Golden Gate Fire Protection District
Community Wildfire Protection Plan

Jefferson County, Colorado

Prepared by:
Jefferson Conservation District, in conjunction with
Jefferson County Department of Emergency Management
800 Jefferson County Parkway
Golden, CO 80401

2011

Jefferson Conservation District

Jefferson County Sheriff Emergency Management

Colorado State Forest Service

Golden Gate Fire Protection District
Community Wildfire Protection Plan

July, 2011

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Introduction
This *Community Wildfire Protection Plan* (CWPP) was developed for the Golden Gate 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, 2009). 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 Golden Gate 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 Golden Gate 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:

_____
Allen Gallamore
Colorado State Forest Service, Golden District

_____
Rocco Snart
Jefferson County Sheriff's Office, Division of Emergency Management

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Golden Gate 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
GGFPD	Golden Gate 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
WFU	Wildland Fire Use
WUI	Wildland-Urban Interface

GLOSSARY 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 around a structure, 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 at least 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 particular vegetation, elevation, and climate, and typically a combination of fire return interval and fire intensity (i.e., high frequency low intensity/low frequency high intensity).
Fire Risk	The probability that wildfire will start from natural or human-caused ignitions
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 acts as available fuel; deciduous vegetation such as aspen can serve as a barrier to fire spread, and many shrubs are only available as fuels when they are dead or drought-stressed.
Fuel Loading	The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area, usually as tons per acre.
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.
LANDFIRE	Landscape Fire and Resource Management Planning Tools; an interagency vegetation, fire, and fuel characteristics mapping program, sponsored by the United States Department of the Interior (DOI) and the United States Department of Agriculture, Forest Service.
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 physical 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.

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 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 homeowners.

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. 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 CWPP treatment 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 and engagement
- Risk assessment – fuels, historical ignitions, infrastructure, structure ignitability, local resources, and firefighting capability
- Community fire hazard mapping
- Hazard reduction recommendations
- Suggested project prioritization

This CWPP provides wildfire hazard and risk assessments for neighborhoods and subdivisions identified as Wildland-Urban Interface (WUI) zones within the Golden Gate Fire Protection District (GGFPD). WUI is defined as the area where development abuts undeveloped areas. Intermix areas are more sparsely populated and scattered throughout undeveloped areas, but still form cohesive, homogenous communities. Due to highly dispersed housing density and location combined with limited infrastructure adjacent to large and remote wildland areas, there is high potential for loss of life and property from wildfire. WUI delineations within the GGFPD focus on somewhat homogeneous communities that represent a common emergency response area with similar assets, risks, and hazards. This CWPP builds upon the original plan completed for GGFPD in 2004, and which provides specific hazard assessments and recommendations for individual homes within those smaller assessment areas.

The Golden Gate Fire Protection District (GGFPD) is located at the western edge of the greater Denver metropolitan area, in the Front Range Foothills of Colorado. The GGFPD comprises approximately 43 square miles of primarily wildland-urban interface. The area is part of the Clear Creek Watershed; Ralston Creek, a main tributary of Clear Creek, runs through the district. The area is adjacent to Golden Gate Canyon State Park and several county Open Space Parks, which are popular recreational sites in the area, and a major draw to the district.

Decades of absence of fire and other natural disturbances coupled with years of persistent drought have resulted in dense and weakened timber stands in some areas. This has also negatively affected other vegetation types besides timber that are present within the district. Shrublands have grown dense and resulted in the accumulation of significant amounts of available hazardous surface fuels. In addition, woody species have encroached on areas that were historically characterized by more grass species, altering natural ecosystems. In some areas these ecosystems have gone undisturbed by fire for more than a century. The net result is significant hazardous fuels across various vegetation types within the district and potential for above average fire intensity. In March of 2011, these hazardous fuel conditions, coupled with extreme fire weather resulted in the Indian Gulch Fire, which burned 1570 acres in and near GGFPD. This fire prompted pre-evacuation orders of 750 homes in the area.

Although extensive fire hazard and fuels mitigation work has been completed throughout the assessment area on public and private lands, there are still ample opportunities for individual landowners to extend and improve upon existing treatment areas and collaborate with local land management agencies for planned projects in the future.

Field surveys, public input, and collaboration with the GGFPD and other non-governmental stakeholders were utilized for data collection, hazard assessments, and formation of treatment recommendations. Jefferson County Division of Emergency Management provides access to the full CWPP report for the public.

Public education, wildfire awareness, and community involvement are important components of any CWPP. For the CWPP update, public input was gathered in the form of an online survey, and information about the updated CWPP was presented at community events. Safety pamphlets and brochures explaining defensible space, shaded fuelbreaks, proper home construction, and landscaping practices designed to reduce the risk of wildfire loss were also distributed.

Public meetings and community events provide the means to share information about the assessment process and facilitate communication between the core team, non-governmental stakeholders, and other interested parties. Public meetings also provide a collaborative forum through which hazards can be identified, discussed and prioritized. General receptiveness to mitigation recommendations may also be gauged. The community is encouraged to use these opportunities to pursue mitigation projects.

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. Seven neighborhoods identified by the GGFPD as areas of concern were surveyed according to NFPA Form 1144 protocols during the spring of 2011. A summary of the community hazard ratings are provided in Table ES-1.

Table ES-1. Community Hazard Ratings

WUI	Score*	Hazard Rating
Bear Paw	93	High
Douglas Mountain North	63	Moderate
Douglas Mountain South	76	High
Drew Hill	70	Moderate
Geneva Glen	100	High
Guy Hill	54	Moderate
Horseradish Gulch	69	Moderate
Lower Canyon	79	High
Middle Crawford Gulch	93	High
North Ranch	72	High
Red School Ranch	52	Moderate
Robinson Hill East	51	Moderate
Robinson Hill West	67	Moderate
Rye Gulch	71	High
The Grange	81	High
Thea Gulch	71	High
Window Rock	67	Moderate

*Numerical rating based on the National Fire Protection Agency form for assessing fire hazard

In addition to the larger-scale treatments identified 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 threat to 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 GGFPD are timber understory fuel models. In neighborhood margins that interface with these fuel types, effective hazardous fuel reduction can be as straight forward as establishing and maintaining a defensible space around the home in order to reduce home ignitability. 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: http://jeffco.us/sheriff/sheriff_T62_R191.htm.

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. Responsibility lies with each community, neighborhood, and homeowner association identified in the CWPP to carry the momentum forward.

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

Table ES-2. Proposed Wildfire Mitigation Project Schedule

Year	Project	Actions
2011	Annual spring outreach	▪Contact and organize homeowners ▪Hold educational meeting about defensible space
	Annual spring/summer mitigation	▪Clean roofs and gutters ▪Trim limbs and shrubs within 3 to 5 feet of home ▪Rake and mow yard ▪Assist neighbors ▪Organize debris disposal
2012	Annual spring outreach	▪Contact and organize homeowners
	Annual spring/summer mitigation	▪Clean roofs and gutters ▪Rake and mow yard ▪Organize debris disposal
2013	Annual spring outreach	▪Contact and organize homeowners ▪Identify needed improvements to construction features throughout community
	Annual spring/summer mitigation	▪Where possible, coordinate projects between homeowner groups who have created defensible space and open space managed lands ▪Repeat yard maintenance & debris disposal
2014	Annual spring outreach	▪Contact and organize homeowners ▪Follow up with landowners who have not completed defensible space, offer assistance
	Annual spring/summer mitigation	▪Complete any outstanding projects from previous years ▪Begin long-term maintenance (as needed, re-trim shrubs, remove small trees, etc) ▪Initiate construction feature improvements

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Allen Gallamore
Colorado State Forest Service, Golden District

Rocco Snart
Jefferson County Sheriff's Office, Division of Emergency Management

Jusdon Miller
Golden Gate Fire Protection District

GOLDEN GATE 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. The purpose of the fire behavior analysis and community wildfire hazard rating is to provide a comprehensive, scientifically-based assessment of the wildfire hazards and risks within the Golden Gate Fire Protection District (GGFPD). This CWPP is not a legal document. There is no legal requirement to implement the recommendations herein. 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, and motivating individual home owners.

Dramatic natural and human-caused changes to forested areas occurred throughout the 20th century. In many cases, these changes led to a high accumulation of naturally occurring flammable forest fuels. Decades of fire suppression and fire exclusion in fire-adapted ecosystems have removed a critical natural process from the vegetation regeneration cycle. 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 continue to shift the nation's population growth centers to western and southwestern states where fire-adapted forest ecosystems are predominant, resulting in fragmented forested landscapes. The region where human development is pushing into previously undeveloped expanses of wildland is known as the wildland-urban interface (WUI). This is the area where risk of loss to life and property due to wildfire is the greatest. The potential consequences of severe wildfires are devastating and costly, and in recent years spurred Congress to pursue 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 provides the impetus for wildfire risk assessment and planning at the county and community level and helps implement the core components of the plan. HFRA refers to this level of planning as the CWPP. This empowers the participating community to take advantage of wildland fire and hazardous fuel mitigation 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.

The CWPP can be a useful tool for people who are interested in improving the environment in and around their homes. It provides a coordinated assessment of neighborhood wildfire risks and hazards. 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. This CWPP addresses fire hazard and makes recommendations to reduce wildfire hazard in the GGFPD in order to make it a safer place to live, work, and play.

