. The most significant improvement that can be made to many of the homes in the assessment areas is the replacement of wood shake roofing with noncombustible roofing material, as is required for all new and replaced roofs in Jefferson County's WUI. All homeowners should keep roofs and gutters clear of leaves and pine needles. Screening of gutters and roof vents is recommended. Embers from a wildfire can become windborne and travel long distances before settling.

Common structural fuel hazards associated with homes in the WUI include:

- Combustible decks with exposed undersides
- Combustible material under decks
- Open attic vents
- Propane tanks adjacent or downhill from home
- Combustible fencing
- Woody debris in gutters

Action Item: Community education, outreach, and information distribution through HOA and other neighborhood associations. Coordinate public education through existing spring cleanup programs. Grass-roots public awareness can be as simple and straight forward as coordinating with a local scout troop to distribute applicable CSFS flyers door-to-door.

Shaded Fuelbreaks: All forested access roads should be maintained as shaded fuelbreaks zones where possible. Reducing the forest canopy along access roads provides strategic fuel breaks along likely evacuation and incident access routes. This creates a safer emergency ingress/egress scenario while greatly aiding potential tactical suppression efforts. Fuels treatment along roadways reduces removal costs as well as project complexity (Figure 11). Visit http://csfs.colostate.edu/library for fuelbreak guidelines (Appendix F).



Cross-section of a typical fuelbreak built in conjunction with a road.

Plan view of fuelbreak showing minimum distance between tree crowns.

Dennis, undated

Figure 11. Shaded Fuelbreak

Action Item: All access roads within the FFPD with vegetation or timber encroachment should be targeted for mitigation or seasonal mowing. Treatments may be coordinated with property owners along private roads and coordinated with county and state transportation departments for any public roads. A shaded fuel break is currently being implemented by private land owners along upper Indian Head Road. Due to emergency response concerns, monitoring the progress and evaluation of effectiveness by a certified forester is recommended.

Area Treatments of Hazardous Fuel: Treatment recommendations may target areas that are not directly adjacent to a neighborhood or road, but provide a critical wildfire buffer in areas where ignitions area likely and topography and fuel loads combine to create a hazardous situation for a subdivision at a higher elevation or downwind in common fire weather situations. Wildfires frequently burn across jurisdictional

boundaries and recommended area treatments may involve agencies outside of the primary assessment area. Coordination with neighboring agencies may be necessary.

Fuel treatments of this scale are often subject to a number of hurdles that may include presiding agency staffing levels, current available funding levels, environmental impact concerns, public support, and private ownership.

Action Item: Jefferson County Office of Emergency Management and Jefferson County Open Space Department should investigate opportunities for a seasonal fuel break program along the WUI perimeter of North Table Mountain. Should this opportunity involve limited prescribed burning, FFPD participation should be considered.

Weeds: Weed abatement programs will reduce fuel hazards around and within communities and improve the health of grasslands. Post-fire treatment management such as the seeding of native grasses and spreading mulch is beneficial ands may be necessary to establish a productive plant community.

Action Item: An ecological evaluation of the status of prairie and shrub rehabilitation is recommended for local areas affected by fires within the last few years. Analysis should focus on presence of noxious weeds and aggressive non-native species as well as mortality rates in shrubs. Studies may foster modifications to county burned area rehabilitation seeding practices for future wildfire incidents.

Access: Access is a critical safety component of a neighborhood's or community's hazard and risk profile. Most secondary public roads within the FFPD are paved, in excess of 25 feet wide, with adequate turnarounds for a Type 3 or Type 6 fire apparatus. Most turnarounds are also equipped with a pressurized hydrant. Exceptions were noted in the survey notes. Access to foothill canyons to the west or open space lands is generally much more limited.

Action Item: As primarily an emergency response concern, the FFPD may consider classifying roads in the district that are considered to reflect hazardous characteristics as "watch out situations" in the district run book. No other direct road or evacuation route improvements are being recommended for the district at this time.

5.3 Treatment Options

Fuels treatment recommendations for the FFPD focus primarily on reducing the grass and shrub fuels found along the margins of the neighborhoods that border North Table Mountain. Similar mowing treatments will also benefit individual homes in the Lone Pine assessment area. The timber treatment options may be considered for upper Indian Head Road or potential future actions as the district's infrastructure grows.

Each of the recommended fuel mitigation projects can be achieved by a variety of methods (Table 18). Selecting the most appropriate, cost effective option is an important planning step. This brief synopsis of treatment options and cost estimates is provided to

assist in this process. Cost estimates for treatments should be considered as very general guidelines. Timber treatment costs can vary tremendously based on project complexity, but generally run $300 to $1,200 per acre depending upon:

- Type of fuel
- Diameter of materials
- Acreage of project
- Steepness of slope
- Density of fuels
- Proximity to structures
- Access
- Transportation costs

It is imperative that implementers plan for the long-term monitoring and maintenance of all treatments. Post-treatment rehabilitation including seeding with native plants and erosion control may be necessary.

Table 18. Treatment Methods

Treatment	Estimated Cost	Comments
Machine Mowing	$90 - $200 per acre	▪ Appropriate for large, flat grassy areas on relatively flat topography.
Prescribed Fire	$100 - $125 per day	▪ Can be very cost effective. ▪ Ecologically beneficial. ▪ Can be used as training opportunities for firefighters. ▪ Cost varies with complexity. ▪ Carries risk of escape which may be unacceptable in some ▪ WUI areas. ▪ Unreliable scheduling due to weather and smoke ▪ management constraints.
Brush Mastication	$300 - $500 per acre	▪ Brush species (Gamble oak in particular) tend to resprout vigorously after mechanical treatment. ▪ Follow-treatment with herbicides, fire, grazing, or further mechanical treatments are typically necessary. ▪ Mastication tends to be less expensive than manual treatment and eliminates disposal issues.
Timber Mastication	$300 - $1,200 per acre	▪ Materials up to 10” in diameter and slopes up to 30percent can be treated. ▪ Eliminates disposal issues. ▪ Environmental impacts of residue being left on-site are still under study.
Manual Treatment with Chipping or Pile Burning	$300 - $1,200 per acre	▪ Allows for removal of merchantable materials or firewood in timber. ▪ Requires chipping, hauling, pile burning of slash.
Feller Buncher	$750 and up per	▪ Mechanical treatment on slopes over 30% or of materials over 10” in diameter may require a feller buncher rather than a masticator. ▪ Costs tend to be considerably higher than masticator.

Treatment	Estimated Cost	Comments
		▪ May allow for removal of merchantable material.

5.4 Project Support

Funding and Grants: Grant funding support is often a necessary component of a fuels treatment project and can facilitate recommended mitigation on both private and public lands. In addition to opportunities that may be available through the Jefferson County Office of Emergency Management, an excellent resource for researching available public funding sources is the Rocky Mountain Wildland Fire web site *www.rockymountainwildlandfire.info*.

Public Land Planning: Jefferson County Open Space and the Denver Water Board manage prairie wildlands in the assessment area. The CWPP development process is designed to facilitate dialog with these agencies and coordinate public and private wildfire and forest management strategies. As the CWPP strategic plan is implemented, dialogue and collaboration should be maintained with these agencies in order to coordinate strategies and treatments, and make adjustments if necessary.

Regulatory Support: One of the major issues confronting defensible space and hazardous fuels mitigation is the need for on-going maintenance. Treatment projects in timber fuels have an effective life span of 10 to 15 years before seedling fuel loads become a hazardous fuel component. Defensible buffers mowed in prairie habitats are beneficial only through that growing season. For defensible space to be consistently successful some regulatory impetus is recommended. Jefferson County should examine the options for requiring the maintenance of defensible space. This could be associated with the sale of a home or based on time since initial treatment. Those communities with local statutes or covenants should consider similar regulation as an interim step and to help drive the initiative from the bottom up. This is a public safety issue where failure to maintain one's property can create a hazard for firefighters, adjacent properties, and the community as a whole.

6 EMERGENCY OPERATIONS

6.1 Wildfire Response Capability and Recommendations

Emergency fire, medical and rescue services for the district are provided by the FFPD which is mixed organization of career and volunteer firefighters. Of the 77 firefighters on Fairmount's active roster, 12 are career and 65 are volunteers. FFPD maintains two fully equipped stations.

- Station 1 4755 Isabell St., Golden, CO 80403
  - 2 Type 1 Engines
  - 1 Type 3 Engine
  - 1 Type 6 Engine
  - 1 Ladder
- Station 2 18208 West 58th Dr. Golden, CO 80403
  - 1 Type 1 Engines
  - 1 Type 2 Tender
  - 1 Type 3 Engine
  - 1 Type 6 Engine

For illustration purposes, Table 19 compares initial attack capabilities for an average engine crew as determined from the "Line Production Rates for Initial Action by Engine Crews" charts (National Wildfire Coordinating Group 2004) with predicted fire spread under 50th percentile weather conditions. These are generalized figures provided to illustrate the potential gap between potential fire behavior and available suppression resources. This highlights the importance of mutual aid and aerial support.

Table 19. Wildland Fire Production Rates

Wildland Fire Production Rates Per Hour Using Type-6 Engine (3 firefighters)				
Anderson Fire Behavior Fuel Model (FBFM)	**Predicted Fire Line Production Rates Chains/Hr**	**Predicted Fire Line Production Rates Feet/Minute**	**Acreage**	**Predicted Fire Spread Feet/Minute Under Average Conditions**
1 - Short Grass	24	26	2	68
2 - Short grass with scattered shrubs or open timber	15	16	1	29
6 - Shrubs under 6 ft. tall	12	13	0.75	33
9 - Closed timber litter	15	16	1	2
10 - Closed timber with heavy dead and down woody debris	12	13	0.5	8

1 chain = 66 feet;

The structure protection Table 20 is based on the time a crew can prepare a structure for a wildland fire using a Type-1 engine. The accepted standard is 20 minutes for a four-firefighter crew and 30 minutes for a three-firefighter crew.

Table 20. Structural Protection Rates

Structural Protection Rates Per Hour Using Type-1 Engines		
Firefighters	**Rates**	**Total per hour**
3	30 minutes/structure	6
4	20 minutes/structure	6
Total		12

Mutual Aid

Mutual aid agreements for FFPD are governed by the Denver-wide Mutual Aid Agreement as well the Jefferson County AFOP which provides an intergovernmental mutual aid agreement between all fire districts in the county, including the CSFS and USFS. Jefferson County maintains a certified Type 3 IMT for additional overhead support in the event of a large-scale incident.

Recommendations:

The wildland fire production rate analysis illustrates the potential for fire behavior to exceed the suppression capability of initial attack crews. This is especially true in the Fairmount area where so much of the surrounding terrain is difficult to access. This department is well trained and well equipped for wildland firefighting. The maintenance of this training, apparatus, and equipment is obviously essential. Extended wildfire incidents along the Front Range inevitably become very complex management challenges. The development and annual review of pre-attack plans, in coordination with likely cooperators, for specific locations and scenarios would provide tactical and strategic guidelines in the event of an actual incident.

6.2 Emergency Procedures and Evacuation Routes

In the event that the County Sheriff orders a community to evacuate because of threatening wildfire, residents should leave in an orderly manner. The Sheriff would proclaim the preferred evacuation routes and safe sites. However, the need for evacuation can occur without notice when conditions for wildfire are favorable. Homeowners should be prepared to evacuate without formal notice.

Before residents leave, they should take every precaution to reduce the chance of structure loss as time allows. Human safety is the number one concern in an evacuation. Actions could include thoroughly irrigating the defensible space, watering down the roof, and removing all debris from rain gutters. Remove all flammable materials 30 feet or more from the house such as woodpiles, leaves, debris, and patio furniture. Windows and doors should be closed but not locked. Other openings should be covered. A ladder should be placed for roof access by firefighters. A fully charged hose that reaches around

the house should also be available for firefighter use. Porch lights should be left on to allow firefighters to find homes at night.

Families should have meeting locations in place and phone numbers to call in case family members are separated. Families should take with them important papers, documents, pets, food, water, and other essential items. The exterior of the house should be monitored for smoke for several days after return. Embers may lodge in small cracks and crevices and smolder for several hours or days before flaming.

Evacuation procedures vary according to subdivision. The FFPD should ensure that every resident has the opportunity to become familiar with these procedures. Evacuation plans should outline available evacuation centers and the procedures to activate them. Large animal evacuation centers also need to be identified. These procedures should be addressed in public or HOA meetings with information eventually being distributed door-to-door.

7 FAIRMOUNT FIRE PROTECTION DISTRICT CWPP MONITORING AND EVALUATION

7.1 CWPP Plan Adoption

Public meetings and a public comment period are incorporated into this CWPP process to provide the opportunity for wide-spread participation and input. Comments and input were solicited from stakeholders. The final draft of the CWPP was formally adopted by the Core Team, comprised of representatives from the FFPD, Jefferson County Office of Emergency Management, Jefferson County Open Space, and the CSFS.

The HFRA authority for CWPP requires adoption of this plan, as does the FEMA Disaster - Mitigation Act of 2000. With formal adoption by the Core Team, participating agencies and WUI neighborhoods will be competitive for available hazardous fuels and non-fuels mitigation funding that may assist with plan implementation. Furthermore, adoption of this plan highlights a collaborative planning and development process between the FFPD, local government, public agencies, and neighborhood organizations.

7.2 Sustaining CWPP Efforts

A CWPP can serve as the foundation for a safer and healthier WUI through hazard assessment and strategic planning focusing on the threat of wildfire. The mitigation strategies outlined in this report will greatly reduce that risk, but only if implemented. Converting strategy into action is the key to achieving that core goal.

Communities can, in fact, be made safer, and this CWPP has outlined realistic measures to achieve that goal. The CWPP process encourages homeowners to take an active role as fuel treatment strategies are developed and prioritized. Ownership of CWPP implementation at that same local level is the most effective means to achieving effective results and sustaining the effort from year to year.

Proactive neighborhoods can seek support and guidance through a variety of local, state and federal resources identified in this report including the State Forest Service, Jefferson County Emergency Services, and the FFPD.

