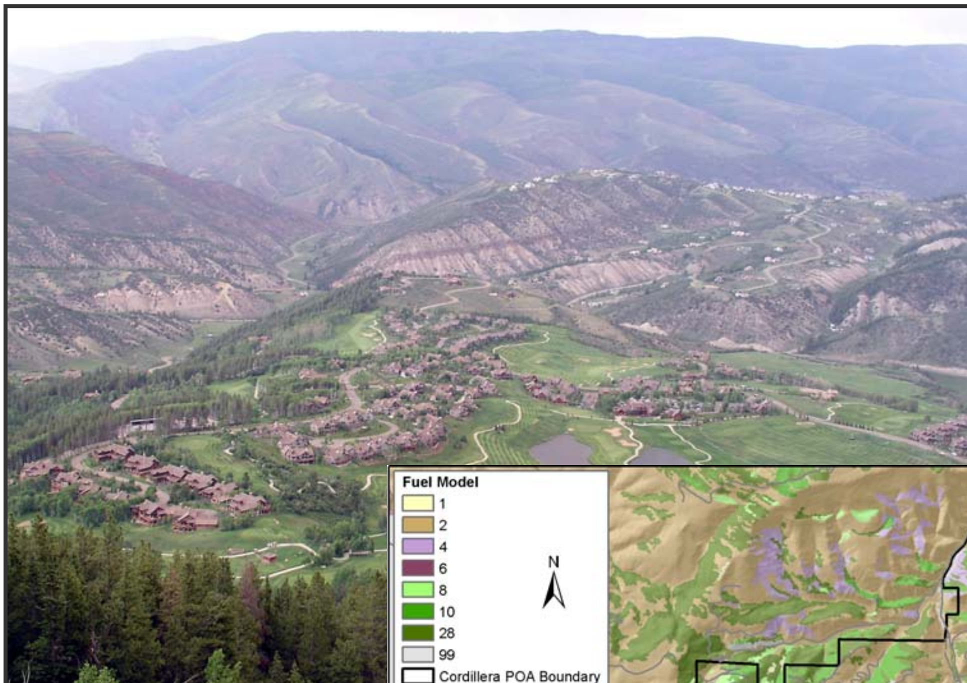
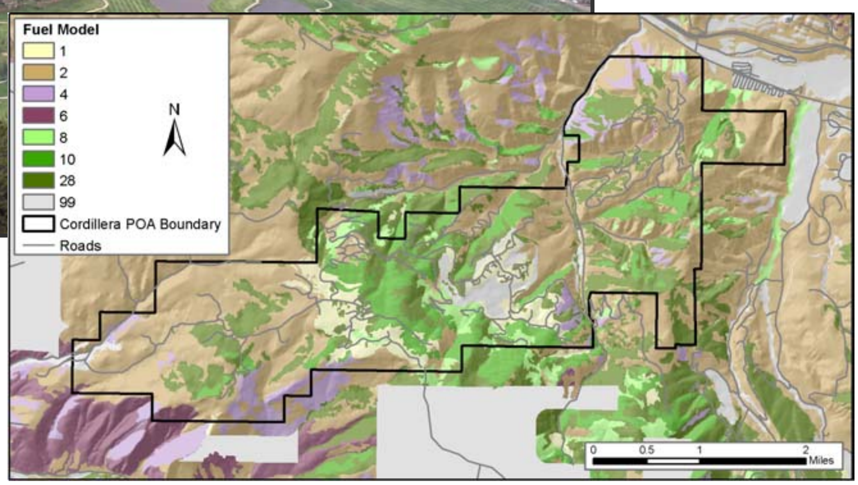
Wildland Urban Interface Community Fire Plan

Prepared for:

Cordillera Property Owner's Association
Edwards, Colorado





Submitted By:

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Boulder, Colorado

August, 2004

ANCHOR POINT
FIRE MANAGEMENT

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Purpose

The purpose of this analysis is to provide a comprehensive, scientifically based assessment of the wildfire hazards and risks within the Cordillera Property Owner's Association study area. The assessment will aid stakeholders in developing short-term and long-term fuel and fire management plans. This initial level of pre-planning will assist land managers in making valid, timely decisions for planned and unplanned ignitions. The assessment estimates the hazards associated with wildland fire in proximity to communities. The hazard information, in conjunction with values-at-risk information, defines "areas of concern" for the community and allows prioritization of mitigation efforts. In addition to the general purpose, several task-specific goals are addressed within this study.