1.2 Golden Gate Fire Protection District's need for a CWPP

The Golden Gate Protection District (GGFPD) is located northwest of the greater Denver, Colorado metropolitan area (Map 1, Appendix A). It currently has a population of about 1,200. The communities here occur in the wildland-urban interface (WUI) and Intermix. According to the Federal Register, Interface is defined as a community that directly abuts wildland fuels. Intermix communities exist where structures are scattered throughout a wildland area. Both interface and intermix require fire hazard mitigation.

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. They are common examples of the WUI and each presents emergency responders with unique, identifiable, and addressable hazards and risks. Outlying ranches, homesteads, and individual homes are not specifically addressed by the CWPP process and are best served through individual home hazard and risk assessments. However, recommended improvements to home ignition zones and defensible space apply to all properties, including those not within the delineated community areas.

The district occupies the montane zone, which extends between the grasslands and shrublands of the lower elevations to sub-alpine forests at higher elevations. Much of this region is a fire-dependent ecosystem that historically experienced frequent natural ignitions that maintained an open forest stand structure and diverse vegetation composition. Natural resource management policies and changing ecological conditions have interacted in ways that resulted in hazardous fuel conditions throughout the district. Continuous and rapid urban development has created the expansion of the WUI, coupled with the accumulation of hazardous fuels in a fire-prone region suffering from prolonged drought has set the stage for catastrophic wildfires with significant risk to life and property. Steep topography and narrow dead end roads complicate an already potentially catastrophic scenario.

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 identified in the original plan, following the standardized steps for developing a CWPP as outlined in "Preparing a Community Wildfire Protection Plan, A Handbook for Wildland-Urban Interface Communities" and the 2009 Colorado State Forest Service Minimum Standards for Community Wildfire Protection Plans.

Table 1. CWPP Update and Revision Process

Step	Task	Explanation
One	Convene decision makers	Form a core team made up of representatives from local governments, fire authorities, non- governmental stakeholders, relevant local, state, and federal land management agencies, and the and Colorado State Forest Service (CSFS).
Two	Update district information	Update and revise district information that has changed since original CWPP was adopted. Incorporate newest scientific information and changes to forestry practices, if applicable.
Three	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.
Four	Establish community priorities and recommendations	Use the risk assessment and base map to prioritize fuel treatments and non-fuel mitigation practices to reduce fire risk and structural ignitability.
Five	Develop an action plan and assessment strategy	Develop a detailed implementation strategy and a monitoring plan that will ensure long-term success.
Six	Finalize the CWPP	Finalize the district CWPP and communicate the results to interested parties and stakeholders.

The core team (Table 2) consists of representatives from local government, local fire authorities, and the CSFS. For the purposes of this updated and revised CWPP, a small "revision core team" was formed to facilitate the plan's updates. These entities guide the development of the CWPP as described in the HFRA and must mutually agree on the plan's final contents. Collaboration between agencies and communities is an important CWPP component because it promotes sharing of perspectives, priorities, and other information that are useful to the planning process.

Table 2. GGFPD CWPP Revision Core Team Members and Affiliations

Team Member	Organization
Judson Miller	Golden Gate Fire Protection District
Phil Headrick	Colorado Parks and Wildlife
Allen Gallamore	Colorado State Forest Service
Rocco Snart	Jefferson County Sheriff's Office
Robin Keith	Jefferson Conservation District
F Scot Fitzgerald	Jefferson Conservation District

Geographical information system (GIS) data and input from Golden Gate FPD staff were used to develop the community base map. The community base map identifies and delineates communities at a scale relevant to the GGFPD, and encompasses relatively homogenous communities or subdivisions.

A comprehensive risk assessment is conducted at the neighborhood or community level in order to determine relative levels of wildfire risk to better address fuels 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 are derived from the risk assessment. Mitigation recommendations are prioritized through an open and collaborative effort with the core team stakeholders. Prioritized treatments target wildfire hazard reduction in these WUI communities and neighborhoods, including reducing structural ignitability and protecting critical supporting infrastructure. An action plan guides treatment implementation for high priority projects over the span of several years.

To gather public input for the plan, a survey was posted online for one year. The data gathered is provided in Appendix D. In addition, the final draft of the CWPP was posted online for one month and the community was encouraged to read over and provide comments, edits, and suggestions prior to the plan being finalized.

The finalized CWPP represents a strategic plan 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.

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

- 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 Healthy Forests Restoration Act of 2003 required the Colorado State Forest Service to establish minimum standards for the development of CWPPs in Colorado.

  There are also several sources of information that supports wildfire mitigation and response that provide guidance to the development of the CWPP for the GGFPD:

- 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 Operation Plan (AOP) 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.

1.4 GGFPD CWPP Goals and Objectives

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

Table 3. GGFPD CWPP Goals and Objectives

Goals	Objectives
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 fuels	• Identify communities at highest risk and prioritize hazard reduction treatments. • 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.

As a strategic plan, the real success of any CWPP hinges on effective and long-term implementation of the identified objectives. The public outreach phase of the CWPP development process includes efforts to identify stakeholder groups that can serve as an implementation team, which oversees the execution of prioritized recommendations and maintains 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. Core team representatives may, but are not required to, assist in the implementation of the CWPP action plan. Overall, however, the key to the success of CWPP implementation is community participation. Continued public meetings are recommended as a means to generate additional support and maintain momentum.

2 WILDLAND FIRE MANAGEMENT OVERVIEW

2.1 Wildland Fire Types and Classification

There are two types of fires that burn in wildland fuels: prescribed fire and wildfire. Prescribed fires are planned fires ignited by land managers to accomplish specific natural resource management objectives. Wildfires are unplanned fires that result from natural ignition, human-caused fire, or escaped prescribed fire. Under certain circumstances wildfires can be managed with minimum suppression to achieve multiple objectives, including resource benefits.

Wildland fires are also classified by how they burn in various fuels. *Ground fire* refers to burning/smoldering materials beneath the surface including duff, roots, decomposing 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, which includes leaves, needles, small branches, as well as grasses, forbs, low and medium shrubs, tree seedlings, fallen branches, downed timber and slash. Depending on the type of surface fuel, surface fires can range from small and slow-moving to intense, fast-moving, and/or prolonged fires. *Passive crown fire* encompasses a wide range of crown fire behavior, from occasional torching of isolated trees or groups of trees to nearly active crown fire. Passive crown fire is often referred to simply as "torching". Torching occurs when the vegetation that spans the gap between the forest floor and tree crowns (ladder fuel) allows a surface fire to travel vertically into flammable tree crowns. *Active crown fire* is a wildland fire that moves rapidly through the crowns of trees or shrubs independently of a surface fire. Active crown fires are intense, destructive, and difficult to suppress.

Wildland fuels comprise both dead and live vegetation, and are described in terms of density, bed depth, continuity, vertical arrangement, and moisture content. For fire to ignite and spread, wildland fuels must meet the conditions of combustion (sufficient heat and oxygen). If the potential fuel does not meet the conditions of combustion, it will not ignite. Conditions of combustion can vary widely across geographic region and among different fuels in an area. This explains why some trees, patches of vegetation or structures may survive a wildland fire and others in the near vicinity are completely burned.

2.2 Wildland Fire Behavior

Fire behavior is a description of the manner in which a fire reacts to the combined 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 essential components of suppression strategies and tactics,

particularly in terms of the difficulty of control and effectiveness of various suppression resources.

Table 4. Fire Behavior Ratings

Adjective class	Rate of Spread (ch/hr)*	Flame Length (ft)
Very Low	0 - 2	0 - 1
Low	2 - 5	1 - 4
Moderate	5 - 20	4 - 8
High	20 - 50	8 - 12
Very High	50 - 150	12 - 25
Extreme	> 150	> 25

Stubbs T., 2005, Adjective Ratings for Fire Behavior

*ch/hr = chains per hour, where 1 chain = 66 feet; this standard measurement of rate of spread is approximately the same as feet per minute, where 1 chain per hour ~ 1 foot per minute

Potential surface fire behavior may be predicted by classifying vegetation in terms of fire behavior fuel models (FBFM) and using established mathematical models to predict potential fire behavior under specific climatic conditions. In this CWPP, FBFMs were obtained from existing GIS and vegetation data layers of the GGFPD.

In general, fire burns more rapidly and intensely up slopes. Additionally, topographic features such as narrow drainages and box canyons can funnel warm air upslope, further intensifying fire behavior. However, wind tends to be the most significant factor in the most extreme and destructive fires, driving active crown fires and causing long-range spotting ahead of the main fire front. Strong winds common along the Front Range can override topographic effects on fire behavior, even causing wildfire to be driven rapidly down slope.

2.3 History of Wildfire

Lightning-caused fire is a natural component of Front Range 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. For example, ponderosa pine woodlands of the montane zone and lower elevation brushlands and grasslands historically experienced relatively frequent fire return intervals. Extensive research has been conducted in Front Range forests in the assessment area. Fire history reconstruction in ponderosa pine forests in the vicinity of Cheesman Reservoir shows evidence that fire occurred in the area every 20 to 50 years between 1531 and 1880. As such, many of the plant species and communities are adapted to recurring fire through phenological, physiological, or anatomical attributes. In addition, the reproduction and persistence of some plant species, such as lodgepole pine and western wheatgrass, require reoccurring fire.