7.3 CWPP Oversight, Monitoring and Evaluation

As wildfire hazard reduction efforts are implemented over time and the characteristics of particular WUIs change, neighborhoods may wish to reassess particular areas and update the findings of the original CWPP. Monitoring the progress of project implementation and evaluating the effectiveness of treatments is an important component of CWPP oversight and maintenance. The assessment methodology utilized in this report is a standardized, well documented hazard and risk survey approach that is designed to provide an addressable benchmark against which future assessments can be compared. Successes, challenges and new concerns should be noted and guide any modifications to the CWPP that better accommodate your changing landscape.

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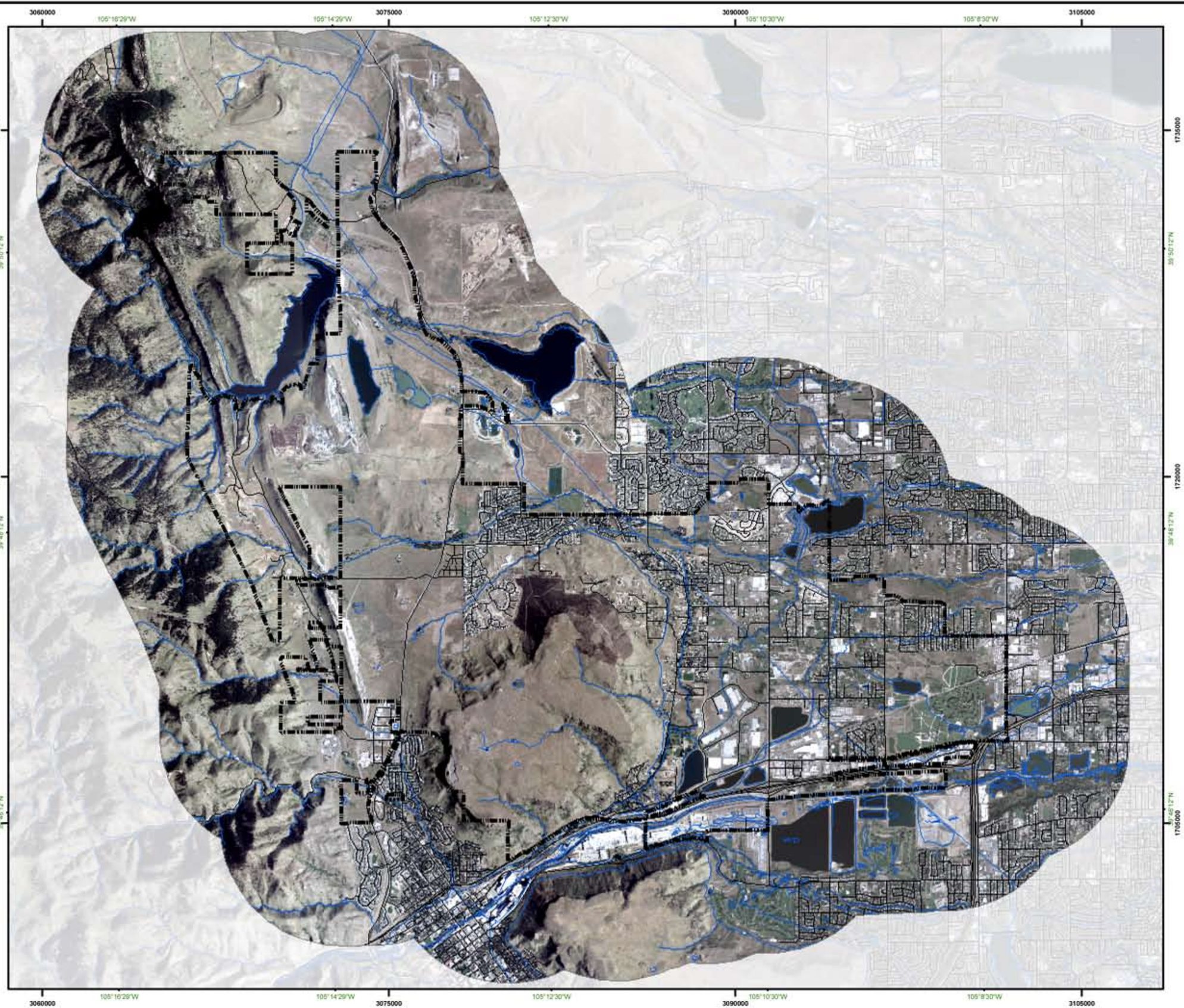
APPENDIX A
PROJECT MAPS



Fairmount
Fire Protection District
Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams

0 0.5 1
Miles

Colorado State Plane
Central NAD 1983

Walsh
an ecology and environment company

Map 1
Assessment Area Overview

Proj # 7404	Date: 3/2007

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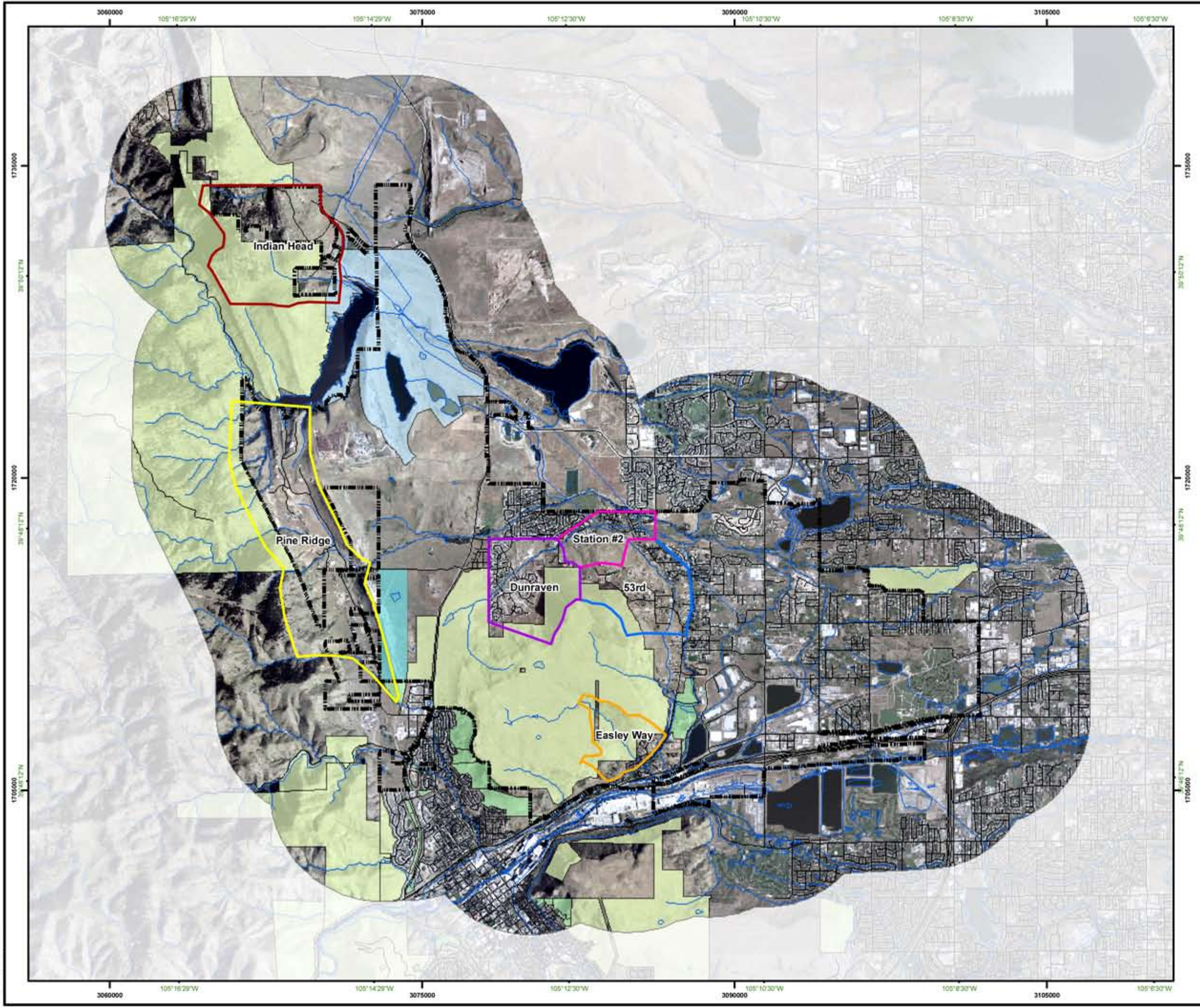

Fairmount Fire Protection District Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams

Communities

- 53rd
- Dunraven
- Easley Way
- Indian Head
- Pine Ridge
- Station #2

Open Space

- City of Golden
- Denver Water Board
- Jefferson County
- State of Colorado

0 0.5 1
Miles

Colorado State Plane
Central NAD 1983

Walsh
an ecology and environment company

Map 2
Community Map

Proj # 7404	Date: 3/2007

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3060000 105°16'29"W 3075000 105°14'29"W 3090000 105°12'30"W 3105000 105°10'30"W 105°8'30"W

1735000 39°48'12"N 1720000 1705000

Station 6

Station 6 (Headquarters)

Station 2

Station 1

Station 2

Station 1

Fairmount Fire Protection District Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams
- a Fire Station

0 0.5 1 Miles

Colorado State Plane
Central NAD 1983

μ

Walsh
an ecology and environment company

Map 3
District Infrastructure

Proj # 7404	Date: 3/2007

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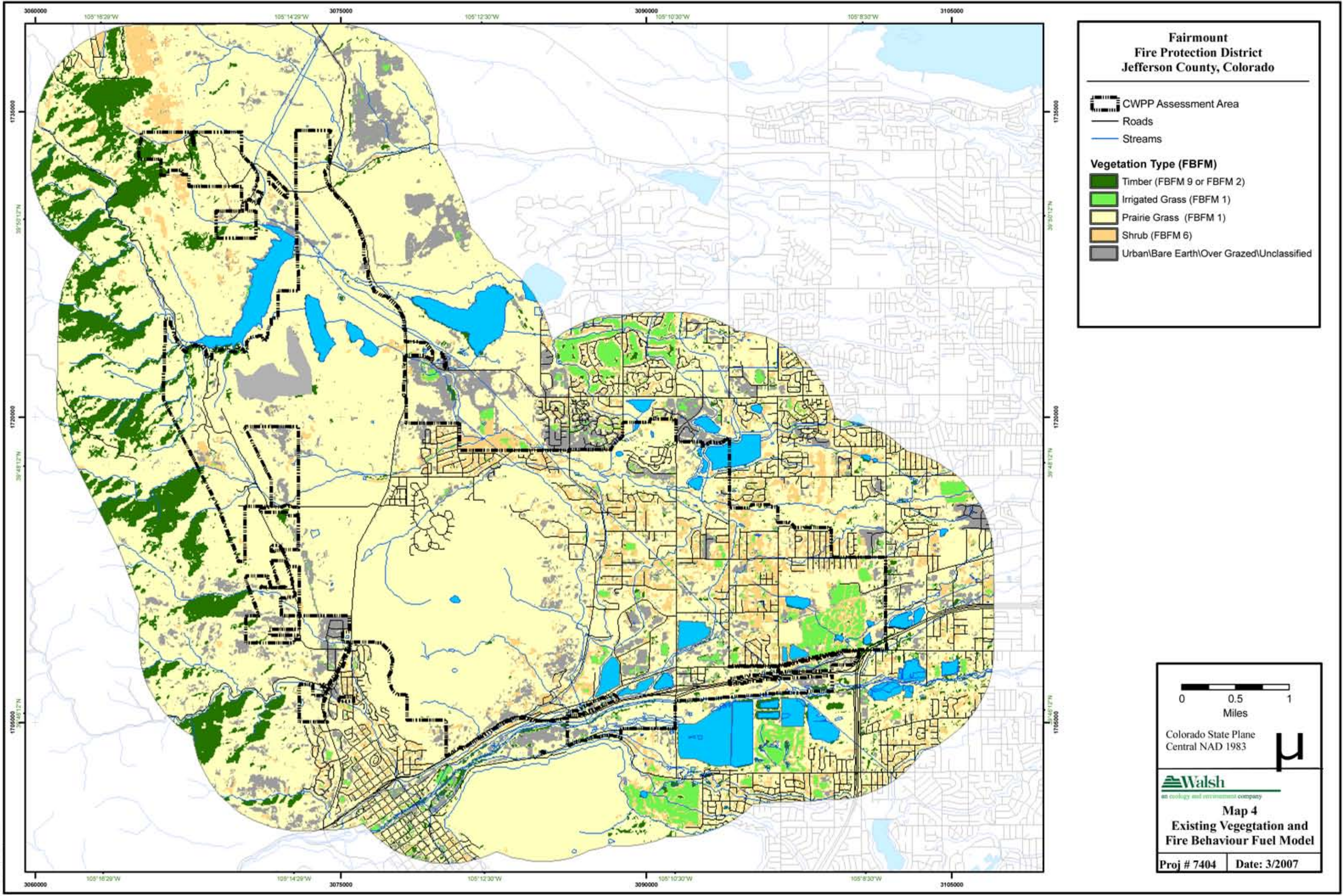
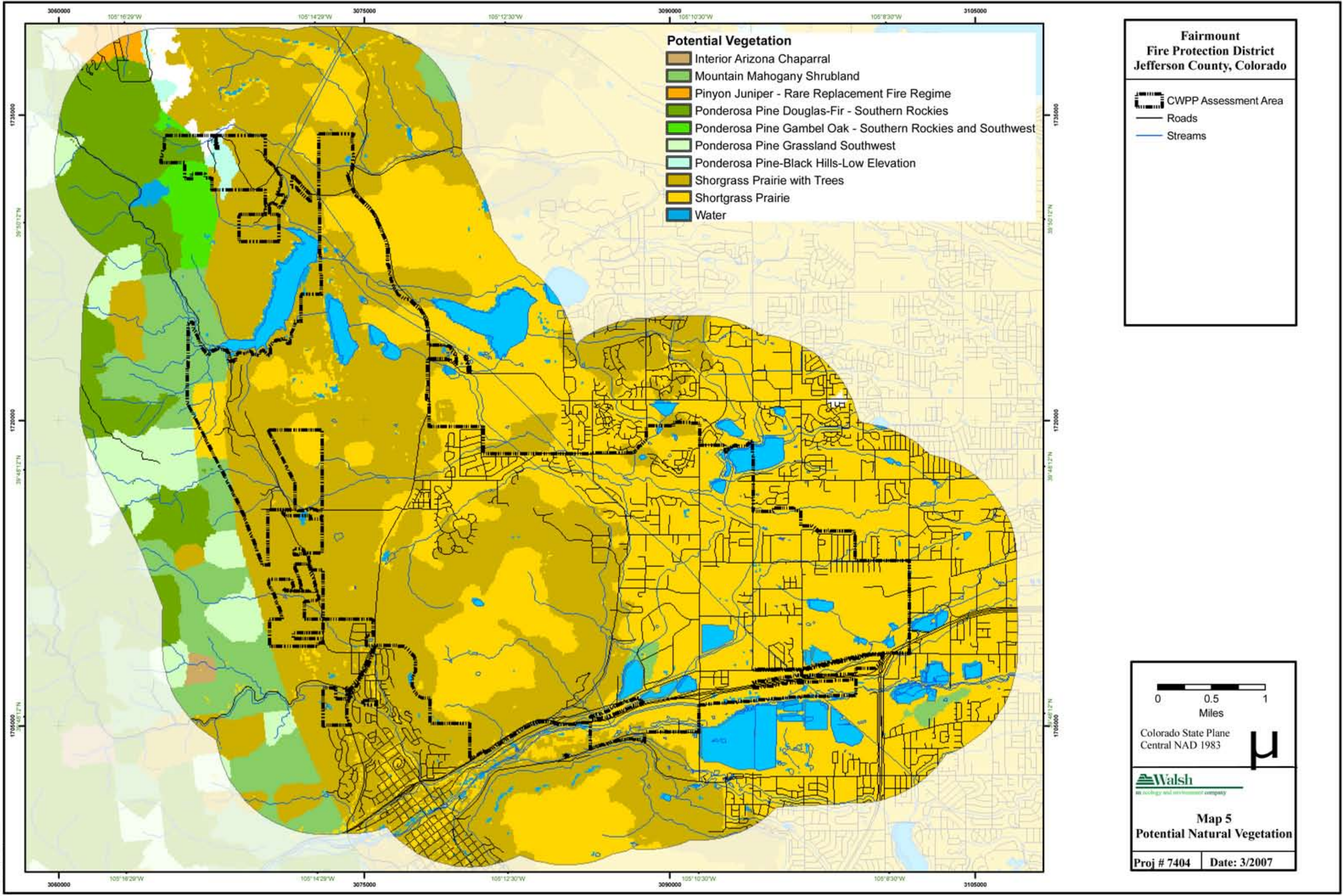