Task Specific Goals

1. Promote community awareness:

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

2. Improve wildfire prevention through education:

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

3. Facilitate appropriate hazardous fuel reduction:

- The prioritization of hazardous Fire Management Units (FMU) can assist land managers in focusing future efforts towards the areas of highest concern from both an ecological and fire management perspective.

4. Promote improved levels of response:

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

Study Area Profile

Cordillera is located in Eagle County, 120 miles west of Denver, Colorado. Cordillera is divided into four areas, The Divide, The Ranch, The Summit and the Cordillera Valley Club. The boundary of the study area includes all of these except the Cordillera Valley Club and covers 6,139 acres (approximately 9.5 square miles). For the sake of simplicity all references to Cordillera and Cordillera Property Owners Association (CPOA) in this document will apply only to communities in the study area. The primary access to Cordillera is via Squaw Creek Road.

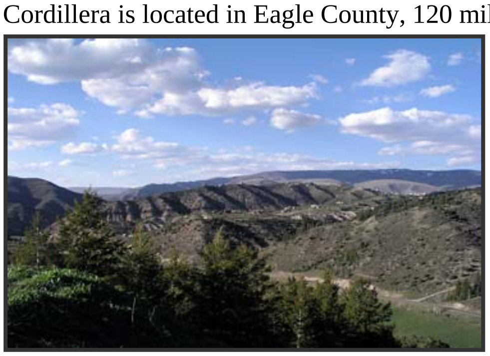


Figure 1: Typical Area

The communities in the study area fall into two fire districts. Hazard and risk recommendations pertaining to fire suppression apparatus and personnel only pertain to areas that lie within the boundaries of Cordillera unless otherwise noted.

The area is considered to be in the Foothills and Montane zones (5,500'- 9,500') of the western slope of the Northern Colorado Front Range.[1] The predominant vegetation is quaking aspen (*Populus tremuloides*) (typically with a dense understory of serviceberry (Genus *Amelanchier*), chokecherry (*Prunus virginiana*) and other mountain shrubs), and dense stands of mixed conifers including lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*) and Englemann spruce (*Picea englemannii*). Other flora that occur commonly, particularly on drier slopes, include Gambel's oak (*Quercus gambelii)*, pinyon pine (*Pinus edulis*), Rocky Mountain juniper (*Juniperus scopulorum*) and various species of sagebrush (Genus *Artemesia*).

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

Current Risk Situation

For the purposes of this report, risk will be considered to be the probability of an ignition occurrence. This is primarily determined by the fire history of the area. Hazard is the measure of fire behavior potential as modeled from the fuels, weather and topography of the study area.

The majority of the study area is at a high risk for Wildland Urban Interface (WUI) fires. Cordillera is listed in the Federal Register as a community at high risk from wildfire (http://www.fireplan.gov/reports/351-358-en.pdf) as are the near-by communities of Eagle and Vail. The area is also shown in the Colorado State Forest Service WUI Hazard Assessment map to be an area of high Hazard Value (an aggregate of Hazard, Risk and Values Layers). This area has a significant fire history. From 1986 to 2002 the Bureau of Land Management reported 3,648 fires in the Craig District and the United States Forest Service reported 210 fires for the same period in the Eagle and Holy Cross sub-units of the White River National Forest. This represents an average of 241 fires a year on adjacent federal land management units.

Information regarding the response to WUI ignitions in Cordillera by Eagle River Fire and Greater Eagle Fire was not available for this report.

For reference to the rest of this document, Figure 2 and Table 1 show the communities that comprise the Wildland/Urban Interface study area, and Figures 3 and 4 show the general topography of the area.