Beginning in the 19th century, Euro-American settlers in western North America altered 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. Additionally, with the significant reduction of naturally occurring fire after 1880, there has been widespread establishment and persistence of trees since 1880, leading to denser forest stands that can carry more intense, severe wildfires.

Although advances in scientific knowledge and land management techniques have improved the way wildland fire is managed in recent years, land managers and firefighters are faced with many challenges when fires burn in the WUI. Present-day land use changes, particularly residential development, have continued to impact wildland ecosystems and hazardous fuel distribution. Since the 1970's, housing growth within 1-km of national forests and other protected areas has outpaced the rate of growth in urban areas. Increasing population density in the WUI makes wildfires more complex and potentially dangerous for firefighters and the general public.

There have been few significant fires in the GGFPD in recent years. In 1991, The Elk Creek Fire burned 102 acres north of Clear Creek Canyon and east of Centennial Cone, in Michigan Creek and Elk Creek drainages. In March of 2011, the Indian Gulch Fire burned 1570 acres of Mount Galbraith Open Space Park and adjoining private land in and near the district. Given its close proximity to Highway 6 and the city of Golden, it was a high-profile WUI fire. There have, however, been numerous wildfires in the WUI in the areas surrounding the district, and the area overall has a relatively high risk of ignitions.

Figure 1. Foothills burned in the Indian Gulch fire in March, 2011. Golden and Denver are shown in the background, exemplifying a fire in the Wildland-Urban Interface. Photo by Judson Miller.

2.4 Fuels Management

Heavy wildland fuel loading and continuity has created hazardous situations for public safety and fire management, especially when found in proximity to communities. These hazardous conditions require an array of mitigation tools, including prescribed fire and mechanical thinning treatments to protect human life, economic values, and ecological

values. Objectives of fuels management include (but are not limited to) reducing surface fire intensity, reducing the likelihood of crown fire initiation and spread, and improving forest health. These objectives may be accomplished by various methods of reducing surface fuels and ladder fuels, 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, firefighters and other suppression resources are afforded better opportunities to control fire rate of spread and contain wildfires before they become catastrophic.

Prescribed fire is commonly used as a resource management tool under carefully planned conditions by many land management agencies. It includes completing a detailed burn plan with burn parameters (prescriptions), pre-treatment of the fuel load, close monitoring of weather, and use of specific ignition patterns to achieve desired results. When implemented correctly, prescribed fire can improve wildlife habitat, help abate invasive vegetation, reduce excess fuel loads, and lower the severity of future wildfires in the treatment area. Prescribed fires are ignited 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) in order to ensure the safety of firefighters and the public. Prescribed fires 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 within pre-prepared control lines by highly trained fire personnel. Burn piles are utilized to dispose of excess woody material after thinning if other means of disposal are not available or cost-prohibitive. Pile burns do not necessarily need to be conducted by trained professionals, but are subject to local permitting and air quality control guidelines. Acceptable burn days are determined by county government, and are usually limited to high moisture or snowy conditions.

Mechanical thinning is another management tool that can be used to break up fuel continuity in order to reduce fire intensity and spread. This can be accomplished in a variety of ways, but most commonly with chainsaws and/or masticators. Chainsaws and other hand tools have been traditionally used to mitigate fuels on a smaller scale because it is time-and labor-intensive, but affords the most controlled results. Once the forest is thinned, the slash and wood must be removed from the forest, chipped onto the forest floor, or piled and burned. In some cases, slash can be “lopped and scattered”, but this can have a negative impact on fire hazard if too much woody debris is left after thinning. Slash removal can be the most costly and time-intensive phase of forest thinning by chainsaws and hand tools. Therefore, masticators have become a widely used management tool in recent years. A masticator head is mounted on a skid steer or tractor and shreds forest fuels, including whole trees, then leaves the shredded/chipped material on the forest floor. Mastication of fuels does not reduce the amount of fuels in a forest stand, but redistributes it in a manner in which it does not contribute to crown fire initiation and spread. Although limited to machine-operable terrain (slopes less than 50%, not rocky, etc.), this method of thinning is generally quicker and more cost-effective than hand-thinning with chainsaws, and large-scale fuel treatments can be completed in a relatively short time.

Land managers often use a combination of these fuel mitigation techniques to achieve management objectives, depending on the vegetation type, terrain, adjacent private lands, or other values at risk. Private landowners should also consider these factors when choosing fuel mitigation tools.

3 GOLDEN GATE FIRE PROTECTION DISTRICT PROFILE

3.1 County Setting and Assessment Area

The assessment area for this CWPP is defined by the boundaries of the Golden Gate Fire Protection District. The GGFPD is located 5 miles west of Golden, CO, and comprises approximately 49 square miles, in northern Jefferson County, and has approximately 500 homes.

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 has the fourth largest population in the state, currently estimated at 545,290 people with approximately 190,440 people living in the incorporated areas.

The district is bordered on the east by the City of Golden and the Fairmont Fire Protection District, on the south by Clear Creek Canyon, on the west by High Country Fire Protection District (Gilpin County), and on the north by Coal Creek Fire Protection District. Land ownership within the district is primarily private, but there are also large tracts owned by Colorado State Forest Service and Jefferson County Open Space. The primary access to the district is via Golden Gate Canyon Road.

The local economy is dictated by the proximity and ease of access to the business and employment opportunities in the nearby Denver metro area. Most working residents commute daily to Golden and Denver. Numerous getaways on nearby county, state, federal and private lands with world-class hunting, climbing, cycling, camping, and fishing areas abound throughout the district.

Communities were generally delineated by subdivision. For this CWPP, the core team identified WUI areas based on population distribution, infrastructure, and emergency response. Each community represents a specific response area with unique characteristics and identifiable hazards and risks. A number of the WUI community boundaries have changed from the previous version. Some boundaries have been added or extended to encompass more structures, or more accurately represent a common response area. The remainder of the district (outside of WUI community boundaries) is characterized by larger parcel sizes and lower structural density and would be more accurately assessed using individual home hazard and risk surveys, which are addressed in part of the recommended methods for reducing structural ignitability, but remain outside the scope of the identified communities in this CWPP.

3.2 Climate

The climate of the area is relatively dry with the majority of precipitation occurring in the spring months and late summer monsoons. However, with over 3,000 feet of vertical relief within the district, average conditions can vary from one location to another. In the summer months, thunderstorms can occur almost daily and can produce hundreds of lightning strikes in a single storm. The area receives over 240 days of sunshine per year and an average of 25 inches of annual precipitation. Winter high temperatures are typically in the mid 30s and summer highs tend to remain in the 70s. The low precipitation months are November through February. Seasonal weather patterns over the region and topographic effects from the continental divide can generate high winds year-round. It is not uncommon for this area to experience winds in excess of 50 miles per hour. These conditions are optimum for wildfire ignition and spread. As the climate has warmed and dried over the past century, it is now possible for wildfires to occur 12 months a year in GGFPD.

Table 5. Average Monthly Climate Summary for GGFPD, Bailey Climate Station

	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average max temp (ºF)	34.1	35.2	41.5	46.8	56.8	66.9	74.8	71.9	64.6	52.7	42.1	33.8	51.8
Average min temp (ºF)	15.3	14.6	19.3	24	32.4	40.4	48.1	46	38.3	29.7	21.4	15	28.7
Average total precipitation (inches)	0.97	1.03	2.6	4.4	2.74	2.35	2.58	3.33	1.81	1.78	1.02	1.2	25.83
Average snowfall (inches)	16.6	17.4	37.4	47.1	14.7	1.2	0	0	4.3	17.7	15.8	21.9	194.2

Data obtained from the High Plains Regional Climate Center (http://hprcc.unl.edu).

3.3 Topography

Topography refers to the steepness of slope (expressed in percent or degrees) and aspect (expressed as direction the slope faces). The elevation of the GGFPD ranges from about 6500 to 9900 feet. The entire district is comprised of mountainous terrain with slopes ranging from 10 percent to over 60 percent slope. Most homes are in areas near slopes of 20 percent or steeper. Although most of the homes in the WUI and Intermix are on slopes that are less than 30%, almost all of the homes are within 300 feet of steeper slopes. Not only does this affect potentially severe fire behavior, it can limit the type and extent of fuel mitigation that can take place near homes that need it. For example, mechanical fuels reduction with masticators is generally limited to slopes of approximately 30%, on average. Mitigation with chainsaws is the most feasible method for steep slopes, but in general, the more difficult the terrain is, the more costly and dangerous the work is. Therefore, slopes exceeding 40% are usually omitted from implementation plans in favor of more cost-effective areas on easier terrain.

In this CWPP, topography was assessed with a digital elevation model (DEM) in GIS. Both topography and elevation play an important role in dictating existing vegetation

and, therefore, fuels and fire behavior. The steep slopes, canyons, draws, and ravines throughout the area channel winds and contribute to severe fire behavior. Topography also dictates community infrastructure design, further influencing overall hazard and risk factors.