3060000
105°16'29"W
3075000
105°14'29"W
105°12'30"W
3090000
105°10'30"W
105°8'30"W
3105000
1735000
1720000
1705000
39°50'12"N
39°48'12"N
Fairmount
Fire Protection District
Jefferson County, Colorado
CWPP Assessment Area
Roads
Streams
Vegetation Type (FBFM)
Timber (FBFM 9 or FBFM 2)
Irrigated Grass (FBFM 1)
Prairie Grass (FBFM 1)
Shrub (FBFM 6)
Urban\Bare Earth\Over Grazed\Unclassified
0
0.5
1
Miles
Colorado State Plane
Central NAD 1983
Walsh
an ecology and environment company
Map 4
Existing Vegegtation and
Fire Behaviour Fuel Model
Proj # 7404
Date: 3/2007
7404_cwpp\fc_maps.mxd



Fairmount Fire Protection District Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams

0 0.5 1 Miles

Colorado State Plane Central NAD 1983

μ

Walsh
an ecology and environment company

Map 5
Potential Natural Vegetation

Proj # 7404	Date: 3/2007

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3060000 105°16'29"W 3075000 105°14'29"W 3090000 105°12'30"W 3105000 105°10'30"W 105°8'30"W

1735000 39°50'12"N 1720000 39°48'12"N 1705000

Historical Fire Regimes

- '0-35 year frequency; low and mixed severity'
- '0-35 year frequency; replacement severity'
- '200+ year frequency; replacement severity'
- '35-200 year frequency; low and mixed severity'
- '35-200 year frequency; replacement severity'
- 'Water'

Fairmount Fire Protection District Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams

0 0.5 1 Miles

Colorado State Plane Central NAD 1983

μ

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an ecology and environment company

Map 6
Historical Fire Regimes

Proj # 7404	Date: 3/2007

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3060000 105°16'29"W 3075000 105°14'29"W 3090000 105°12'30"W 3105000 105°10'30"W 105°8'30"W

1735000 39°50'12"N 1720000 39°48'12"N 1705000 39°46'12"N

Fairmount
Fire Protection District
Jefferson County, Colorado

- CWPP Assessment Area
- Roads
- Streams

Fire Regime Condition Class

- Class 1
- Class 2
- Class 3

0 0.5 1
Miles

Colorado State Plane
Central NAD 1983

μ

Walsh
an ecology and environment company

Map 7
Fire Regime Condition Class

Proj # 7404	Date: 3/2007

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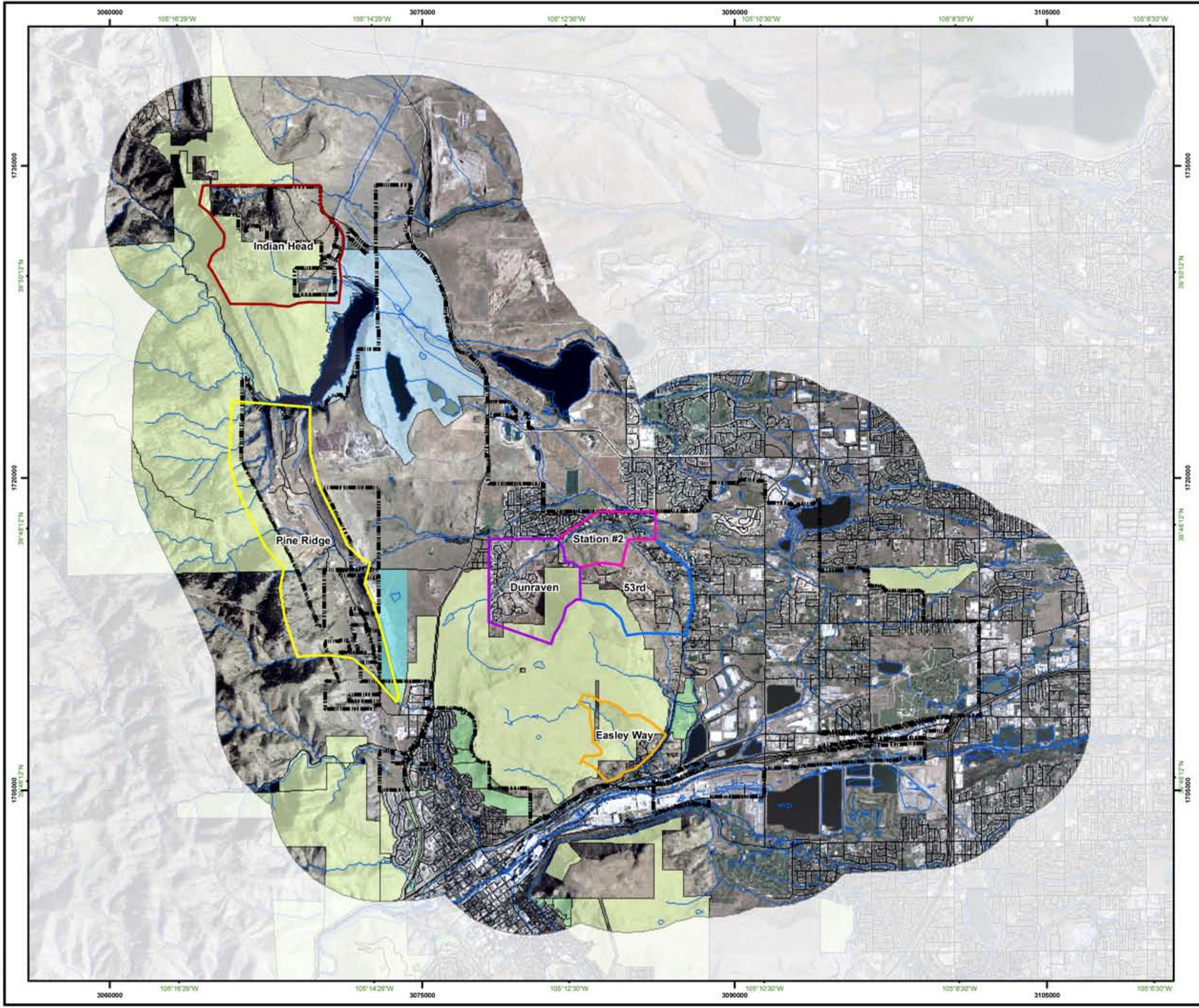

Fairmount Fire Protection District
Jefferson County, Colorado

CWPP Assessment Area
Roads
Streams

Communities
- 53rd
- Dunraven
- Easley Way
- Indian Head
- Pine Ridge
- Station #2

Open Space
- City of Golden
- Denver Water Board
- Jefferson County
- State of Colorado

Fuel treatment Areas (TBD)

0 0.5 1
Miles

Colorado State Plane
Central NAD 1983

Walsh
an ecology and environment company

Map 8
Fuels Treatment Area

Proj # 7404	Date: 3/2007

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APPENDIX B
NFPA WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM 1144

WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM

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

Element	Points	
A. Means of Access		
1. Ingress and egress		
a. Two or more roads in/out	0	_____
b. One road in/out	7	_____
2. Road width		
a. ≥7.3 m (24 ft)	0	_____
b. ≥6.1 m (20 ft) and <7.3 m (24 ft)	2	_____
c. <6.1 m (20 ft)	4	_____
3. All-season road condition		
a. Surfaced road, grade <5%	0	_____
b. Surfaced road, grade >5%	2	_____
c. Non-surfaced road, grade <5%	2	_____
d. Non-surfaced road, grade >5%	5	_____
e. Other than all-season	7	_____
4. Fire Service Access		
a. ≤91.4 m (300 ft) with turnaround	0	_____
b. >91.4 m (300 ft) with turnaround	2	_____
c. <91.4 m (300 ft) with no turnaround	4	_____
d. ≥91.4 m (300 ft) with no turnaround	5	_____
5. Street signs		
a. Present [10.2 cm (4 in.) in size and reflectorized]	0	_____
b. Not present	5	_____
B. Vegetation (Fuel Models)		
1. Characteristics of predominate vegetation within 91.4 m (300 ft)		
a. Light (e.g., grasses, forbs, sawgrasses, and tundra) NFDRS Fuel Models A, C, L, N, S, and T	5	_____
b. Medium (e.g., light brush and small trees) NFDRS Fuel Models D, E, F, H, P, Q, and U	10	_____
c. Heavy (e.g., dense brush, timber, and hardwoods) NFDRS Fuel Models B, G, and O	20	_____
d. Slash (e.g., timber harvesting residue) NFDRS Fuel Models J, K, and L	25	_____
2. Defensible space		
a. More than 30.48 m (100 ft) of vegetation treatment from the structure(s)	1	_____
b. 21.6 m to 30.48 m (71 ft to 100 ft) of vegetation treatment from the structure(s)	3	_____
c. 9.14 m to 21.3 m (30 ft to 70 ft) of vegetation treatment from the structure(s)	10	_____
d. <9.14 m (30 ft) of vegetation treatment from the structure(s)	25	_____
C. Topography Within 91.4 m (300 ft) of Structure(s)		
1. Slope <9%	1	_____
2. Slope 10% to 20%	4	_____
3. Slope 21% to 30%	7	_____
4. Slope 31% to 40%	8	_____
5. Slope >41%	10	_____

(NFPA 1144, 1 of 2)

Element	Points	
D. Additional Rating Factors (rate all that apply)		
1. Topographical features that adversely affect wildland fire behavior	0–5	_____
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations (e.g., heavy lightning, railroads, escaped debris burning, and arson)	0–5	_____
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	0–5	_____
4. Separation of adjacent structures that can contribute to fire spread	0–5	_____
E. Roofing Assembly		
1. Class A roof	0	_____
2. Class B roof	3	_____
3. Class C roof	15	_____
4. Nonrated	25	_____
F. Building Construction		
1. Materials (predominate)		
a. Noncombustible/fire-resistive siding, eaves, and deck (*see Chapter 8*)	0	_____
b. Noncombustible/fire-resistive siding and combustible deck	5	_____
c. Combustible siding and deck	10	_____
2. Building setback relative to slopes of 30% or more		
a. ≥9.14 m (30 ft) to slope	1	_____
b. <9.14 m (30 ft) to slope	5	_____
G. Available Fire Protection		
1. Water source availability		
a. Pressurized water source availability		
1892.7 L/min (500 gpm) hydrants ≤304.8 m (1000 ft) apart	0	_____
946.4 L/min (250 gpm) hydrants ≤304.8 m (1000 ft) apart	1	_____
b. Nonpressurized water source availability (off site)		
≥946.4 L/min (250 gpm) continuous for 2 hours	3	_____
<946.4 L/min (250 gpm) continuous for 2 hours	5	_____
c. Water unavailable	10	_____
2. Organized response resources		
a. Station ≤8 km (5 mi.) from structure	1	_____
b. Station >8 km (5 mi.) from structure	3	_____
3. Fixed fire protection		
a. NFPA 13, 13R, 13D sprinkler system	0	_____
b. None	5	_____
H. Placement of Gas and Electric Utilities		
1. Both underground	0	_____
2. One underground, one aboveground	3	_____
3. Both aboveground	5	_____
I. Totals for Home or Subdivision (Total of all points)		

Hazard Assessment	Total Points
Low hazard	<40
Moderate hazard	40–69
High hazard	70–112
Extreme hazard	>112

(NFPA 1144, 2 of 2)

1144 digital field survey form example:

Wildfire Fire Risk and Hazard Severity Field Form NFPA 1144	
Community	**Rating**
Means of Access	
Ingress and Egress	0
2 or more roads in & out	0
One road in & out	7
Road Width	0
> 24 ft	0
> 20 ft < 24 ft	2
< 20 ft	4
All-Season Road Condition	0
Surfaced Road, grade <5%	0
Surfaced Road, grade >5%	2
Non-surfaced Road, grade <5%	2
Non-surfaced Road, grade >5%	5
Other than all season	7
Fire Service Access	0
< 300 ft with turnaround	0
> 300 ft with turnaround	2
< 300 ft with no turnaround	4
> 300 ft with no turnaround	5
Street Signs (predominent)	0
Present - reflective	0
Not present	5
Vegetation (fuel models)	
Characteristics of predominent veg w/in 300 ft	0
Light - 1, 2, 3	5
Medium - 5, 6, 7, 8, 9	10
Heavy - 4, 10	20
Slash - 11, 12, 13	25
Defensible Space - vegetation treatment around structure	0
> 100 ft around structure	1
> 70 ft < 100 ft around structure	3
> 30 ft < 70 ft around structure	10
< 30 ft around structure	25
Topography Within 300 ft of Structures	
Slope	0
< 9%	1
10% to 20%	4
21% to 30%	7
31% to 40%	8
> 41%	10
Additional Rating Factors (rate all that apply)	
Additional factors	0
Topographic feaures that adversely affect fire behavior (0 - 5)	0
Areas with a history of high fire occurance - ignition potential (0 - 5)	0
Severe fire weather potential (0 - 5)	0
Separation of adjacent structures contributing to fire spread (0 - 5)	0
Roofing Assembly	
Roofing	0
Class A	0
Class B	3
Class C	15
Unrated	25
Building construction	
Materials (predominent)	0
Non-combustible fire-resistive siding, eaves and deck	0
Non-combustible siding, eaves and combustible deck	5
Combustible siding and deck	15
Building set-back relative to slope of 30% or more	0
> 30 ft to slope	1
< 30 ft to slope	5
Available Fire Protection	
Water source availability	0
Hydrants 500 gpm < 1000 ft apart	0
Hydrants 250 gpm < 1000 ft apart	1
Non-pressurized water source > 250 gpm for 2 hours	3
Non-pressurized water source < 250 gpm for 2 hours	5
Water unavailable	10
Organized response resources	0
Station < 5 mi from structure	1
Station > 5 mi from structure	3
Fixed fire protection	0
NFPA 13, 13R, 13D sprinkler system	0
None	5
Placement of gas and Electric Utilities	
Utilities	0
Both underground	0
One above, one below	3
Both above ground	5
Totals for home or subdivision	**0**
Hazard Rating Scale	
< 40 LOW	
> 40 MODERATE	
> 70 HIGH	
> 112 EXTREME	

APPENDIX C
COMMUNITY/NEIGHBORHOOD/SUBDIVISION HAZARD AND RISK SURVEY SUMMARIES

APPENDIX D
FAIRMOUNT FPD QUESTIONNAIRE

Questionnaire
Community Wildfire Protection Plan (CWPP)
Jefferson County

October 2006

Walsh Environmental Scientists and Engineers LLC—under contract with Jefferson County Emergency Management and in collaboration with Colorado State Forest Service and US Forest Service—is developing CWPPs for nine fire protection districts, which have significant wild-land urban interface lands. You can help by providing information and suggestions on your perceptions of wildland fire and potential mitigation projects by responding to the following question:

1. What **community** do you live in or are closest to? (please write in)	
2. How great of **risk** does wildfire pose to your community?	□ Extreme Risk □ Moderate Risk □ Low Risk □ No Risk
3. What areas are at **extreme fire hazard** and pose a risk to homes or property?	□ Forestlands □ Grasslands □ Shrublands □ Juniper Stands □ Other Areas: _____ **Location:**
4. What is the best way to **mitigate or reduce** wildfire hazards?	□ Increase number of fire department personnel □ Reduce vegetation (grasses, trees, etc.) on public lands by controlled burns. □ Reduce vegetation (grasses, trees, etc.) on public lands by mechanical treatments. □ Increase firefighting equipment (more trucks, water tenders, etc.) □ Increase water availability □ Encourage private landowners to reduce fuels and develop defensible spaces around

	structures.
5. What **recent actions** have been taken to reduce the risk of wildfire to your community?	□ None that I am aware of. □ If you know of actions that have been taken, please explain:
6. What **fire education programs** have occurred in your community?	□ None that I am aware of. □ If you know of programs that have occurred, please explain:
7. Is the community **prepared** to combat wildfire?	□ No, if not, why: □ Yes, if so, how come: □ I do not know
8. What **actions** do you think need to be taken to reduce the risk of wildland fire?	
Additional Comments:	

Please provide **contact information** in case we have further questions:

Name	
Address	
Phone	

Please fill out this survey and mail, fax, or email your response to:

Walsh Environmental Jerry Barker 303-443-0367 (fax) 4888 Pearl E. Circle, Suite 108 Boulder, CO 80301-2475 jbarker@walshenv.com	Jeffco Emergency Management Rocco Snart 303-271-4905 (fax) 800 Jefferson County Parkway Golden, CO 80419 rsnart@jeffco.us

APPENDIX E

FAIRMOUNT FPD QUESTIONNAIRE FEEDBACK SUMMARY

Questionnaire Summary

Questionnaires were provided at public meetings convened on February 7 and April 4, 2007 at Station 2. Participants of the meetings were asked to respond to the questionnaire while at the meeting or mail responses at a latter time. One questionnaire has been received as of April 20, 2007. The following tables summarize the responses of the one questionnaire that was received.

Questionnaire Summary

Question		Number of Response
2. How great of risk do wildfires pose to your property and community?	Extreme	1
	Moderate	
	Low	
	No	
3. What areas do you think are at extreme fire hazard and pose a risk to homes or property?	Forestlands	
	Grasslands	1
	Shrublands	
	Juniper	
	Other	
4. What do you think would be the best way to mitigate or reduce these hazardous?	Reduce Vegetation	
	Increase Equipment	
	Increase Volunteers	
	Develop Defensible Space	1
	Firewise Education	
	Evacuation Routes	
	Increase available water	
5. Do you know of recent actions taken to reduce the risk of wildfires or to protect residents from wildfire spreading from public lands onto private lands or visa versa?	No	1
	Yes	
6. Have there been recent fire education programs in your community?	No	1
	Yes	
7. Do you think that the community in which you live is prepared to combat wildfire?	No	
	Yes	
	I do not know	1
8. What actions do you think need to be taken to reduce wildfire risk? See Table 2.	See Table 2 for responses.	

Summary of Responses to Question Number 8

Comment	Number Received	Comment
1	1	Procedure for homeowners adjacent to open space to mitigate fuels on these lands.

APPENDIX F
FUELBREAK GUIDELINES FOR FORESTED SUBDIVISIONS AND COMMUNITIES

Fuelbreak Guidelines for Forested Subdivisions & Communities

By

Frank C. Dennis

Colorado State Forest Service
Knowledge to Go Places

This publication was developed for use by foresters, planners, developers, homeowners' associations and others. Implementation of these measures cannot *guarantee* safety from all wildfires, but will greatly increase the probability of containing them at more manageable levels.

Inadequate fire planning can result in loss of life or property and costly suppression activities.

Colorado's forested lands are experiencing severe impacts from continuing population increases and peoples' desire to escape urban pressures. Subdivisions and developments are opening new areas for homesite construction at an alarming rate, especially along the Front Range and around recreational areas such as Dillon, Vail, and Steamboat Springs.

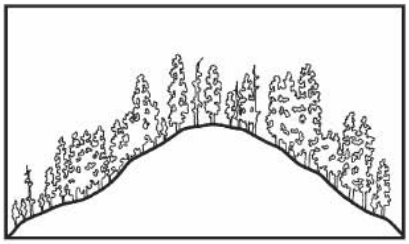
But with development inevitably comes a higher risk of wildfire as well as an ever-increasing potential for loss of life and property. Methods of fire suppression, pre-suppression needs, and homeowner and fire crew safety must all be considered in the planning and review of new developments as well as for the "retrofitting" of existing, older subdivisions.

Fuelbreaks should be considered in fire management planning for subdivisions and developments; however, the following are guidelines **only**. They should be customized to local areas by professional foresters experienced in Rocky Mountain wildfire behavior and suppression tactics.

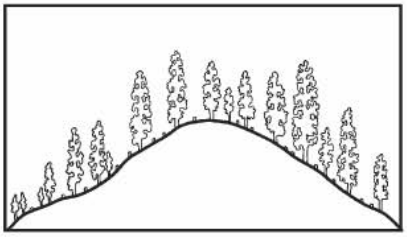
Fuelbreak vs Firebreak

Although the term fuelbreak is widely used in Colorado, it is often confused with firebreak. The two are entirely separate, and aesthetically different, forms of forest fuel modification and treatment.

• A firebreak is strip of land, 20 to 30 feet wide (or more), in which all vegetation is removed down to bare, mineral soil each year prior to fire season.



Above, cross section of mixed conifer stand before fuelbreak modification. Below, after modification.



• A fuelbreak (or shaded 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. The stand is thinned, and remaining trees are pruned to remove ladder fuels. Brush, heavy ground fuels, snags, and dead trees are disposed of and an open, park-like appearance is established.

The following is a discussion of the uses, limitations, and specifications of fuelbreaks in wildfire control and fuels management.

Fuelbreak Limitations

Fuelbreaks provide quick access for wildfire suppression. Control activities can be conducted more safely due to low fuel volumes. Strategically located, they break up large, continuous tracts of dense timber, thus limiting uncontrolled spread of wildfire.

Fuelbreaks can aid firefighters greatly by slowing fire spread under normal burning conditions. However, under extreme conditions, even the best fuelbreaks stand little chance of arresting a large

Before and after photos of a forest stand thinned to reduce fuel loads.

fire, regardless of firefighting efforts. Such fires, in a phenomenon called "spotting," can drop firebrands 1/8-mile or more ahead of the main fire, causing very rapid fire spread. These types of large fires may continue until there is a major change in weather conditions, topography, or fuel type.

It is critical to understand: A fuelbreak is the line of defense. The area (including any homes and developments) between it and the fire may remain vulnerable.

In spite of these somewhat gloomy limitations, fuelbreaks have proven themselves effective in Colorado. During the 1980 Crystal Lakes Subdivision Fire near Fort Collins, crown fires were stopped in areas with fuelbreak thinnings, while other areas of dense lodgepole pine burned completely. A fire at O'Fallon Park in Jefferson County was successfully stopped and controlled at a fuelbreak. The Buffalo Creek Fire in Jefferson County (1996) and the High Meadow Fire in Park and Jefferson Counties (2000) slowed dramatically wherever intense forest thinnings had been completed. During the 2002 Hayman Fire, Denver Water's entire complex of offices, shops and caretakers' homes at Cheesman Reservoir were saved by a fuelbreak with no firefighting intervention by a fuelbreak.

Burned area near Cheesman Reservoir as a result of the Hayman Fire. Note the unburned green trees in the middle right of the photo, a treated fuelbreak.

The Need For A Fuelbreak

Several factors determine the need for fuelbreaks in forested subdivisions, including: (1) potential problem indicators; (2) wildfire hazard areas; (3) slope; (4) topography; (5) crowning potential; and (6) ignition sources.

Potential Problem Indicator

The table below explains potential problem indicators for various hazards and characteristics common to Colorado's forest types. All major forest types, except aspen, indicate a high potential for wildfire hazard.

Fuel Type	Characteristics			Hazards			
	Aesthetics	Wildlife	Soil	**Wildfire**	Avalanche	Flood	Climate
Aspen	2	3	3	**2**	4	3	2
Douglas-fir	2	2	3	**5**	2	2	3
Greasewood-Saltbrush	4	2	2	**2**	1	3	3
Limber-Bristlecone Pine	3	2	4	**3**	4	2	5
Lodgepole Pine	2	2	3	**5**	4	2	4
Meadow	5	4	4	**2**	3	4	3
Mixed Conifer	2	1	1	**5**	3	1	3
Mountain Grassland	5	3	4	**3**	3	2	4
Mountain Shrub	3	5	4	**4**	2	2	3
Piñon-Juniper	2	3	4	**4**	2	3	2
Ponderosa Pine	2	3	1	**5**	2	2	3
Sagebrush	4	4	3	**3**	3	2	3
Spruce-Fir	2	3	3	**4**	5	**3**	4

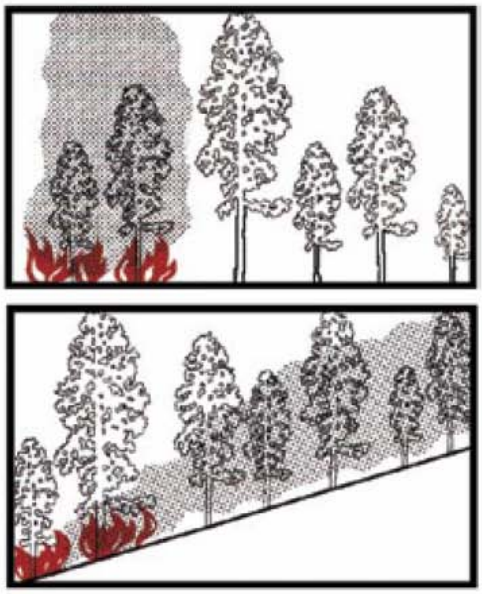
Legend: 5 – Problem may be crucial; 4 – Problem very likely;
3 – Exercise caution; 2 – Problem usually limited;
1 – No rating possible

Wildfire Hazard Maps

The Colorado State Forest Service (CSFS), numerous counties and some National Forests have completed wildfire hazard mapping for many areas within Colorado, particularly along the Front Range. These maps typically consider areas with 30 percent or greater slope; hazardous fuel types; and hazardous topographic features such as fire chimneys. Wildfire Hazard Ratings may be depicted in several ways. Whatever system is used, areas rated moderate or higher should be considered for fuel modification work.

Slope

Rate of fire spread increases as the slope of the land increases. Fuels are preheated by the rising smoke column or they may even come into contact with the flames themselves.



Fire effects, flat vs steep terrain. Note preheating of fuels on steep ground from passage of smoke column.