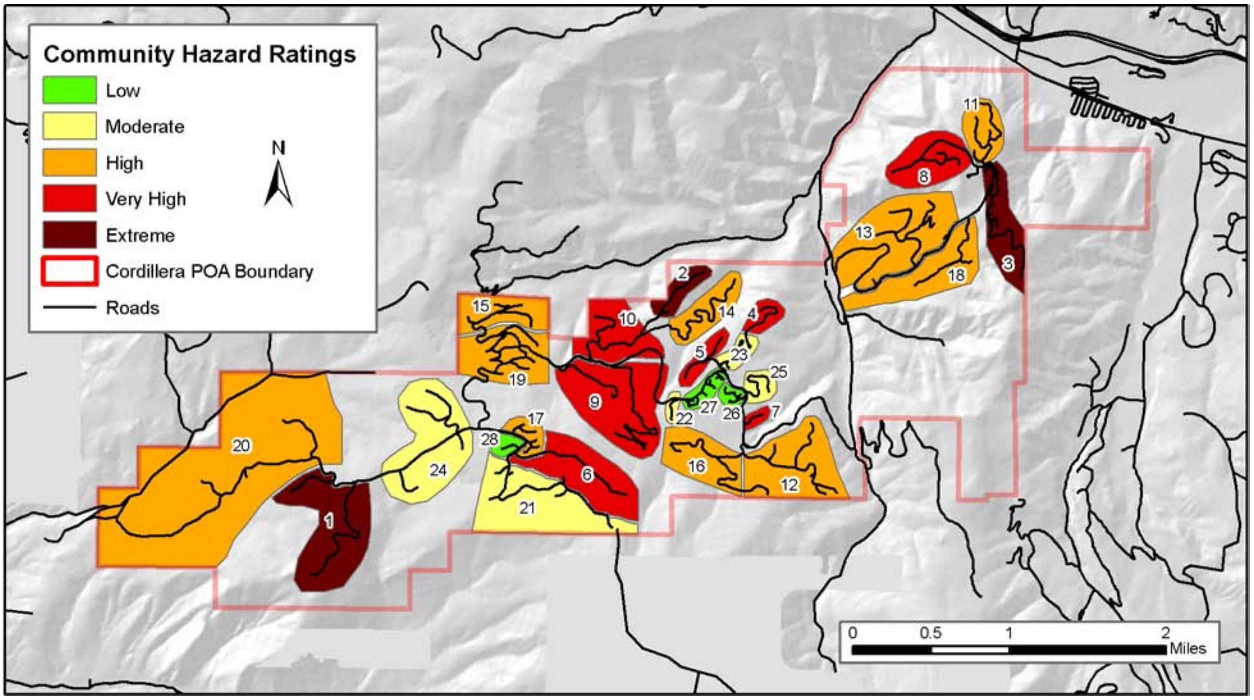


Figure 2: Study Area Communities

1. Webb Peak and Summit Springs	**15. Settler's Woods**
2. Redtail Ridge	**16. Elk Woods & Springs**
3. El Mirador	**17. Summit Club**
4. The Ridge	**18. Granada Glen**
5. The Timbers and Fairways	**19. Settler's Loop**
6. Granite Springs	**20. Territories**
7. Grey Hawk	**21. Gold Dust/Murphy's Creek**
8. Casteel Ridge	**22. Cimarron**
9. The Aspens/Black Bear/Whitaker Ponds	**23. Bearcat**
10. Red Draw and Peregrine	**24. Summit Fairways**
11. Kensington Green	**25. Founder's Preserve**
12. Bearden Meadows	**26. Club Cottages**
13. Andorra/Central Divide	**27. Bentgrass**
14. Red Draw Meadows	**28. Martingale**