3.4 Wildland Vegetation and Fuels of the Assessment Area

The vegetation in the district is typical of the Rocky Mountain Montane zone, which ranges from 5,600 to 9,500 feet. The dominant tree species throughout the assessment area are ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). The distribution and density of vegetation species are driven primarily by available soil moisture, which is closely related to elevation and slope aspect. This variability is known as the topographic-moisture gradient (Whittaker 1967), one of the key concepts in forest science. Common species of grass in this area include prairie Junegrass (*Koeleria macrantha*), blue grama (*Bouteola gracilis*), western wheatgrass (*Pascopyrum smithii*), little bluestem (*Schizachyrium scoparium*), Timothy (*Phleum pretense*), and cheatgrass (*Bromus tectorum*).

As elevation and moisture availability increase, ponderosa pine (*Pinus ponderosa*) and mixed conifer woodlands with herbaceous and shrub understory are common. North-facing slopes throughout the district are characterized by denser stands of ponderosa and mixed conifer forests dominated by Douglas-fir (*Pseudotsuga menziesii*). In the upper montane zone, lodgepole pine (*Pinus contorta*) is prevalent. Quaking aspen (*Populus tremuloides*) occurs intermittently where micro-site conditions provide enough moisture for them to thrive in either persistent or seral stands.

Deciduous riparian zones along rivers and creek beds are present throughout the area, with occasional stands of cottonwood (*Populus* spp.) and willow (*Salix* spp.). The vegetation in these riparian zones are generally not significant carriers of fire, and therefore do not usually require extensive mitigation.

The type of vegetation coupled with disturbance regimes determines the amount and distribution of wildland fuels. For example, dead and down timber and needle litter can be heavy in timber stands and woodlands where disturbance has been absent for many decades. Conversely, grasslands and that lack woody species and can burn more frequently have very low fuel loads. Predicting the potential behavior and effects of wildland fire in different fuels is an essential task in fire management. Mathematical surface fire behavior models and prediction systems are driven in part by fuelbed inputs such as load, bulk density, fuel particle size, heat content, and moisture of extinction.

To facilitate use in models and systems, fuel inputs have been formulated into fire behavior fuel models (FBFM). The FBFM concept was developed in 1972 by Rothermel, and Albini (1976) refined the original 11 fuel models based on a series of fire behavior calculations derived from 13 discrete fuel and vegetation types. Scott and Burgan refined the 13 FBFM system in 2005 to create 40 FBFM, which are now widely

used in fire management and considered more accurate than the original 13 fuel model system.

This CWPP update utilizes the Scott and Burgan 40 FBFM methodology in order to accurately represent the current fire hazards and risks in the GGFPD. The forty FBFMs are divided into seven general fuel groups; grass, grass-shrub, shrub, timber-understory, timber litter, slash-blowdown, and non-burnable. Each group comprises four or more fuel models. Of these 40 fuel models, thirteen occur in the GGFPD in six fuel categories (Table 6). Appendix E contains information about each FBFM in the GGFPD, and can be used as a pull-out reference section.

Table 6. Fuel Models in the District

Fuel Group	Code	Description	% Cover of Area
Grass	GR1	Short sparse dry climate grass	<1%
Grass	GR2	Low load dry climate grass	8%
Grass-shrub	GS1	Low load dry climate grass-shrub	6%
Grass-shrub	GS2	Moderate load dry climate grass-shrub	20%
Shrub	SH1	Low load dry climate shrub	10%
Shrub	SH7	Very high load dry climate shrub	<1%
Timber understory	TU1	Low load dry climate timber-grass-shrub	19%
Timber understory	TU5	Very high load dry climate timber-shrub	24%
Timber Litter	TL1	Low load compact conifer litter	<1%
Timber Litter	TL3	Moderate load conifer litter	8%
Timber Litter	TL8	Long needle litter	2%
Non-burnable	NB	Non-burnable (open water, urban, agricultural, snow, bare ground)	2%

Grass; FBFM GR1 and GR2

In these fuel models, grass is the primary carrier of fire. Grass is either naturally sparse, or heavily grazed. For both, flame lengths and rate of fire spread is quite low, and therefore do not significantly contribute to extreme fire behavior. The grass species present are common in open short grass prairie, meadows, or alpine tundra. Historically, at lower elevations, relatively frequent disturbance by wildfire removes dried biomass and woody shrub and tree species before it becomes excessive surface fuels. In fast-moving or low-intensity fires, the underground portions of plants are rarely killed, and vegetation (particularly grasses) can resprout quickly. These fuel types cover just over 8% of the assessment area.

Grass-Shrub; FBFM GS1 and GS2

The primary carriers of fire in these fuel models are grasses and shrubs combined. Within the GGFPD, shrubs in these fuel models are mostly 1-3 feet in height, mixed with short grass. Shrub and grass species in this fuel type requires disturbance such as fire to reproduce, either by seed or root crown sprouting. Rate of spread is high due to the size

and continuity of fuels, and flame lengths are moderate. These fuel types cover 26% of the assessment area.

Shrub; FBFM SH 1 and SH7

The primary carriers in this fuel groups are shrubs and shrub litter. Vegetation cover may be multi-layered, with short shrub and herb species in the understory of dominant overstory shrubs. In some cases, Gambel oak can reach small tree size. Rate of spread is moderate to high, and flame lengths are generally moderate. These fuel types cover about 10% of the assessment area.

Timber Understory; TU1, TU5

The primary carriers of fire in these fuel types are forest litter, grass, shrub, and small tree understory. Spread rate is low to moderate; flame length is low to high. Fire usually does not ladder into tree canopies unless the surface fuels reach vertically to tree crowns. However, active crown fire could spread from adjacent areas to TU fuel types if the forest canopy is continuous. Common species in the TU fuel types in this area include ground juniper, Gambel oak, Rocky Mountain juniper, ponderosa pine, and Douglas-fir. These fuel types cover 43% of the assessment area, with TU5 (very high load timber understory) representing about 24% of the assessment area.

Timber Litter; TL1, TL3, TL8

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 higher elevation stands on the western side of the district, surface fuels are influenced by long needle timber litter (TL8). These fuel types cover about 10% of the assessment area.

Non-burnable; NB

Non-burnable fuel types include a variety of substrate cover. These include open water, agricultural, bare ground, and urban. Each non-burnable fuel type has its own code and characteristics, but they are combined in this CWPP for simplicity. Non-burnable areas about 2% of the assessment area.

3.5 Fire Protection Authority and Water Resources

Emergency fire, medical, and rescue services for the district are primarily provided by the Golden Gate Volunteer Fire Department. There are two fire stations in the district (Map 1, Appendix A). The apparatus and their capacities are listed in 6.1.

In the assessment area, like all mountainous areas of Colorado, water supply is a critical fire suppression issue. The district is currently completing a report of verified water

sources, many of which were field verified at the time of the original CWPP's completion. There are 40 confirmed cisterns and 5 draft ponds throughout the WUI communities in GGFPD. Additional water resources have unverified location and capacity, although there were numerous small private property cisterns observed during the community hazard assessments.

Suppression resources move water using techniques called "drafting" and the "water shuttle system." This involves using atmospheric and negative pressures to take water directly from a river, stream or lake and using water tender trucks to shuttle the water to the scene of the fire. The water tenders then release their tanks into fold-out portable tanks next to an attacking engine (or a supplying engine, if driveways or narrow roads restrict access), essentially creating a water source where ever it is needed. In remote areas where water is scarce or not easily accessible, this is an important tool for firefighting crews.

3.6 Values at Risk

In any hazard and risk assessment, human life and welfare are the most important resources to protect. To develop the original CWPP, Anchor Point Group LLC, in collaboration with the citizens and other stakeholders in the GGFPD, identified five priority values to be protected. Any ranking process for values is inherently subjective and should be continuously updated and prioritized by stakeholders and land managers. The WUI communities in the assessment area have inherent wildfire hazards: residential development in areas historically prone to fire, hazardous fuels, and limited access. These hazards contribute to fires that have high resistance to control. The actions recommended in this CWPP are geared towards lowering the wildfire hazards to neighborhoods, as well as economic and ecological values at risk to wildfire losses. With these issues in mind, the following values at risk are priorities for protection in the planning area for the GGFPD:

Homes
About 500 homes are located in the GGFPD, with approximately 2000 permanent and seasonal residents. Nine out of 17 WUI communities in the district have a "high" fire hazard rating due to expected fire behavior and surrounding wildland fuels. Additionally, damage from severe erosion and flooding following severe wildfires threatens homes that are located on the banks of Ralston Creek and in narrow canyons. Mitigating the severity of wildfires in the area reduces these multiple risks.

Watersheds
GGFPD is part of the Clear Creek watershed. Ralston Creek, which runs through the district, is a major tributary of Clear Creek. The Clear Creek Watershed is the source of drinking water for more than 300,000 people. The area is dominated by highly erosive, decomposed granitic soils. When the dense, continuous vegetation is completely burned away, there can be devastating circumstances, because severe wildfires reduce the erosion threshold of watersheds.

Local Economy
Much of the district's economy relies on recreation and tourism. Data compiled by the Census Bureau show that in Colorado more people are involved, and spend more money, in wildlife related activities than any other state in the nation. The loss of scenic vegetation and access to trails that draw tourists would severely impact the local economy.