At 30 percent slope, rate of fire spread doubles compared to rates at level ground, drastically reducing firefighting effectiveness. **Areas near 30 percent or greater slopes are critical and must be reviewed carefully.**

Topography

Certain topographic features influence fire spread and should be evaluated. Included are fire chimneys, saddles, and V-shaped canyons. They are usually recognized by reviewing standard U.S.G.S. quad maps.

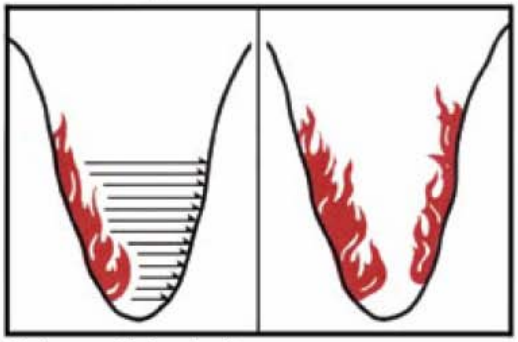
• Chimneys are densely vegetated drainages on slopes greater than 30 percent. Wind, as well as air pre-heated by a fire, tends to funnel up these drainages, rapidly spreading fire upslope.

• Saddles are low points along a main ridge or between two high points. Like chimneys, they also funnel winds to create a natural fire path during a fire's uphill run. Saddles act as corridors to spread fire into adjacent valleys or drainages.

Chimney.

Saddle.

• Narrow, V-shaped valleys or canyons can ignite easily due to heat radiating from one side to the other. For example, a fire burning on one side of a narrow valley dries and preheats fuels on the opposite side until the fire "flashes over." The natural effect of slope on fire then takes over and fire spreads rapidly up drainage and uphill along both sides of the valley.



Flashover in V-shaped valley.

Crowning Potential

An on-site visit is required to accurately assess crowning potential. A key, below, helps determine this rating. Fuel modification is usually unnecessary if an area has a rating of 3 or less.

Crowning Potential Key

	Rating
A. Foliage present, trees living or dead — B	
B. Foliage living — C	
C. Leaves deciduous or, if evergreen, usually soft, pliant, and moist; never oily, waxy, or resinous.	0
CC. Leaves evergreen, not as above — D	
D. Foliage resinous, waxy, or oily — E	
E. Foliage dense — F	
F. Ladder fuels plentiful — G	
G. Crown closure > 75 percent	9
GG. Crown closure < 75 percent	7
FF. Ladder fuels sparse or absent — H	
H. Crown closure > 75 percent	7
HH. Crown closure < 75 percent	5
EE. Foliage open — I	
I. Ladder fuel plentiful	4
II. Ladder fuel sparse or absent	2
DD. Foliage not resinous, waxy, or oily — J	
J. Foliage dense — K	
K. Ladder fuels plentiful — L	
L. Crown closure > 75 percent	7
LL. Crown closure < 75 percent	4
KK. Ladder fuels sparse or absent — M	
M. Crown closure > 75 percent	5
MM. Crown closure < 75 percent	3
JJ. Foliage open — N	
N. Ladder fuels plentiful	3
NN. Ladder fuels sparse or absent	1
BB. Foliage dead	0

The majority of dead trees within the fuelbreak should be removed. Occasionally, large, dead trees (14 inches or larger in diameter at 4 1/2 feet above ground level) may be retained as wildlife trees. If retained, all ladder fuels must be cleared from around the tree's trunk.

Ignition Sources

Possible ignition sources, which may threaten planned or existing developments, must be investigated thoroughly. Included are other developments and homes, major roads, recreation sites, railroads, and other possible sources. These might be distant from the proposed development, yet still able to channel fire into the area due to slope, continuous fuels, or other topographic features.

Fuelbreak Locations

In fire suppression, an effective fire line is connected, or "anchored," to natural or artificial fire barriers. Such anchor points might be rivers, creeks, large rock outcrops, wet meadows, or a less flammable timber type such as aspen. Similarly, properly designed and constructed fuelbreaks take advantage of these same barriers to eliminate "fuel bridges." (Fire often escapes control because of fuel bridges that carry the fire across control lines.)

Since fuelbreaks should normally provide quick, safer access to defensive positions, they are necessarily linked with road systems. Connected with county-specified roads within subdivisions, they provide good access and defensive positions for firefighting equipment and support vehicles. Cut-and fill slopes of roads are an integral part of a fuelbreak as they add to the effective width of modified fuels.

Fuelbreaks without an associated road system, such as those located along strategic ridge lines, are still useful in fire suppression. Here, they are often strengthened and held using aerial retardant drops until fire crews can walk in or be ferried in by helicopter.

Preferably, fuelbreaks are located along ridge tops to help arrest fires at the end of their runs. However, due to homesite locations and resource values, they can also be effective when established at the base of slopes. Mid-slope fuelbreaks are least desirable, but under certain circumstances and with modifications, these too, may be valuable.

Fuelbreaks are located so that the area under management is broken into small, manageable units. Thus, when a wildfire reaches modified fuels, defensive action is more easily taken, helping to keep the fire small. For example, a plan for a subdivision might recommend that fuelbreaks break up continuous forest fuels into units of 10 acres or less. This is an excellent plan, especially if defensible space thinnings are completed around homes and structures, and thinning for forest management and forest health are combined with the fuelbreak.

When located along ridge tops, continuous length as well as width are critical elements. Extensive long-range planning is essential in positioning these types of fuelbreaks.

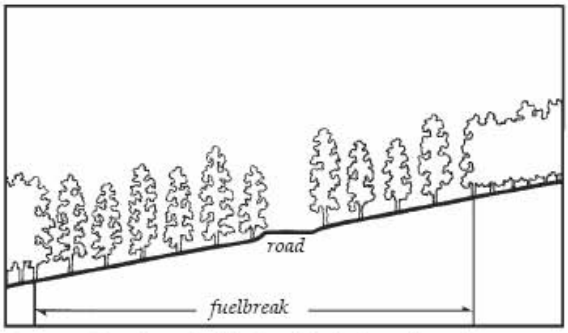
Aesthetics

Improperly planned fuelbreaks can adversely impact an area's aesthetic qualities. Careful construction is necessary when combining mid-slope fuelbreaks with roads involving excessive cut-and-fill.

These photos, far- and near- views of the same site, illustrate that forest can be thinned without impacting aesthetics.

Care must also be taken in areas that are not thinned throughout for fuel hazard reduction. In such cases the fuelbreak visually sticks out like a "sore thumb" due to contrasting thinned and unthinned portions of the forest. (Especially noticeable are those portions of the fuelbreak above road cuts).

These guidelines are designed to minimize aesthetic impacts. However, some situations may require extensive thinning and, thus, result in a major visual change to an area. Additional thinning beyond the fuelbreak may be necessary to create an irregular edge and to "feather," or blend, the fuelbreak thinning into the unthinned portions of the forest. Any thinning beyond the fuelbreak improves its effectiveness and is highly recommended.



Cross-section of a typical fuelbreak built in conjunction with a road.

Constructing the Fuelbreak

Fuelbreak Width and Slope Adjustments

Note: Since road systems are so important to fuelbreak construction, the following measurements are from the toe of the fill for downslope distances, and above the edge of the cut for uphill distances.

The minimum recommended fuelbreak width is approximately 300 feet for level ground. Since fire activity intensifies as slope increases, the overall fuelbreak width must also increase. However, to minimize aesthetic impacts and to maximize fire crew safety, the majority of the increases should be made at the bottom of the fuelbreak, below the road cut.

Widths are also increased when severe topographic conditions are encountered. Guidelines for fuelbreak widths on slopes are given below:

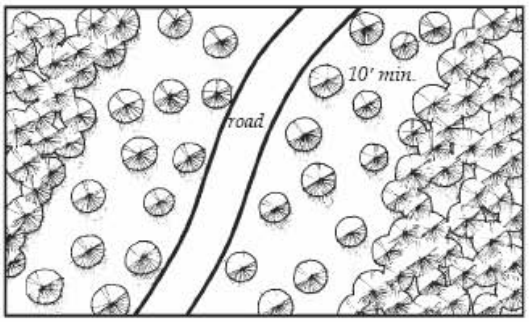
Fuelbreak Width/Slope

Percent Slope (%)	Minimum Uphill Distance (ft)	Minimum Downhill Distance (ft)	Total Width of Modified fuels (ft)*
0	150	150	300
10	140	165	303
20	130	180	310
30	120	195	315
40	110	210	320
50	100	225	325
60	100	240	340

*As slope increases, total distance for cut-and-fill for road construction rapidly increases, improving fuelbreak effective width.

Stand Densities

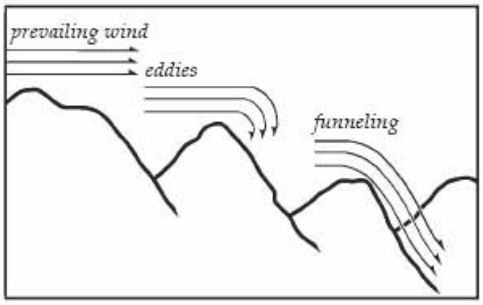
Crown separation is a more critical factor for fuelbreaks than a fixed tree density level. A *minimum* 10-foot spacing between the edges of tree crowns is recommended on level ground. As slope increases, crown spacing should also increase. However, small, isolated groups of trees may be retained for visual diversity. Increase crown spacing around any groups of trees left for aesthetic reasons and to reduce fire intensities and torching potential.



Plan view of fuelbreak showing minimum distance between tree crowns.

In technical terms, a fuelbreak thinning is classified as a heavy "sanitation and improvement cut, from below." Within fuelbreaks, trees that are suppressed, diseased, deformed, damaged, or of low vigor are removed along with all ladder fuels. Remaining trees are the largest, healthiest, most wind-firm trees from the dominant and co-dominant species of the stand.

Because such a thinning is quite heavy for an initial entry into a stand, prevailing winds, eddy effects, and wind funneling must be carefully evaluated to minimize the possibility of windthrow. It may be necessary to develop the fuelbreak over several years to allow the timber stand to "firm-up" — this especially applies to lodgepole pine and Engelmann spruce stands.



Topography affects wind behavior – an important consideration during fuelbreak construction.

Area-wide forest thinnings are recommended for any subdivisions. Such thinning is not as severe as a fuelbreak thinning, but generally should be completed to fuelbreak specifications along the roads (as outlined on page 6.) In addition, "defensible space thinnings" are highly recommended around all structures (see CSU Coop. Extension Fact sheet 6.302, *Creating Wildfire-Defensible Zones*).

Debris Removal

Limbs and branches left from thinning (slash) can add significant volumes of fuel to the forest floor, especially in lodgepole pine, mixed-conifer, or spruce/fir timber types. These materials can accumulate and serve as ladder fuels, or can become "jackpots," increasing the difficulty of defending the fuelbreak during a wildfire. **Slash decomposes very slowly in Colorado and proper disposal is essential.** Proper treatment reduces fire hazard, improves access for humans and livestock, encourages establishment of grasses and other vegetation, and improves aesthetics.

Three treatment methods are commonly used. These are lopping-and-scattering, piling and burning, and chipping. Mulching of small trees and slash using equipment similar to Hydro-axes or Timbcos equipped with mulching heads are becoming a popular method of treatment. Size, amount, and location of slash dictates the method used, in addition to cost and the final desired appearance. The method chosen will also depend on how soon an effective fuelbreak is needed prior to construction in new developments.

Lop and scatter: slash should be no deeper than 12" above ground surface.

Chipping is the most desirable, but also the most expensive method of slash disposal.

Piled slash can be burned but only during certain conditions, such as after a snowfall.

Fuelbreak Maintenance

Following initial thinning, trees continue to grow (usually at a faster rate). The increased light on the forest floor encourages heavy grass and brush growth where, in many cases, where little grew before. The site disturbance and exposed mineral soil created during fuelbreak development is a perfect seed bed for new trees that, in turn, create new ladder fuels. Thus, in the absence of maintenance, fuelbreak effectiveness will decrease over time.

Fuelbreak maintenance is essential. Ingrowth, shown above, will minimize the effectiveness of this fuelbreak within a few years.

Fuelbreak maintenance problems are most often the result of time and neglect. Misplaced records, lack of follow-up and funding, and apathy caused by a lack of fire events are some of the major obstacles. In addition, the responsibility for fuelbreak maintenance projects is often unclear. For example, control of a fuelbreak completed by a developer passes to a homeowner's association, usually with limited funds and authority to maintain fuelbreaks.

If fuelbreak maintenance is not planned and completed as scheduled, consider carefully whether the fuelbreak should be constructed. An un-maintained fuelbreak may lead to a false sense of security among residents and fire suppression personnel.

Conclusion

An image of well-designed communities for Colorado includes:

- Forested subdivisions where the total forest cover is well-managed through carefully planned, designed, and maintained thinnings. This contributes to reduced wildfire hazards and a much healthier forest — one that is more resistant to insects and disease.
- A system of roads and driveways with their associated fuelbreaks that break up the continuity of the forest cover and fuels. These help keep fires small, while also providing safer locations from which to mount fire suppression activities. In addition to allowing fire personnel in, they will allow residents to evacuate if necessary.
- Individual homes that all have defensible space around them, making them much easier to defend and protect from wildfire, while also protecting the surrounding forest from structure fires.

Creation of such communities is entirely feasible if recognition of the fire risks, a spirit of cooperation, an attitude of shared responsibility, and the political will exists.

Colorado's mountains comprise diverse slopes, fuel types, aspects, and topographic features. This variety makes it impossible to develop general fuelbreak prescriptions for all locations. ***The previous recommendations are guidelines only.*** *A professional forester with fire suppression expertise should be consulted to "customize" fuelbreaks for particular areas.*

APPENDIX G
CREATING WILDFIRE DEFENSIBLE ZONES

NATURAL RESOURCES SERIES

FORESTRY

Creating Wildfire-Defensible Zones no. 6.302

by F.C. Dennis [1]

Quick Facts...

Wildfire will find the weakest links in the defense measures you have taken on your property.

The primary determinants of a home's ability to survive wildfire are its roofing material and the quality of the "defensible space" surrounding it.

Even small steps to protect your home and property will make them more able to withstand fire.

Consider these measures for all areas of your property, not just the immediate vicinity of the house.