Historic Sites
The GGFPD has a rich cultural and historic legacy. Native Americans, mining operations, railroads, and ranches contribute to the story. Historical resources foster connection to and an understanding of our past, and serve as an inspiration for future generations. The district is home to several historic and cultural sites, including early homesteads, ranches, and mining sites.

Figure 2. Historic Tallman Ranch, in Golden Gate Canyon State Park

Natural Ecosystems and Habitat
The GGFPD is home to numerous native wildlife species, such as elk, mule deer, red fox, pine marten, songbirds, and raptors. Although all endemic species have endured for thousands of years with the occurrence of wildfire, loss of habitat due to exurban development results in higher negative impacts from wildfires. Effects from flooding and severe runoff after severe fires also damages aquatic and riparian habitat, which takes many years to recover.

4 WILDFIRE HAZARD ASSESSMENT METHODS

4.1 Components of Wildfire Hazard Analysis

Wildfire hazard assessment takes into account a variety of factors that ultimately result in a representative hazard ranking of the neighborhoods and subdivisions that have been collaboratively identified within the assessment area by the core team. Hazard rankings provide quantifiable guidance in the determination of mitigation treatment project prioritization.

Factors that contribute to wildfire hazard assessment are fire behavior, community infrastructure, and ignition potential. Elements that influence fire behavior include topography, weather conditions, and the type, density and configuration of vegetation and other fuels. Community infrastructure is evaluated in terms of emergency response, defensibility, and structural flammability. Ignition potential is influenced by population density, proximity to roads and other infrastructure. Overall, the relationship between expected fire behavior in wildlands and the placement and design of neighborhoods in wildland areas is at the core of an effective community wildfire hazard assessment. From this process, targeted mitigation recommendations are developed that directly address the identified hazards and, if implemented, will reduce the risk of loss from a wildfire for each homeowner as well as the community as a whole.

As part of the assessment, a questionnaire (Appendix D) was posted online and distributed at a community event to obtain public opinion information concerning the perceived level of wildfire risk in the GGFPD, understand public values at risk, and assess attitudes about 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. The survey was general in its scope, and response was limited. The responses do not represent a statistical sample of GGFPD residents. The results of the survey can, however, give a broad picture of the overall perception of fire risk and mitigation efforts in the district. Follow-up surveys could target individual communities and/or address specific planned projects.

While fires originating in or near communities are the most immediate concern, wildfires that ignite well beyond the boundaries of the planning area can have profound effects

upon the communities and ecosystems in the GGFPD. There is a high possibility for rapid rates of spread and long-distance spotting are high for a typical fire in this area.

4.2 Fire Behavior Analysis

Fire behavior, as previously stated in section 2.2, 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 fire intensity. In fire management, rate of spread is expressed in chains per hour. A chain is 66 ft, and one chain per hour closely approximates a spread rate of 1 foot per minute. Fireline intensity is defined as the rate of heat energy released per unit time per unit length of fire front, regardless of the depth of the flame zone. It is calculated as the product of available fuel energy and the fires rate of advance.

Using weather data from local remote automated weather stations (RAWS) and GIS data obtained from Landfire, we obtained information about potential flame lengths in the assessment area for average (50th percentile) and extreme (90th percentile) weather conditions. Fire moving through the forest canopy (active crowning) and other types of extreme fire behavior are not represented in this analysis.

Fire Weather

Average and severe case weather and fuel moisture conditions were determined using records from local RAWS during the summer wildfire season of June through August. Data from the Lookout Mountain, Sugarloaf, and Waterton North stations were used to best represent the climate of the assessment area. Percentile refers to historic occurrences of specified conditions. For example, 50th percentile is considered average conditions, with half the records exceeding recorded conditions and half the records below recorded conditions. Severe weather conditions are expressed as 90th percentile conditions, meaning that within the weather data examined from the RAWS, only 10 percent of the days had more extreme conditions. Weather was calculated for the typical summer fire season of June through August based on data from 1979 through 2009. Mid-flame wind speeds of 4 and 8 mph were used for the modeling of 50th and 90th percentile conditions, respectively.

Table 7. Average and Severe Case Fire Weather and Fuel Moisture Conditions

RAWS Station	Percentile	Max Temp ºF	Relative Humidity %	1-Hour Fuel Moisture %	10-Hour Fuel Moisture %	100-Hour Fuel Moisture %	Herbaceous Fuel Moisture %	Woody Fuel Moisture %
Lookout Mountain	50th	70	29	6	7	11	29	83
2009-2011	90th	81	12	2	4	7	3	69
Sugarloaf	50th	72	27	6	7	12	30	67
1980-2011	90th	83	11	2	3	6	3	59
Waterton North	50th	64	29	5	7	11	29	64
2004-2011	90th	77	13	3	4	7	3	59

Additional important fire- and weather-related resources include:

- Fort Collins Interagency Wildfire Dispatch Center Web index for Fire Intelligence, Fire Weather, Fire Danger/Severity, RAWS – http://www.fs.fed.us/r2/arnf/fire/fire.html
- RAWS 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 simulations were conducted for average (50th percentile) and severe (90th percentile) conditions for the critical months of the fire season, June through August (Table 11). Slope steepness was set to 20 percent.

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 surface 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 times for flame length and three to four times 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 TU1 converts into the denser TU5, the increase in fire behavior is pronounced and conducive to the initiation of crown fire.

Table 8. BehavePlus Predictions of Fire Behavior on 20 Percent Slope*

FBFM	Flame Length (ft), average conditions[1]	Rate of Spread (chains/hr), average conditions	Flame Length (ft), severe conditions[2]	Rate of Spread (chains/hr), severe conditions
GR1	1.6	10	3.1	37.6
GR2	3.5	19.9	9.8	152.8
GS1	0.9	2.6	5.9	42.2
GS2	1.5	4.1	8.5	58
SH1	0.5	0.8	1.3	4.2
SH7	8.3	15.5	19	73.6
TU1	0.5	0.5	2.8	6.4

TU5	5.3	4.8	11.1	19.1
TL1	0.6	0.8	0.9	1.7
TL3	1	1.5	1.9	4.8
TL8	3.3	5.5	6	17.1

[1]50th percentile weather conditions: average midflame widspeed = 4mph; fuel moisture percentages: 1-hour=5%, 10-hour = 8%, 100-hour = 10%; Live herbaceous fuel moisture = 75%; live woody fuel moisture = 200%.
[2]90th percentile weather conditions: severe midflame widspeed = 8mph; fuel moisture percentages: 1-hour=2%, 10-hour = 3%, 100-hour = 6%; Live herbaceous fuel moisture = 30%; live woody fuel moisture = 100%.
*All calculations were completed using 20% slope.
**Chains per hour ≈ feet per minute, where 1 chain = 66 feet.

4.3 Community Hazard Assessment Methods

Community hazard rating was calculated using the NFPA 1144 assessment form. In order to expedite the overall community assessments, we developed a tally method. For each major street in a community, a small representative handful of homes were assessed individually on the same form. For each WUI, we assessed approximately 20% of the homes. Rating factors such as defensible space, driveway access, and building setback from steep slopes were somewhat variable throughout the community, while factors such as severe weather potential, overall topography and road widths were consistent. If 10 homes were assessed overall, and six had defensible space <30 feet (25 points), three with 31-70 feet (10 points), and one with >100 feet (1 point), these ten homes were tallied as such on the 1144 form. Given that the majority of homes in the tally had less than 30 ft of defensible space, the score of 25 was given the most weight. However, we would assign an overall score of 20 to account for the few representative homes in the community with more defensible space, thereby reducing the hazard score by 5 points. Although the average scores can be calculated using a weighted average formula in Excel, we found that determining the score qualitatively from the tally produced similar results more quickly.

We found this method to be efficient and repeatable, and accurately reflected the overall hazard conditions in a community. This method could also be used in more populated areas to evaluate communities quickly and effectively.

5 WILDFIRE MITIGATION PLAN

5.1 Mitigation Planning

Wildfire mitigation can be defined as those actions taken to reduce the likelihood of loss of life and property due to wildfire. The intent of mitigation is not to completely eliminate the risk of loss nor does it reduce the risk of a wildfire occurring. Effective wildfire mitigation enables residents to evacuate safely, homes to withstand the occurrence of wildfire, and firefighters to defend structures and suppress fires where possible. This can be accomplished through a variety of methods, including reducing hazardous fuels, creating defensible space around individual homes and subdivisions, utilizing fire-resistant building materials, enhancing emergency preparedness and response capabilities, upgrading current infrastructure, and developing programs that foster community awareness and neighborhood activism. Once implemented, these actions can significantly reduce the risk of loss due from wildfire to an individual home, and on a larger implementation scale, for an entire community. Most importantly, it makes WUI communities safer places to live and work, and in the event of a wildfire, enhances the safety of residents and emergency personnel.

Specific mitigation treatment recommendations for the GGFPD were identified through detailed community wildfire assessment surveys. These surveys evaluated parameters such as wildland fuels, predicted fire behavior, infrastructure, emergency response resources, and structure ignitability. Recommendations were reviewed and approved by the core team. Project prioritization was based on public input, practicality of implementation, and proximity to existing planned and completed mitigation projects.

Communities should seek out and take advantage of opportunities to partner with local agencies or organizations. Working cooperatively can provide communities with a higher level of technical assistance and project management.

5.2 Recommended Actions

Action items include a variety of specific recommendations that reduce ignitability of structures, make ingress and egress safer for residents and emergency personnel, remove hazardous wildland fuels from around homes, and reduce the amount of fuels in strategic locations. Many recommended action items do not involve drastic changes to the forest; simple structural maintenance and pruning are basic, but essential components to effective mitigation. Additionally, all the plan's recommendations are also meant to apply to rural intermix and occluded properties that lie outside the WUI community boundaries.

Actions on public lands can 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.

While the GGFPD, USFS, and CSFS have worked hard to promote defensible space and land management, private landowners must accept responsibility for completing work on their own lands. Table 9 lists the recommended action items by category and described in further detail below.

Table 9. Action Items

Category	Action Items
Public Outreach and Education	• Encourage stakeholder participation in community meetings • Distribute Firewise and other informational materials • Assess individual homes
Building Improvements	• Replace shake roofs with fire-resistant roofing materials • Implement Firewise construction principals for new construction and remodels • Cover vents and chimneys with metal screens • Enclose exposed decks and gables, and/or use fire-resistant construction materials
Defensible Space	• Establish a fuel-free zone around homes • Establish a treated second zone that is thinned, pruned, and cleared of excess surface fuels • Extend thinning treatments to property boundary to reduce hazardous fuels • Employ defensible space practices around resources such as cisterns, draft sites, or community safety zones
Access and Egress Improvements	• Where not present, clearly mark roads and addresses with metal, reflective signs • Thin trees along main roads to avoid blockage • Create or widen turnarounds • Widen or improve narrow switchbacks • Create secondary evacuation routes where needed
Shaded Fuelbreaks	• Thin in strategic areas, such as along evacuation routes and utility right-of ways • Coordinate with adjacent public land management agencies • Identify existing breaks in vegetation to expand fuelbreak areas • Remove or treat slash by chipping, burning in piles, or hauling to collection site • Perform periodic maintenance where necessary • Incorporate additional management goals where appropriate (such as bark beetle infestation control)
Fire Department Preparedness	• Own and update district GIS • Update and distribute run books • Verify community water sources • Conduct pre-suppression planning • Conduct ongoing recruitment, training, and certification • Coordinate mutual aid strategic planning • Upgrade apparatus, facilities, and personal protective equipment when appropriate

	• Explore and support grant funding opportunities
	• Involve Jefferson County in evacuation route improvements
Supporting Actions	• Revise county statutes addressing defensible space requirements for home sales
	• Coordinate with land management agency forest management plans

5.2.1. Public Outreach and Education

The most effective means of initiating local action is through community education and public outreach. Given the significant fire events in and near the GGFPD in recent years, particularly the Indian Gulch fire in the spring of 2011, many local residents are well-informed of the inherent fire risk in the area, but as more people move to the area, it is necessary to maintain and improve the community's knowledge of the basic principles behind wildland fire, and the actions they can implement to increase their personal safety and that of their home. Through education, homeowners are empowered to take action on their own properties, and coordinate efforts with their neighbors to maximize the efficacy of individual treatments.

Action Item: Conduct annual community meetings each spring. Community meetings held in the spring, just prior to the main fire season, can spur action by individuals and neighborhoods and allow for coordination of cleanup efforts within the community. This can also serve as a forum for presentations by experts in the field who can answer questions, provide technical guidance, and inform community members of available resources.

Action Item: Firewise materials and CSFS publications should be made available to the public at each fire station, post office, HOA, and library on a regular basis.

5.2.2. Building Improvements

The purpose of building improvements is to reduce structural ignitability. Structural ignitability is defined as the flammability of the home and its immediate surroundings. This separates the problem of WUI structure fire loss from other landscape-scale fire management issues, because highly ignitable homes can be destroyed during lower-intensity wildfires, whereas homes with low structural ignitability can survive high intensity wildfires. Structural ignitability, rather than wildland fuels, is the principal cause of structural losses during wildland/urban interface fires. While reducing hazardous fuels around a structure is very important to prevent fire loss, recent studies indicate that building materials have a significant influence on whether a structure will survive a wildfire.

Key structural components that increase ignitability are flammable roofing materials (e.g. cedar shingles), flammable decks and/or siding, and the presence of burnable vegetation (e.g. ornamental trees, shrubs, wood piles) immediately adjacent to homes. The area around the home, 100-200 feet, is called the home ignition zone and is the most critical area to prepare and maintain to prevent loss from fire. Investing in building improvements to decrease the structural ignitability of the home is just as important as forest management and fuels thinning on the property.

Studies of home survivability in wildfire incidents also 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. This evidence suggests that investing in building improvements to decrease the structural ignitability of the home is just as important as forest management and fuels thinning on the property. In areas where tree removal is not desirable or possible, homeowners can still mitigate fire hazard in this way.

Action Item: All homeowners should continually keep roofs and gutters clear of leaves and pine needles. Embers from a wildfire can become windborne and travel long distances before settling, and even small amounts fine fuels on a structure can ignite and put a home at risk. Defensible space becomes inconsequential if embers cause ignition on the roof, deck, or in eaves. Clear combustible material such as firewood, trash, or woody debris from the side of the home and underneath exposed decks.

Action Item: Cover openings around the home, such as gutters, attic vents, chimneys, and areas under decks with screens to prevent the accumulation of fuels where embers can ignite the structure.

Action Item: Addresses should be clearly marked and visible from the road, preferably with reflective, durable, fire-resistant materials.

Action Item: Where possible, propane tanks adjacent or downhill from home should be relocated to a location uphill or at least 30 feet from the home (outside the home ignition zone).

Action Item: Replace wood-shake (cedar shingle) roofing with noncombustible roofing materials. Roofing materials rated as "Class A" include materials that are non-burnable or can withstand a high amount of radiant heat, and are therefore the most appropriate for homes in the assessment area. Jefferson County requires all new and replacement roofs in the WUI to be fire-resistant. Minimum Class "B" roofing material is required in a wildfire hazard area. Prior to receiving a Certificate of Occupancy (CO) for homes and structures with living quarters, and prior to final building inspection for accessory structures, all structures are required to meet the minimum defensible space requirements identified in the on-site assessment at the time of permitting. Minimum requirements for driveway access are permitted and enforced to obtain safe and reasonable access for every day vehicular use and ingress/egress of emergency vehicles.

5.2.3. Defensible Space

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 a vital component in wildfire hazard reduction. These efforts are typically concentrated within 0 to 75 feet of the home to increase the chance for structure survival and create an area for firefighters to work safely 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. In general, structures that do not have defensible space do not provide adequate area for firefighters and firefighting apparatus to work efficiently and safely. The risk to human life outweighs any possible benefit of trying to defend an unsafe property. Appendix I shows the Jefferson County Structure Triage Form, which enables firefighters to quickly prioritize structure defense in a wildfire. If a structure has a score greater than 13, it is considered a "last priority" over properties with more clearance, lighter vegetation, and better access.

It is recommended that defensible space be created following the CSFS guidelines set forth in *Creating Wildfire Defensible Space Zones,* Bulletin Number 6. Refer to Appendix G for the complete CSFS defensible space guidelines and treatment area size recommendations.

Action Item: Implement defensible space around all homes and structures in the assessment area. Create a fuel-free zone approximately 15 feet wide directly adjacent to the structure, which reduces structural ignitability and reduces direct flame impingement on the structure. In a secondary zone farther out from the structure, complete pruning of ladder fuels, stand thinning, and removal of dead, dying, or diseased trees for overall stand improvement. Where possible, extend forest treatments out to property line to reduce fuel loading and enhance overall forest health.

before

after

Figure 3. A home and surrounding property before and after the completion of defensible space action items. Photos from CSFS.

Table 10 outlines a phased 4-year implementation schedule communities can use to complete this action item.

Table 10. Community Defensible Space Implementation Schedule

Year	Project	Actions
1	Annual spring outreach	▪Contact and organize homeowners ▪Hold educational meeting about defensible space
	Annual spring/summer mitigation	▪Clean roofs and gutters ▪Trim limbs and shrubs within 3 to 5 feet of home ▪Rake and mow yard ▪Assist neighbors ▪Organize debris disposal
2	Annual spring outreach	▪Contact and organize homeowners
	Annual spring/summer mitigation	▪Clean roofs and gutters ▪Rake and mow yard ▪Organize debris disposal
3	Annual spring outreach	▪Contact and organize homeowners ▪Identify needed improvements to construction features throughout community
	Annual spring/summer mitigation	▪Where possible, coordinate projects between homeowner groups who have created defensible space and open space managed lands ▪Repeat yard maintenance & debris disposal
4	Annual spring outreach	▪Contact and organize homeowners ▪Follow up with landowners who have not completed defensible space, offer assistance
	Annual spring/summer mitigation	▪Complete any outstanding projects from previous years ▪Begin long-term maintenance (as needed, re-trim shrubs, remove small trees, etc) ▪Initiate construction feature improvements

5.2.4. Access & Egress Improvements

In addition to defensible space, it is essential for communities to have adequate access and egress. Not only does this allow for emergency personnel to access and escape properties in a wildfire, residents are also able evacuate quickly and safely when necessary. In GGFPD, it is common for driveways, dead-ends, and switchbacks to lack adequate turnaround space for fire trucks, which compromises emergency response to properties. Golden Gate Fire adopted the 2003 International Fire Code, which details the specifications for driveways, turnouts, turnarounds, and access roads.