Colorado State University Cooperative Extension

Putting Knowledge to Work

Fire is capricious. It can find the weak link in your home's fire protection scheme and gain the upper hand because of a small, overlooked or seemingly inconsequential factor. While you may not be able to accomplish all measures below (and there are no guarantees), each will increase your home's, and possibly your family's, safety and survival during a wildfire.

Start with the easiest and least expensive actions. Begin your work closest to your house and move outward. Keep working on the more difficult items until you have completed your entire project.

Defensible Space

Two factors have emerged as the primary determinants of a home's ability to survive wildfire. These are the home's roofing material and the quality of the "defensible space" surrounding it.

Use fire-resistive materials (Class C or better rating), not wood or shake shingles, to roof homes in or near forests and grasslands. When your roof needs significant repairs or replacement, do so with a fire-resistant roofing material. Check with your county building department. Some counties now restrict wood roofs or require specific classifications of roofing material.

Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space provides *room for firefighters to do their jobs.* Your house is more likely to withstand a wildfire if grasses, brush, trees and other common forest fuels are managed to reduce a fire's intensity.

The measure of fuel hazard refers to its continuity, both horizontal (across the ground) and vertical (from the ground up into the vegetation crown). Fuels with a high degree of both vertical and horizontal continuity are the most hazardous, particularly when they occur on slopes. Heavier fuels (brush and trees) are more hazardous (i.e. produce a more intense fire) than light fuels such as grass.

Mitigation of wildfire hazards focuses on breaking up the continuity of horizontal and vertical fuels. Additional distance between fuels is required on slopes.

Creating an effective defensible space involves developing a series of management zones in which different treatment techniques are used. See Figure 1 for a general view of the relationships among these management zones. Develop defensible space around each building on your property. Include detached garages, storage buildings, barns and other structures in your plan.

The actual design and development of your defensible space depends on several factors: size and shape of buildings, materials used in their construction, the slope of the ground on which the structures are built, surrounding topography,

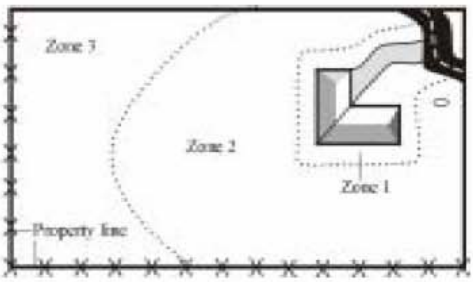


Figure 1: Forested property showing the three fire-defensible zones around a home or other structure.

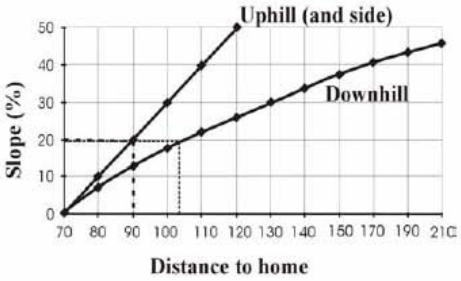


Figure 2: This chart indicates the *minimum recommended* dimensions for defensible space from the home to the outer edge of Zone 2. For example, if your home is situated on a 20 percent slope, the minimum defensible space dimensions would be 90 feet uphill and to the sides of the home and 104 feet downhill from the home.

and sizes and types of vegetation on your property. These factors all affect your design. You may want to request additional guidance from your local Colorado State Forest Service (CSFS) forester or fire department. (See the Special Recommendations section of this fact sheet for shrubs, lodgepole pine, Engelmann spruce, and aspen.)

Defensible Space Management Zones

Zone 1 is the area of maximum modification and treatment. It consists of an area of 15 feet around the structure in which all flammable vegetation is removed. This 15 feet is measured from the outside edge of the home's eaves and any attached structures, such as decks.

Zone 2 is an area of fuel reduction. It is a transitional area between Zones 1 and 3. The size of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space should extend *at least* 75 to 125 feet from the structure. See Figure 2 for the appropriate distance for your home's defensible space. Within this zone, the continuity and arrangement of vegetation is modified. Remove stressed, diseased, dead or dying trees and shrubs. Thin and prune the remaining larger trees and shrubs. Be sure to extend thinning along either side of your driveway all the way to your main access road. These actions help eliminate the continuous fuel surrounding a structure while enhancing homesite safety and the aesthetics of the property.

Zone 3 is an area of traditional forest management and is of no particular size. It extends from the edge of your defensible space to your property boundaries.

Prescriptions

Zone 1

The size of Zone 1 is 15 feet, measured from the edges of the structure. Within this zone, several specific treatments are recommended.

Plant nothing within 3 to 5 feet of the structure, particularly if the building is sided with wood, logs or other flammable materials. Decorative rock, for example, creates an attractive, easily maintained, nonflammable ground cover.

If the house has noncombustible siding, widely spaced foundation plantings of low growing shrubs or other "fire wise" plants are acceptable. Do not plant directly beneath windows or next to foundation vents. Be sure there are no areas of continuous grass adjacent to plantings in this area.

Frequently prune and maintain plants in this zone to ensure vigorous growth and a low growth habit. Remove dead branches, stems and leaves.

Do not store firewood or other combustible materials in this area. Enclose or screen decks with metal screening. Extend the gravel coverage under the decks. Do not use areas under decks for storage.

Ideally, remove all trees from Zone 1 to reduce fire hazards. If you do keep a tree, consider it part of the structure and extend the distance of the entire defensible space accordingly. Isolate the tree from any other surrounding trees. Prune it to at least 10 feet above the ground. Remove any branches that interfere with the roof or are within 10 feet of the chimney. Remove all "ladder fuels" from beneath the tree. Ladder fuels are vegetation with vertical continuity that allows fire to burn from ground level up into the branches and crowns of trees. Ladder fuels are potentially very hazardous but are easy to mitigate. No ladder fuels can be allowed under tree canopies. In all other areas, prune all branches of shrubs or trees up to a height of 10 feet above ground (or 1/2 the height, whichever is the least).

Zone 2

Zone 2 is an area of fuel reduction designed to reduce the intensity of any fire approaching your home. Follow these recommended management steps.

Thin trees and large shrubs so there is at least 10 feet between crowns. Crown separation is measured from the furthest branch of one tree to the nearest branch on the next tree (Figure 3). On steep slopes, allow more space between tree crowns. (See Figure 4 for *minimum recommended* spacing for trees on steep slopes.) Remove all ladder fuels from under these remaining trees. Carefully prune trees to a height of at least 10 feet.

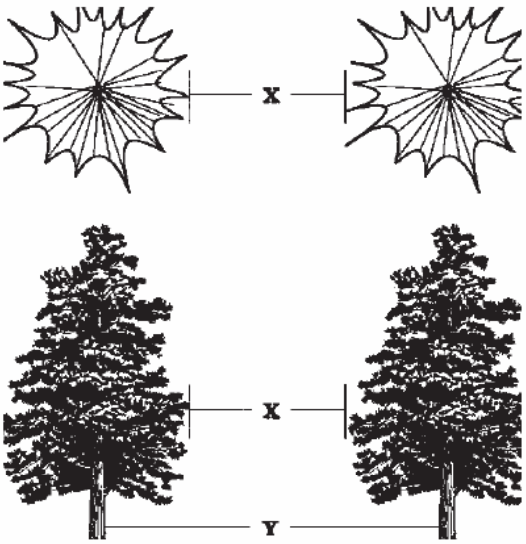


Figure 3: X = crown spacing; Y = stem spacing. Do not measure between stems for crown — measure between the edges of tree crowns.

Small clumps of 2 to 3 trees may be occasionally left in Zone 2. Leave more space between the crowns of these clumps and surrounding trees.

Because Zone 2 forms an aesthetic buffer and provides a transition between zones, it is necessary to blend the requirements for Zones 1 and 3. Thin the portions of Zone 3 adjacent to Zone 2 more heavily than the outer portions.

Isolated shrubs may remain, provided they are not under tree crowns. Prune and maintain these plants periodically to maintain vigorous growth. Remove dead stems from trees and shrubs annually. Where shrubs are the primary fuel in Zone 2, refer to the Special Recommendations section of this fact sheet.

Limit the number of dead trees (snags) retained in this area. Wildlife needs only one or two snags per acre. Be sure any snags left for wildlife cannot fall onto the house or block access roads or driveways.

Mow grasses (or remove them with a weed trimmer) as needed through the growing season to keep them low, a maximum of 6 to 8 inches. This is extremely critical in the fall when grasses dry out and cure or in the spring after the snow is gone but before the plants green up.

Stack firewood and woodpiles uphill or on the same elevation as the structure but at least 30 feet away. Clear and keep away flammable vegetation within 10 feet of these woodpiles. Do not stack wood against your house or on or under your deck, even in winter. Many homes have burned from a woodpile that ignited as the fire passed. Wildfires can burn at almost any time in Colorado.

Locate propane tanks at least 30 feet from any structures, preferably on the same elevation as the house. You don't want the LP container below your house — if it ignites, the fire would tend to burn uphill. On the other hand, if the tank is above your house and it develops a leak, LP gas will flow downhill into your home. Clear and keep away flammable vegetation within 10 feet of these tanks. Do not screen propane tanks with shrubs or vegetation.

Dispose of slash (limbs, branches and other woody debris) from your trees and shrubs through chipping or by piling and burning. Contact your local CSFS office or county sheriff's office for information about burning slash piles. If neither of these alternatives is possible, lop and scatter slash by cutting it into very small pieces and distributing it over the ground. Avoid heavy accumulations

% slope	Tree Crown Spacing	Brush and Shrub Clump Spacing
0 -10 %	10´	2 1/2 x shrub height
11 - 20%	15´	3 x shrub height
21 - 40%	20´	4 x shrub height
> 40%	30´	6 x shrub height

Figure 4: Minimum tree crown and shrub clump spacing.

Grasses

Keep dead, dry or curing grasses mowed to less than 6 inches. Defensible space size where grass is the predominant fuel can be reduced (Figure 5) when applying this practice.

Windthrow

In Colorado, certain locations and tree species, including lodgepole pine and Engelmann spruce, are especially susceptible to damage and uprooting by high winds (windthrow). If you see evidence of this problem in or near your forest, or have these tree species, consider the following adjustments to the defensible space guidelines. It is highly recommended that you contact a professional forester to help design your defensible space.

Adjustments: If your trees or homesite are susceptible to windthrow and the trees have never been thinned, use a stem spacing of diameter plus five instead of the guides listed in the Zone 3 section. Over time (every 3 to 5 years) *gradually* remove additional trees. The time between cutting cycles allows trees to "firm up" by expanding their root systems. Continue this periodic thinning until the desired spacing is reached.

Also consider leaving small clumps of trees and creating small openings on their lee side (opposite of the predominant wind direction). Again, a professional forester can help you design the best situation for your specific homesite and tree species. Remember, with species such as lodgepole pine and Engelmann spruce, the likelihood of a wildfire running through the tree tops or crowns (crowning) is closely related to the overabundance of fuels on the forest floor. Be sure to remove downed logs, branches and *excess* brush and needle buildup.

Maintaining Your Defensible Space

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

% slope	D-space size (uphill, downhill, sidehill)
0 - 20 %	30'
21 - 40%	50'
> 40%	70'

Figure 6: Minimum defensible space size for grass fuels.

Defensible Space and FireWise Annual Checklist

- ☐ Trees and shrubs are properly thinned and pruned within the defensible space. Slash from the thinning is disposed of.
- ☐ Roof and gutters are clear of debris.
- ☐ Branches overhanging the roof and chimney are removed.
- ☐ Chimney screens are in place and in good condition.
- ☐ Grass and weeds are mowed to a low height.
- ☐ An outdoor water supply is available, complete with a hose and nozzle that can reach all parts of the house.
- ☐ Fire extinguishers are checked and in working condition.
- ☐ The driveway is wide enough. The clearance of trees and branches is adequate for fire and emergency equipment. (Check with your local fire department.)
- ☐ Road signs and your name and house number are posted and easily visible.
- ☐ There is an easily accessible tool storage area with rakes, hoes, axes and shovels for use in case of fire.
- ☐ You have practiced family fire drills and your fire evacuation plan.
- ☐ Your escape routes, meeting points and other details are known and understood by all family members.
- ☐ Attic, roof, eaves and foundation vents are screened and in good condition.

FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

Stilt foundations and decks are enclosed, screened or walled up.

- ☐ Trash and debris accumulations are removed from the defensible space.
- ☐ A checklist for fire safety needs inside the home also has been completed. This is available from your local fire department.

References

Colorado State Forest Service, Colorado State University, Fort Collins, CO 80523-5060; (970) 491-6303:

- *FireWise Construction — Design and Materials*
- Home Fire Protection in the Wildland Urban Interface
- Wildfire Protection in the Wildland Urban Interface
- *Landowner Guide to Thinning*

Colorado State University Cooperative Extension, 115 General Services Bldg., Fort Collins, CO 80523-4061; (970) 491-6198; E-mail: resourcecenter@ucm.colostate.edu:

- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Forest Home Fire Safety*
- 6.305, *FireWise Plant Materials*
- 6.306, *Grass Seed Mixes to Reduce Wildfire Hazard*
- 7.205, *Pruning Evergreens*
- 7.206, *Pruning Shrubs*
- 7.207, *Pruning Deciduous Trees*

Colorado State Forest Service

This fact sheet was produced in cooperation with the Colorado State Forest Service.

[1] *Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.*

APPENDIX H

PRESCRIBED PILE BURNING GUIDELINES

Colorado State FOREST SERVICE
GOLDEN DISTRICT

This handout is designed to be used by forest landowners, land managers, and fire department personnel in planning and conducting safe and effective burning of piled forest debris ("slash") called "pile burns." These guidelines cannot guarantee safety against accidents, unforeseen circumstances, changing burning conditions, or negligent actions of the individuals conducting the prescribed fire. By following the intent of these guidelines and using common sense, the landowner or forest manager can reduce slash accumulations, improve the appearance of their forest land, and reduce wildfire risk on their property. The reader should contact a local office of the Colorado State Forest Service (CSFS) or their local fire authority for updated versions of this publication and current requirements about the use of open fires.