Clear signage for roads and addresses enable firefighters to navigate through communities they may not be familiar with, or when visibility is compromised. Tenable escape routes are essential to community wildfire safety, and therefore should be considered high-priority action items when recommended.

5.2.5. Shaded Fuelbreaks

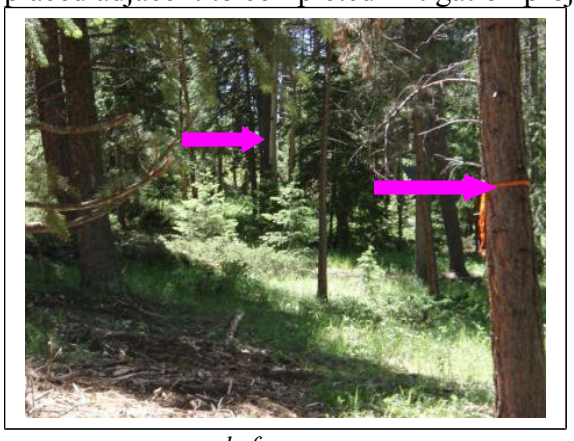
Shaded fuelbreaks are strategically located areas where fuels have been reduced in a prescribed manner in locations that can affect fire behavior on a landscape scale. Fuelbreaks are generally strategically placed where they can be as continuous as possible. To this end, they can be placed contiguously with other fuelbreaks, larger area treatments, along roads, or adjacent to natural breaks in vegetation (such as meadows or bodies of water). When defensible space, fuelbreaks, and area treatments are coordinated, the community and the adjacent natural resources are afforded an enhanced level of protection from wildfire. Fuelbreaks have been completed on several USFS and CSFS parcels within the plan area.

The CSFS provides guidelines on how to determine the width and prescription for fuelbreaks based up the type of fuel and topography. Fuelbreaks need to be tailored to the terrain, fuels, historic fire regimes and expected weather conditions of the landscape in which they are placed. 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 some species of 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. When fuelbreaks are not thinned enough to create sufficient canopy openings, the risk of crown fire is not reduced, and the fuelbreak does not meet its intended objective. The overall benefits of properly constructed fuelbreaks are however, well documented. An area near the Hayman fire that had been recently thinned successfully stopped fire from moving through the tree canopy, which significantly reduced tree mortality in that stand. Untreated areas adjacent to the treatment area burned severely, and had nearly 100% tree mortality.

Figure 4. A WUI neighborhood and forest stand affected by the Hayman fire. The green trees in the foreground with greater canopy spacing were largely unburned, while the denser forest in the background burned more severely. Photo from USFS.

Action item: All access roads flanked by heavy vegetation in WUI communities should be targeted for thinning or seasonal mowing. Treatments may be coordinated with property owners along private roads and with county and state transportation departments for public roads. Conifer regeneration along road margins should be controlled. A qualified forester or fire professional should evaluate the effectiveness and periodic maintenance of roadside mitigation.

Action item: In this CWPP, a strategic shaded fuelbreak has been carefully planned for each WUI community. These fuelbreaks take into account expected fire behavior, workable terrain, and existing road access. When implemented, these landscape-scale fuelbreaks are meant to protect the community as a whole by reducing potential fire behavior under most weather conditions. Where possible, these fuelbreaks should be placed adjacent to completed mitigation projects.



before

after

Figure 5. A montane forest stand in Jefferson County before and after completion of a shaded fuelbreak. Note the tree on the right side of the picture with orange flagging and the aspen tree in the background to compare the change in the stand structure. Photo from Jefferson County Emergency Management.

Action item: Natural resource managers for public lands should take into account fire hazard for adjacent WUI communities when developing or updating forest management plans.

Action item: An ecological evaluation of the status of vegetation community recovery and rehabilitation is recommended for areas affected by fires in recent years. Monitoring should focus on the presence of noxious weeds and other invasive non-native species. Reducing the presence of invasive species such as knapweed (*Centaurea* sp*p.) and Dalmatian toadflax (Linaria dalmatica)* maintains natural biodiversity. In some cases, it can help maintain historic fire regimes, especially in grasslands and shrublands.

5.3 Treatment Options

Each of the recommended fuel mitigation projects can be achieved by a variety of methods. Selecting the most appropriate, cost effective option is an important planning step. The brief synopsis of treatment options and cost estimates in Table 11 is provided to assist in this process. Cost estimates for treatments should be considered as general guidelines. Costs can vary tremendously based on a variety of factors, including but not limited to:

- Acreage of project
- Proximity to structures
- Fuel costs & other equipment needs
- Treatment techniques used
- Density and type of vegetation
- Steepness of slope
- Area accessibility

Table 11. Treatment Methods

Treatment	Approximate Cost*	Comments
Machine Mowing	$90 - $200 per acre	▪Appropriate for large, flat, grassy areas on relatively flat terrain ▪Usually requires yearly treatment
Prescribed Fire	$100 - $200 per day	▪Cost-effective for larger acreage ▪Implementation requires trained professionals ▪Ecologically beneficial ▪Provides training opportunities for firefighters ▪Inherent risk of escape may be unacceptable in some areas ▪Unpredictable scheduling due to weather and smoke management constraints
		▪Some brush (shrub) species, such as Gambel oak, resprout vigorously after mechanical treatment

Brush Mastication	$300 - $500 per acre	▪Follow-up treatment with herbicides, prescribed fire, grazing, or repeat mechanical treatments are typically necessary ▪Less expensive and faster than manual treatment ▪No need to dispose of slash
Timber Mastication	$600 - $1000 per acre	▪Large diameter trees can be felled quickly over large areas ▪Less expensive and faster than manual treatment ▪No need to dispose of slash ▪Machinery usually limited to slopes <35% ▪Rough, unattractive appearance for first year post-treatment
Manual thinning and felling	$700-$3000 per acre	▪Not limited to slopes <35% ▪More control of specific trees removed/left ▪Allows for removal of merchantable/usable wood products, such as firewood ▪Slash must be chipped, hauled away, or burned in piles
Feller Buncher	$600 and up per acre	▪Appropriate for steep slopes with larger-diameter trees ▪Allows for removal of merchantable/usable wood products, such as firewood ▪Generally more expensive than mastication

*Costs per acre are based upon various area contractors' rates for work in the Colorado Front Range and are subject to change.

Figure 6. A feller buncher machine thinning a forest. Photo from USFS.

5.4 Project Support

Several of the recommended actions will require cooperation of various agencies that operate within the FPD. Studies, monitoring, and determination of legal jurisdictions are integral to the action items recommended in this CWPP. Although this may add complexity to implementation, it should not discourage communities from pursuing these projects.

Funding and Grants: Due to the high cost of large-scale forestry projects, many landowners and communities are unable to complete complex projects such as shaded fuelbreaks. Grant support may be able to accelerate implementation of treatments. The Jefferson County Office of Emergency Management is an excellent resource for information about available grants. The website

http://www.rockymountainwildlandfire.info/grants.htm has a searchable grants database, as well as other helpful information about wildfire.

Access/Egress Improvements: The proposed work on roadways may require further study to address engineering and environmental issues, and may be subject to the consent of adjacent landowners or County Road and Bridge.

Public Land Planning: Jefferson County Open Space and Colorado Parks and Wildlife manage forested wildlands in and around GGFPD. 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, dialog and collaboration should be maintained with these agencies in order to coordinate strategies and treatments, and make adjustments if necessary. Where possible, strategic fuelbreak recommendations should be tied into completed or planned treatment areas on public lands.

Regulatory Support: One of the major issues confronting defensible space and hazardous fuels mitigation is the need for on-going maintenance of treatment areas and defensible space. While county statutes require defensible space for new construction, there is no requirement for maintenance and no retroactive regulation for existing structures. For defensible space treatments to remain effective some regulatory impetus may be necessary. Jefferson County should examine the possibility for requiring periodic maintenance of defensible space. This could be associated with the sale of an existing home or on a period of time since initial treatment. Communities with local statutes or covenants should consider similar regulation as an interim step to help drive the initiative from the bottom up.

Continuing Development and Land Use Changes: Some areas of GGFPD that are more sparsely populated are not currently included in a WUI community. There are areas that will have continuing development in the coming years, which will convert rural intermix and occluded areas in to WUI and change the values at risk. As these communities grow, additional WUI community boundaries should be added to reflect the changes. Although new construction in Jefferson County requires conforming defensible space, additional actions such as shaded fuelbreaks, access and egress improvements, and improved road signage should be planned and implemented as these communities grow and change in the future. As large parcels get subdivided, Jefferson County Planning and Zoning need to ensure proper implementation of fuels mitigation in new developments.

6 EMERGENCY OPERATIONS

6.1 Response

Golden Gate Volunteer Fire Department maintains two equipped stations throughout the district. The department consists of one chief, one assistant chief, two station captains, one medical officer, 11 volunteer firefighters, and 3 support staff. Most residences in GGFPD are located less than five miles from a fire station, and there are currently sufficient VFD personnel to respond to the numerous emergency calls they receive each year. In wildland areas outside of the WUI zones in the district, response time could be long due to rugged terrain and lack of road access. However, there is currently adequate staff and equipment to effectively handle the majority of fire and medical emergencies. Jefferson County maintains a certified Type 3 Incident Management Team for overhead support in the event of a multiple-day fire event. Should a complex fire event extend past 36 hours, a Type 2 or Type 1 IMT would need to be brought to the district.

Table 12. Equipment in GGFPD

Apparatus	Type	Station
Brush 862	Type 6 Engine	2
Tender 872	Type 2 Tactical Tender	1
EUV	6x6 Rescue ATV	1
Engine 831	Type 3 Engine	2
Brush 856	Type 6 Engine	1
Tender 870	Type 1 Tender	2
Engine 832	Type 3 Engine	1

Mutual Aid

In the event of a major structure or wildland fire, GGFPD may require additional assistance from other fire departments and government agencies. GGFPD currently has a mutual aid agreement with Fairmount FPD. Additional mutual aid agreements with neighboring fire protection districts are in progress, and the district will continue to pursue additional agreements as opportunities arise. The complete definitions and limitations of local mutual aid agreements are located in the Jefferson County Annual Fire Operating Plan.

Training and National Wildfire Coordinating Group Positions
Maintaining or increasing the level of fireline leadership requires considerable commitment from the department and its volunteers. Completion of taskbooks for wildland firefighter/incident management positions is subject to availability of wildfire assignments. Golden Gate firefighter participation in prescribed fires managed by the CSFS, JCSO, and USFS provide excellent opportunities for fireline training and maintenance of qualifications and skills. The NWCG standards may be challenging to obtain in a timely manner, but can be used as a general guideline for training targets.

Example of NWCG positions & training targets:

- Year 1: Officers initiate FFT1/ICT5 taskbook. Classes: S-131, S-133
- Year 2: Officers complete FFT1/ICT5 taskbook. Engineers initiate FFT1/ICT5 taskbook.
- Year 3: Officers initiate ENGB taskbook. Engineers complete FFT1/ICT5 taskbook and classes S-290, S-230
- Year 4: Officers complete ENGB taskbook and begin working towards engine strike team leader (STEN) and ICT4. Classes: S-200, S-330. Engineers work towards ENGB as able.
- Additional courses that are not required, but recommended: S-290, S-230 (for ICT5), S- 215 (for ENGB).

Performance Standards
Firefighters that have a National Wildfire Coordination Group (NWCG) wildfire qualification of Firefighter Type 2 (FFT2) or higher must complete a yearly refresher training that includes a simulated deployment of a fire shelter and pass an arduous-level physical fitness test.

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 a wildfire is imminent. Homeowners should be prepared to evacuate without formal notice.

Before residents leave, they should take every precaution to reduce the chance of structure loss if time allows. 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. Additional actions could include thoroughly irrigating the defensible space, watering down the roof, or removing patio furniture. However, human safety is the number one concern in an evacuation; staying too long could compromise a safe escape. Families should have pre-planned meeting locations 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.

Evacuation procedures vary according to subdivision. The GGFPD should ensure that every resident is familiar with these procedures, including primary and secondary routes, and the location of any designated community safety zone. Pre-plans should also outline available evacuation centers and the procedures needed to activate them. These procedures should be addressed in public or HOA meetings with information eventually being distributed door to door.

Upon returning to the home, the exterior of the house should be monitored for smoke for several days. Embers may lodge in small cracks and crevices and smolder for several hours or days before flaming.

Given that many residents of the GGFPD own horses and other livestock, large animal evacuation centers also need to be identified prior to emergencies. The Jefferson County Horse Evacuation Assistance Team (Jeffco HEAT) is a team of highly trained volunteers that operates in the area to provide large animal evacuations in wildfires and other natural disasters. Information can be found at *http://jeffcoheat.org/*.

Evacuation Routes

Four road segments have been identified that could serve as alternative evacuation routes to the primary access roads. Most of these evacuation routes are old ranch roads and therefore cross private land. Agreements would need to be pre-planned with landowners to make use of these as emergency escape routes.

1. **Horseradish Gulch to Thea Gulch**: It is possible to escape this area by driving across private ranch land into Thea Gulch. The access is gated, but the road is negotiable by most vehicles in dry conditions.

2. **Robinson Hill Road to Smith Hill Road**: It is possible to escape from the Robinson Hill - West community by continuing on Robinson Hill Road into Gilpin County. Robinson Hill Road eventually dead-ends into Smith Hill Road. This route is passable to passenger cars in dry conditions. Smith Hill Road can be taken south to Highway 119 or north back to Golden Gate Canyon Road. Portions of this route are narrow, winding and lack turnarounds.

3**. Robinson Hill Road to Douglas Mountain Drive:** Douglas Mountain Drive is a wide, steep, winding dirt road that has direct access to State Highway 119. This road is well maintained and should be passable by passenger cars in all conditions.

4. **Rye Gulch to Guy Hill Road**: At the present time only three homes exist in Rye Gulch, however these could easily be cut off by the same factors discussed for Horseradish Gulch. The communication towers may also be considered a value-at-risk in this area. A rough extension of Rye Gulch Road connects into Guy Hill Road and would provide an alternate escape route for residents. The access is not gated and should be passable by high clearance vehicles and 4WD.

5**. Guy Hill Road North of Golden Gate Canyon Road**: Guy Hill Road connects to Crawford Gulch Road via a primarily good dirt road that is negotiable by passenger cars in dry conditions. About one mile north of Golden Gate Canyon Road, Guy Hill Road passes through an area of heavy fuel loading and steep topography.

7 CWPP MONITORING AND EVALUATION

7.1 CWPP Adoption

The HFRA and FEMA Disaster - Mitigation Act of 2000 requires that the CWPP be formally adopted by the core team. The original plan was adopted in 2004; plan revisions do not require formal adoption by a core team, but the final draft of the revision was presented to the revision core team for comment before signing.

With an adopted CWPP, Jefferson County, GGFPD, and the local communities within the FPD will receive additional consideration on future grant applications that can help implement the recommendations in the CWPP. While not required, an adopted CWPP may be a criterion for favorable ranking and/or a grant prerequisite of their applications.

7.2 Sustaining CWPP Efforts

Implementing and sustaining the CWPP is the key to its success. The CWPP process encourages citizens to take an active role as fuel treatment strategies continue to be developed and prioritized. Maintaining the momentum created by this process is critical to successful implementation and ongoing efforts. The GGFPD is committed to supporting fire protection and emergency services within the district and surrounding areas. It is important that the district continue to provide support in maintaining hazard assessment information and emergency management coordination. Stakeholders will implement recommended actions by working with fire authorities, community organizations, private landowners, and public agencies.

Building partnerships among neighborhood-based organizations, fire protection authorities, local governments, public land management agencies, and private landowners is necessary in identifying and prioritizing measures to reduce wildfire hazards. Maintaining this cooperation is a long-term effort that requires the commitment of all parties involved. The CWPP shows that citizens must take an active role in identifying needs, developing strategies, and implementing solutions to address hazards, and participating in fire prevention and mitigation activities.

7.3 CWPP Oversight, Monitoring, and Evaluation

As wildfire hazard reduction efforts continue to be implemented over time, and the characteristics of WUI zones change, neighborhoods should reassess and update the findings of the CWPP. All CWPPs are meant to be living documents that change in response to the changing conditions and needs of the communities. With these changes, action items may be re-prioritized or added.

GGFPD and communities should be responsible for periodic CWPP monitoring and evaluation. This can be accomplished through regular meetings, public involvement, coordination with other district partners and stakeholders. Evaluation can include analysis of the effectiveness of past mitigation projects as well as recent wildfire suppression efforts, if applicable. This ongoing effort helps determine whether the CWPP goals and objectives are being met. Table 14 provides a suggested schedule with explanation of monitoring and evaluation tasks. Ultimately, the responsibility lies with the community, given that neither the USFS nor the CSFS mandates completion of mitigation on private property. It is in the best interest of these local stakeholders to follow through and help implement the CWPP for the benefit to their communities.

Table 13. Monitoring and Evaluation Tasks

Objective	Tasks	Timeline
Risk & Hazard Assessment	▪Use reliable data that is compatible among partner agencies	Ongoing
	▪Update CWPP as new information becomes available	As needed
	▪Periodically assess wildfire risks and hazards in communities	Biennial
Fuels Reduction	▪Identify and prioritize fuels treatment projects on public land through development of a 5-year plan	As needed
	▪Track fuels reduction and defensible space projects on private land	Annual
	▪Monitor fuels reduction projects along evacuation routes	Annual
	▪Track grants and other funding sources and submit appropriate applications	Ongoing
Emergency Management	▪Provide training opportunities for firefighters	Annual
	▪Review suitability and need for additional fuels reduction	Biennial
Public Outreach	▪Plan and hold Firewise education week	Annual
	▪Provide Firewise pamphlets at public events	Ongoing

	▪Evaluate techniques used to motivate and educate private landowners	Annual

SOURCE MATERIAL AND ADDITIONAL INFORMATION

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