DEFINITIONS:

Slash: The accumulation of vegetative materials such as tops, limbs, branches, brush, and miscellaneous residue resulting from forest management activities such as thinning, pruning, timber harvesting, and wildfire hazard mitigation.

Pile Burning: The treatment of slash by arranging limbs and tops into manageable piles. Piles are burned during safe burning conditions, generally during the winter following cutting.

Chunking-In: The process of moving unburned materials from the outside perimeter into the center of the still burning piles. This is done after the pile has initially burned down and is safe to approach, but before the hot coals in the center have cooled. Chunking-in allows greater consumption of the piled slash.

Mop-up: The final check of the fire to identify and extinguish any still-burning embers or materials. This is accomplished by mixing snow, water, or soil with the burning materials.

MATERIALS TO BE INCLUDED IN PILES:

All limbs, tops, brush, and miscellaneous materials recently cut in the area, no greater than 3 inches in diameter and from 1 to 8 feet in length. Older branches can be used as long as they still have needles/foliage attached or have not started decaying. Materials greater than 3 inches in diameter do not significantly help a fire spread rapidly, will generally burn longer and require more chunking-in or mopping-up than is cost-effective, produce greater amounts of smoke, and should be used for sawtimber, posts and poles, firewood, or left for wildlife habitat. **Do not place garbage or debris in the piles**.

LOCATION OF PILES:

Piles should be located in forest openings or between remaining trees, in unused logging roads and landings, meadows, and rock outcrops. Piles should be preferably at least 10 feet from the trunk of any overhead trees. In denser stands of trees, piles can be located closer to the trees and even under the overhanging branches, but these piles should be smaller in size and burned when snow or moisture is present in the tree crowns. Piles should NOT be located on active road surfaces, in ditches, near structures or poles, under or around power lines, or on top of logs or stumps that may catch fire and continue smoldering.

CONSTRUCTION OF PILES:

Piles should be constructed by hand whenever possible, but if constructed by machine they should clean of dirt and debris. Piles should be started with a core of kindling-like materials such as needles, small branches, or paper in the bottom of the pile. Pile slash soon after cutting (while still green) and before winter snowfall. Do not include wood products such as firewood and logs. Pile branches and tops with the butt ends towards the outside of the pile, and with the branches overlapping so as to form a series of dense layers piled upon each other. The piles should be compact, packed down during construction, and with no long branches that will not burn from sticking out into the surrounding snow. Piles should be up to 8 feet in diameter, and at least 4 to 6 feet high. These measures prevent snow and moisture from filtering down into the piles and extinguishing the fire before it gets going. If the fuels do not have sufficient needles or fine fuels to carry the fire or kept moisture out (such as oak brush or very old conifer branches), then you should cover the piles with 6 mil plastic to keep them dry until the day of the burn, and then remove it.

PLANNING YOUR BURNING EFFORT:

Individuals should check with the local CSFS office or fire authority for the current requirements on open fires. Generally, you must complete one or more of the following steps before burning slash:

1. Complete and have an approved open burning permit from the local (county) Health Department.

2. Obtain authorization from the legally constituted fire authority for your area. This may be part of the health department's permit process.
3. Land management agencies must complete and have approval of an open burning permit from the Colorado Department of Health - Air Pollution Control Division.

Copies of all permits should be available on-site during the burning operation. Burning activities should also include plans for safety, supplemental water sources, and extra assistance from the local fire authority or the landowner. The individual(s) planning the burning operation should notify the following entities on the day of a burn: the local fire authority, county sheriff's department, and adjacent landowners who may be affected by smoke. Notification should include the date, times, and exact location of the burn.

Pile burning must be conducted under suitable weather conditions. Periods of snow or light rain, with steady, light winds (for smoke dispersal), and sufficiently snow cover (6-12 inch depths) are ideal. Do not burn during periods of high winds, low humidity or drying conditions, temperature inversions (especially "Red Air Quality" days in metropolitan areas), with a lack of snow cover or these conditions are expected to develop after starting the burn. Persons burning slash piles should have the following: leather gloves; shovels; suitable footwear; masks for covering the mouth and nose; and proper eye protection.

BURNING SLASH PILES:

Piles may be ignited by several means. If the needles and fine fuels within the pile have dried though the summer, ignition can be easily started with matches and a large ball of newspaper placed within the bottom of the pile. If fuels are still partially green, or the pile is wet from rain or melting snow, then a hotter and longer burning source may be necessary. Drip torches (a specially designed gas can used by foresters for igniting fires) or sawdust soaked with diesel fuel can be used to ignite the pile. Flares used for highway emergencies can also be utilized to ignite the piles. **Do not use gasoline for this purpose.**

One test pile should be ignited to see if it burns and at what rate, prior to igniting other piles. If suitable burning conditions exist, then additional piles may be started. Ignite only those piles that can be controlled by the available manpower and resources until they have burned down. You can slow the rate of burning (and possible scorching of adjacent trees) by shoveling snow or spraying water into the pile and cooling the fire down. Depending upon weather conditions, pile size, and moisture content of the fuels, piles should burn down in 30-60 minutes. As a general rule, one person can manage three to six closely situated piles.

After the piles have burned down, chunk-in any unburned slash and wood into the hot coals in the center of the pile. As much as 95 percent of the original slash can be consumed by aggressive chunking-in. Do not start any new piles on fire after 2:00 pm, as they may continue burning into the evening, and will not burn as completely due to lower temperatures and higher relative humidity. Smoke inversions may be a problem for piles still burning after sunset. At all times, piles may need to be actively mopped-up if the

weather conditions will not extinguish the fire, or if the fires could escape. If high winds or melting snow increases this risk, then all burning materials must be mopped-up.

ADDITIONAL ASSISTANCE:

If landowners have questions about burning slash, they should contact a local CSFS office (http://csfs.colostate.edu/). CSFS can assist landowners with planning or conducting prescribed fire activities such as pile burning or broadcast (area) burning. Local, state, and fire department authorities may require a burn plan, smoke management plan, and weather monitoring for complex burning operations.

APPENDIX I
WEB REFERENCE GLOSSARY

Resource	Web Site
Jefferson County Emergency Operating Plan	http://www.co.jefferson.co.us/ca/chap06016.htm#P6_19
Jefferson County Policies and Procedures	http://www.co.jefferson.co.us/ca/ca_T148_R2.htm
Jefferson County CWPP project site	http://www.co.jefferson.co.us/emerg/index.htm
Colorado State Forest Service Library	http://csfs.colostate.edu/library.htm
Rocky Mtn Geographic Science Center – Wildfire Support	http://wildfire.cr.usgs.gov
FireWise	http://www. Firewise.org.
Searchable Grants Database	http://www.rockymountainwildlandfire.info/
Jefferson County Office of Emergency Management	http://www.co.jefferson.co.us/emerg/
Fairmount FPD	http://www.fairmountfire.org/
Landfire Geospatial Data	http://www.landfire.gov/products_overview.php
Colorado State Forest Service	http://csfs.colostate.edu/
National Fire Weather	http://fire.boi.noaa.gov/
RAWS Station index for the Rocky Mountain Geographic Coordinating Area	http://raws.wrh.noaa.gov/cgi-bin/roman/raws_ca_monitor.cgi?state=RMCC&rawsflag=2
Fort Collins Interagency Wildfire Dispatch Center Web Index	http://www.fs.fed.us/r2/arnf/fire/fire.html
Colorado Forest Industries Directory	http://www.colostate.edu/programs/cowood/New_site/Publications/Articles/Colorado%20Forest%20Industry%20Directory.pdf
Current Weather Summary for Rocky Mountain Geographic Coordinating Area	http://raws.wrh.noaa.gov/cgi-bin/roman/raws_ca_monitor.cgi?state=RMCC&rawsflag=2

APPENDIX J
LIST OF PREPARERS

Preparer	Company
Jerry Barker, Ph.D., Rangeland and Fire Ecologist	Walsh Environmental Scientists and Engineers, LLC
George Greenwood, Wildland Fire Specialist	Walsh Environmental Scientists and Engineers, LLC
Geoff Butler, Wildland Fire Specialist	Alpenfire, LLC
Kelly Close, Fire Behavior Analyst	Independent Contractor
Fred Groth, Director of Geospatial Technologies	Walsh Environmental Scientists and Engineers, LLC

APPENDIX K
GRASS SEED MIXES TO REDUCE WILDFIRE HAZARD

NATURAL RESOURCES SERIES

FORESTRY

Grass Seed Mixes to Reduce Wildfire Hazard **no. 6.306**

by F.C. Dennis[1]

Quick Facts...

Plant "FireWise" grass species to reduce the risk of wildfire damage.

"FireWise" grass mixes may contain only native species or a combination of native and non-native species.

Sow half the seed north to south and the other half east to west.

Rake the seed into the soil.

Mulch erosion-prone areas.

If possible, water often and lightly.

Maintain the area properly.

During much of the year, grasses ignite easily and burn rapidly. Tall grass will quickly carry fire to your house. Plant "FireWise" grasses in the defensible space around your home. Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire. See fact sheet 6.302, *Creating Wildfire-Defensible Zones*.

Seed Mixes for Colorado

Grass seed mixes developed for Colorado use native or a combination of native and non-native grass species. While the basic mixes (Tables 1 and 3) work reasonably well on all sites, they were modified for moist sites and/or those with northern exposures (Tables 2 and 4).

Grasses included in these mixes have the following characteristics:

- They are lower growing.
- They need less maintenance.
- Seed is readily available and relatively inexpensive.

Grass seed mixes made up entirely of native seed may take longer to establish — up to three years — than those with a percentage of non-native seed.

Planting

Use either a drop or a cyclone seeder to seed your defensible space.

A drop seeder is more accurate in placing seed, especially if wind is a problem. However, if the ground is rough or rocky, the cyclone seeder will be easier to use.

Seed at the rates shown in the tables below. Divide seed into two equal parts. Sow half of the seed by crossing the area north to south and the other half by crossing east to west.

Rake seed into the soil as soon as possible after sowing to reduce the chances of it blowing or washing out. Soil cover also helps to protect the young seedlings from drying out. When sowing on slopes prone to erosion, cover the seeded area with mulch. Recommended mulches include **clean** straw (straw with no seeds in it), netting or matting of some kind.

If you have water from a central community system or a well permit that allows outside irrigation, water the newly seeded areas frequently and lightly. Water enough to keep the soil moist but not so heavily as to cause soil washing and loss of the grass seed.

Maintenance

Even "FireWise" grasses need proper maintenance. See 6.303, *Fire-Resistant Landscaping*, for tips on proper mowing and other maintenance and landscaping suggestions.

Colorado State University Cooperative Extension

Putting Knowledge to Work

FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

Native Grass "Fire Mixes"

Table 1: All exposures.

Species	Variety	Percent of Mix	Broadcast Rate PLS* Lbs/Acre
Arizona fescue	Redondo	20	9.0 x .20 = 1.80
Western wheatgrass	Barton/Rosana	20	32.0 x .20 = 6.40
Streambank wheatgrass	Sodar	20	22.0 x .20 = 4.40
Indian ricegrass	Nezpar	20	25.0 x .20 = 5.00
Blue grama	Lovington	20	6.0 x .20 = 1.20
	TOTALS	100%	18.80

Table 2: Northerly exposures and/or moist sites.

Species	Variety	Percent of Mix	Broadcast Rate PLS* Lbs/Acre
Arizona fescue	Redondo	25	9.0 x .25 = 2.25
Western wheatgrass	Barton/Rosana	25	32.0 x .25 = 8.00
Streambank wheatgrass	Sodar	25	22.0 x .25 = 5.50
Indian ricegrass	Nezpar	25	25.0 x .25 = 6.25
	TOTALS	100%	22.00

Non-Native/Native Grass "Fire Mixes"

Table 3: All exposures.

Species	Variety	Percent of Mix	Broadcast Rate PLS* Lbs/Acre
Canada bluegrass	Reubens	10	2.0 x .10 = 0.20
Western wheatgrass	Barton/Rosana	20	32.0 x .20 = 6.40
Streambank wheatgrass	Sodar	15	22.0 x .15 = 3.30
Indian ricegrass	Nezpar	15	25.0 x .15 = 3.75
Sheep fescue	Covar	20	8.0 x .20 = 1.60
Blue grama	Lovington	20	6.0 x .20 = 1.20
	TOTALS	100%	16.45

Table 4: Northerly exposures and/or moist sites.

Species	Variety	Percent of Mix	Broadcast Rate PLS* Lbs/Acre
Canada bluegrass	Reubens	15	2.0 x .15 = 0.30
Western wheatgrass	Barton/Rosana	20	32.0 x .20 = 6.40
Streambank wheatgrass	Sodar	20	22.0 x .20 = 4.40
Indian ricegrass	Nezpar	15	25.0 x .15 = 3.75
Sheep fescue	Covar	30	8.0 x .30 = 2.40
	TOTALS	100%	17.25

*Pure Live Seed.

References

For additional information on protecting your homesite, see:

- 6.302, *Creating Wildfire-Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Forest Home Fire Safety*
- 6.305, *FireWise Plant Materials*

Colorado State Forest Service

This fact sheet was produced in cooperation with the Colorado State Forest Service.

[1]*Wildfire Hazard Mitigation Coordinator, Colorado State Forest Service.*

APPENDIX L
WILDFIRE HISTORY
SIGNIFICANT WILDFIRE HISTORY within Wildland Urban Interface – CSFS Golden District and Immediate Vicinity

(Prepared by Allen Gallamore, Colorado State Forest Service, 3/21/07 – subject to revision/correction)

FIRE NAME	LOCATION	SIZE	DATES	ADDN INFO
Murphy Gulch	Jefferson County: Inter-Canyon FPD & West Metro (Lakewood-Bancroft) FPD; along foothills west of Ken-Caryl Ranch subdivision	Approx 3,300 acres	Sept. 21-24, 1978	First EFF fire in Front Range, several structures lost, subdivisions evacuated, interagency resources ordered to supplement local fire departments' resources. CSFS Type 2 IMT (?) takes over and manages to closeout.
North Table Mtn	Jefferson County: Fairmount FPD. Top, west and east sides of North Table Mountain.	Approx 1300 – 2000 acres	Sept. 7 – 9, 1988	Human caused fire off CO 93 crossed mountain to threaten subdivisions on east side of mountain. Over 250 firefighters from 20 fire departments and National Guard respond as well as a helicopter. Structure protection and evacuations in many areas.
Mt. Falcon	Jefferson County: Indian Hills FPD; primarily on Jefferson County OS (Mt. Falcon park)	Approx 125 acres	April 23 - 24, 1989	Fire within open space property, leading to voluntary fire reimbursement program by county open space agencies to local fire departments to support initial attack.
O'Fallon	Jefferson County: Evergreen FPD. DMP parkland east of Kittredge	Approx 52 acres	March 24 – 25, 1991	Fire within Denver Mountain Parks' open space, leading to 100 firefighters from 5 departments responding. Dry winter conditions, gusty winds, and limited access slowed control efforts.
Elk Creek	Jefferson County: Golden Gate FPD. North of Clear Creek Canyon and east of Centennial Cone, in Michigan Creek and Elk Creek drainages.	Approx 102 acres	May 14 – 15, 1991	Fire in steep terrain with limited access, leading to use of hand crews formed from 80+ firefighters representing 15 fire departments from several counties. Fire managed jointly by FPD and Jefferson County Sheriff's Office's newly formed Incident Management Group (IMG).
Carpenter Peak / Chatfield	Douglas County: USFS & West Metro (then Roxborough FPD). Two fires, one uphill from Roxborough State Park & one across South Platte River from Jefferson County	Approx 45 acres & 23 acres	July 9 – 11, 1994	Dry lightning caused fires during larger fire bust throughout Front Range – multiple initial attacks occurring in all locations with limited availability of air resources. Evacuations of Roxborough Park and structure protection occurred using 300 firefighters and 40 engines from throughout Denver metro area, and National Guard helicopters.
Rooney Rd	Jefferson County: West Metro (Lakewood-Bancroft) FPD; along Dakota Hogback between C-470, I-70, and Alameda Pkwy	Approx 185 acres	Dec. 19, 1994	High winds and faulty electrical transformer outside "normal" fire season; Rates of Spread, flame lengths and limited access had fire threatening to cross several man-made barriers (roads). Fire departments from throughout Denver Metro area responded, and several structures were threatened.

FIRE NAME	LOCATION	SIZE	DATES	ADDN INFO
Buffalo Creek	Jefferson County: USFS & North Fork FPD	Approx 10,400 acres	May 18-25, 1996	High winds and human cause, extreme fire behavior, 10 mile run in 6 hours; 10 homes or outbuildings lost; first "large" fire in Front Range WUI. Type 1 IMT takes over on day 2 from local IMT3 and manages until closeout.
Beartracks	Clear Creek County: USFS lands, within Evergreen FPD and Clear Creek Fire Authority boundaries; immediately southwest of Mt Evans State Wildlife Area	Approx 500 acres	June 27, 1998 – July 5, 1998	Heavy fuel loading in roadless area and human caused fire leads to heavy initial attack and extended attack by local fire agencies along with air resources; fire poses threat to Upper Bear Creek drainage and numerous homes; Type 2 IMT takes over from local IMG on day 3 and manages to closeout.
Lininger Mountain	Jefferson County: Genesee FPD & Foothills FPD; immediately southeast of Genesee community	Approx 35 acres	Feb. 26-28, 1999	Dry conditions outside "normal" fire season leads to wildfire threatening several subdivisions and utilizing local fire resources for several days.
Green Mountain	Jefferson County: West Metro FPD; Green Mountain from C-470 to homes on north and east sides of park	Approx 200 acres	March 8, 1999	Multiple departments responding to human caused fire in grass fuels with high Rates of Spread, high flame lengths and limited access, outside "normal" fire season; homes, communications sites were threatened.
Hi Meadow	Park County & Jefferson County: Platte Canyon FPD, Elk Creek FPD, North Fork FPD; from Burland Ranchettes on west to CO 126 on east, and south to Buffalo Creek fire and town of Pine	Approx 10,800 acres	June 12-25, 2000	Human cause fire under initial attack by local FPD, blows up on same day as 10,000 ac Bobcat fire in Larimer County. 52 homes lost & misc. structures; considered "benchmark" WUI fire for Colorado at the time. Type 1 IMT takes over on day 2 from local IMT3 and manages until closeout.
El Dorado/ Walker Ranch	Boulder County: Cherryvale FPD and Coal Creek FPD; west of El Dorado Canyon State Park, through Walker Ranch park to Gross Reservoir; adjacent to border with Jefferson County.	Approx 1,100 acres	Sept. 16-22, 2000	Heavy fuel loading in steep terrain leads to heavy initial attack and extended attack by local fire agencies from Boulder, Gilpin, and Jefferson Counties along with air resources; fire poses threat to Gross Reservoir and numerous homes in Boulder and Jefferson County; Type 2 IMT takes over from zone Type 3 IMT on day 2 and manages to closeout.
Snaking	Park County: USFS and Platte Canyon FPD; north of US 285 from Platte Canyon HS to Crow Hill.	Approx 3,000 acres	April 22 – May 2, 2002	High winds and human cause outside "normal" fire season; heavy initial attack and extended attack by local fire agencies from Jefferson and Park Counties along with air resources; fire poses threat to numerous homes. Type 1 IMT takes over from local type 3 IMT on day 2 and manages until closeout.
Black Mountain	Park County, Jefferson County, Clear Creek County: USFS, Elk Creek FPD and Evergreen FPD; north of Conifer Mountain and south of Brook Forest	Approx 300 acres	May 5 – 11, 2002	Heavy fuel loading in steep terrain leads to heavy initial attack and extended attack by local fire agencies from Jefferson and Park Counties along with air resources; fire poses threat to multiple subdivisions in Conifer and Evergreen; Type 2 IMT takes over from local Type 3 IMT on day 2 and manages to closeout.

FIRE NAME	LOCATION	SIZE	DATES	ADDN INFO
Schoonover	Douglas County: USFS & North Fork FPD (Trumbull VFD in 2002); immediately south across S. Platte River from Jefferson County, from west of Deckers to near Moonridge.	Approx 3,000 acres	May 21 – 31, 2002	Lightning cause fire under initial attack by USFS and local FPDs, blows up on 2nd day and makes 3,000 acre/4 mile run in steep terrain. Fire threatens homes, camps businesses, watershed, regional powerline; approx. cabins & misc. structures lost. Type 1 IMT takes over on day 3 from local IMT3 and manages until closeout.
Hayman	Park, Douglas, Teller, and Jefferson Counties: USFS, multiple FPDs and county sheriffs (North Fork FPD in Jefferson County); from Lake George in Park County to Deckers/CO 126 in Jefferson County to Schoonover fire area and Manitou Exp. Station in Douglas/Teller Counties.	Approx 138,000+ acres	June 8 to mid-July, 2002	Human cause fire under initial attack and extended attack by USFS and local FPDs under direction of interagency IMT3, blows up on 2nd day for historic 17 mile run and 70,000 acres. Multiple evacuations over two-week period as fire made several additional "runs". Over 150 homes & misc. structures lost; large areas of damage to Cheeseman Reservoir and South Platte Watershed areas; fire is considered of nationally significant WUI fire for Colorado and Rocky Mountain region. Type 1 IMT takes over on day 3 from IMT3; fire is eventually managed by series of Type 1 IMTs under an Area Command team, until closeout.
Fountain Gulch	Clear Creek County and Gilpin County: Clear Creek Fire Authority, Central City FD, Clear Creek and Gilpin County Sheriff's Offices. Along county line immediately north of I-70 at the Hidden Valley exit.	Approx 200 acres	June 29-July 5, 2002	Significant fire activity in steep terrain with poor road access leads to heavy initial attack and extended attack by local fire agencies along with air resources; fire poses threat to I-70 and CO 119 travel corridors, businesses, and distant subdivisions. Interagency handcrews are ordered to replace local fire resources; continued use of air resources; fire is managed by local IMG to closeout.
Blue Mountain	Jefferson County: Coal Creek FPD. Immediately south of CO 72 at mouth of Coal Creek Canyon.	Approx 35 acres	August 14 - 15, 2002	Railroad caused fire in light fuels spreads rapidly due to continued drought conditions into adjacent timber and subdivision, leading to heavy initial attack and extended attack by local fire agencies along with air resources; fire poses threat to CO 72 and Coal Creek Canyon, businesses, and multiple subdivisions. Fire is managed by local IMG to closeout.
Cherokee Ranch	Douglas County: Littleton FPD, South Metro FPD, Louviers FPD. Between US 85 and Daniels Park Road.	Approx 1,200 acres	October 29 – 31, 2003	High winds and downed power line outside "normal" fire season; Rates of Spread, flame lengths and limited access had fire threatening to cross several man-made barriers (roads). Fire occurs in "open space" area on same day as 3,500 ac Overland fire in Boulder County. Multiple subdivisions on all sides of fire are threatened as fire resources from throughout Denver Metro area respond. Fire is managed by local IMG to closeout.
North Table Mtn	Jefferson County: Fairmount FPD. Top of, and east, north, west sides of, North Table Mountain outside Golden, CO.	Approx 300 acres	July 22 – 24, 2005	Human cause fire in steep terrain on open space that escapes initial attack. Heavy use of air resources during transition from initial attack to structure protection on day 1. Multiple subdivisions on all sides of fire are threatened as fire resources from throughout Jefferson County respond. Fire is managed by local IMT3 to closeout.

FIRE NAME	LOCATION	SIZE	DATES	ADDN INFO
Plainview	Jefferson County: Coal Creek FPD. Immediately north of CO 72 at mouth of Coal Creek Canyon and east to CO 93, north to approximately Boulder County line.	Approx 2,700 acres	Jan. 9 – 10, 2006	High winds and human cause outside "normal" fire season. Rates of Spread, flame lengths and limited access had fire threatening to cross several man-made barriers (roads) – 60 mph winds at midnight cause 2 mile fire run in under 5 minutes. Heavy initial attack and extended attack by local fire agencies from Jefferson and Boulder Counties; fire poses threat to numerous homes and businesses. Fire is managed by local IMT3 to closeout.
Rocky Flats	Jefferson, Boulder, Adams, and Broomfield Counties: multiple FPDs. Immediately north of CO 128 onto Rocky Flats NWR and east to Indiana Street.	Approx 1,200 acres	April 2, 2006	High winds and human cause outside "normal" fire season; Fire occurs in "open space" area of Rocky Flats NWR and adjacent lands. Rates of Spread, flame lengths and limited access had fire threatening to cross several man-made barriers (roads). Heavy initial attack and extended attack by local fire agencies from Jefferson, Boulder, Gilpin, and Adams Counties. Winds prevent use of air resources; multiple subdivisions, businesses, and Rocky Mountain Airport are threatened. Difficulties with communications and fire management across multiple jurisdictional boundaries noted.
Pine Valley	Jefferson County: Elk Creek FPD. Immediately northwest of Town of Pine.	Approx 100 acres	May 28-30, 2006	High winds and human cause near homes; heavy initial attack and extended attack by local fire agencies from Jefferson and Park Counties along with air resources, local USFS resources, and interagency handcrews. Fire poses threat to numerous homes, while winds limit use of air resources during initial attack. Fire is managed by local IMT3 to closeout.
Ralston Creek	Jefferson County: No-man's lands adjacent to Fairmount FPD and Golden Gate FPD. North end of White Ranch OS park and adjacent uranium mine (private).	Approx 26 acres	June 17 – 19, 2006	Fire within open space property under initial attack by local FPD, "blows up" and forces resources to retreat to safety zones. Significant fire activity in steep terrain with poor road access leads to heavy use of air resources; fire poses threat to Ralston Reservoir and numerous subdivisions. Interagency handcrews supplement local fire resources and continued use of air resources on day 2; fire is managed by local IMT3 to closeout.
Centennial Cone	Jefferson County: No-man's lands adjacent to Golden Gate FPD. Entirely within Centennial Cone OS park.	Approx 22 acres	July 21 – 23, 2006	Fire within open space property with significant fire activity in steep terrain with no road access during height of 2006 national fire season leads to limited initial attack; fire poses threat to US 6 in Clear Creek Canyon and distant subdivisions. Limited air resources are utilized to slow fire spread, and an interagency "hotshot" handcrew supplements local fire resources on day 2 for direct attack. Fire is controlled by day 3 as summer monsoons also reduce fire danger.

Other smaller wildfires within the WUI that posed high potential for significant impacts to adjacent communities, and had large initial attack response by local fire departments, include:

- Coal Creek fire, September 1988: 14 separate fires for 42 acres from train in Coal Creek Canyon area, resulting in response from multiple fire agencies and Single Engine Air Tanker, & CO Natl Guard Huey – dip site Ralston Res.
- Beaver Brook, 7/20/98-7/21/98: 25 acre fire immediately downhill from Mt Vernon Country Club in Clear Creek Canyon, resulting in air resources and structural protection.
- Red Rocks fire, 3/9/00: 10 acre grass and brush fire with high winds immediately southwest of Red Rocks amphitheatre, resulting in response from multiple fire agencies in Jefferson County.
- Bald Mountain fire, 5/6/00: 5 acre fire in Genesee park, immediately west of Mt Vernon Country Club.
- Silver Bullet fire, 6/15/00: approx. 20 acre fire on South Table Mountain immediately above Coors plant in Golden, requiring air tanker use to assist local fire departments. Fire occurred during same time that Hi Meadow fire was making significant run in southern Jefferson County.
- Mt Galbraith fire, 8/11/00: 2 acres in three dry lightning fires on top of Mt. Galbraith above City of Golden, threatening subdivisions in town.
- US 6 fire, 4/6/02: 50 acre grass and brush fire west of US 6 and south of 19th street in City of Golden, threatening multiple subdivisions.
- North Spring Gulch fire, 6/6 – 6/7/02: 20 acre fire northwest of Idaho Springs in Clear Creek County requiring significant air tanker use to assist local fire departments.
- Leyden fire, 1/18/05: 300 acre grass fire northwest of Arvada runs 5 miles in 25-30 mph winds, causing minor damage to numerous homes being protected by 60+ firefighters and multiple engines from Arvada, Fairmount, Rocky Flats, and Golden Fire Departments.