Extreme Very High High Moderate Low

Table 1: Hazard Ranking of Communities in the Study Area

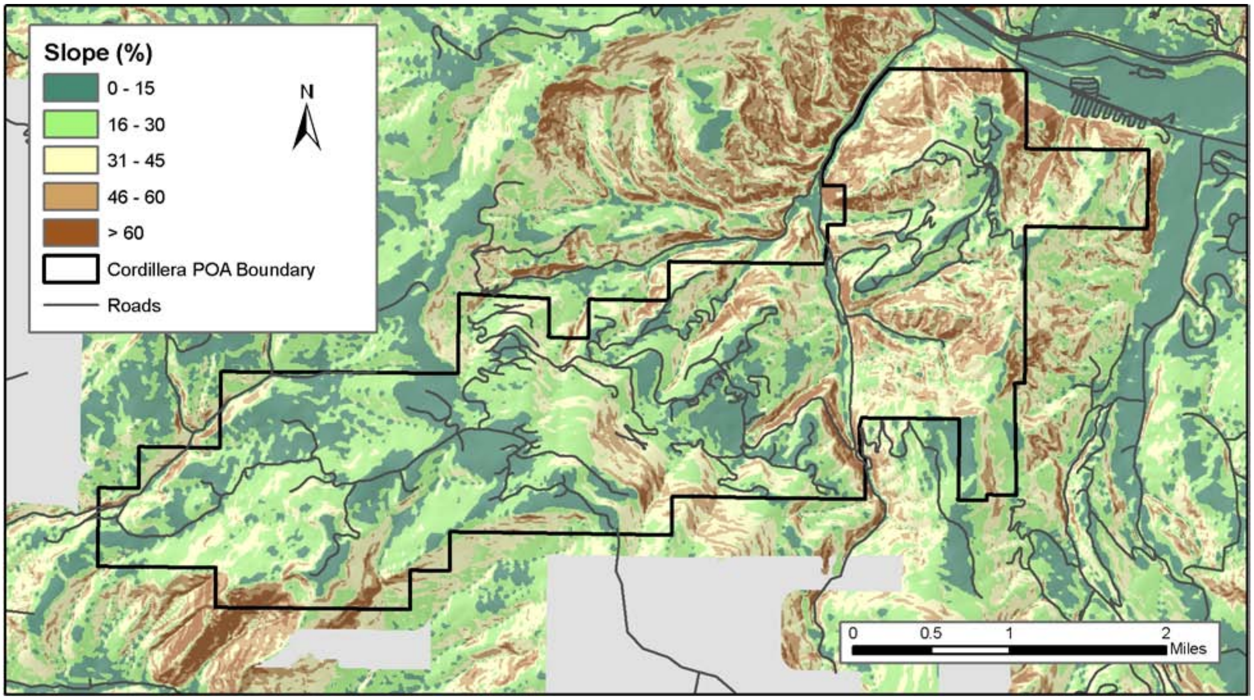


Figure 3: Percent Slope

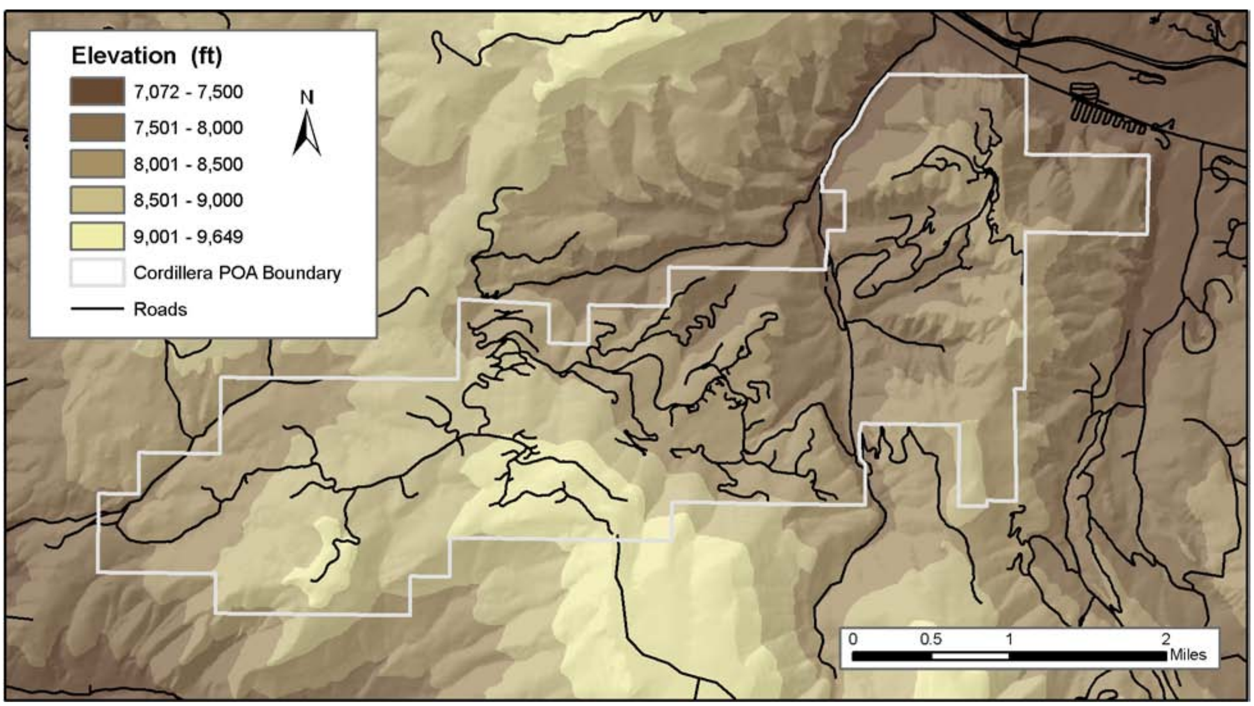


Figure 4: Elevation

Fire Behavior Potential

From the Wildfire Hazard Analysis carried out as a part of this study (see Appendix A), the fire behavior potential of the study area was modeled. This model can be combined with structure density and values-at-risk information to generate current and future “areas of concern”. This is also sometimes referred to as a "values layer". Figure 5 shows the fire behavior potential map for the analysis area given the average weather conditions existing between May 1 and October 31. Weather observations from the Dowd Junction Remote Automated Weather Station (RAWS) were averaged for a sixteen-year period (1987-2003) to calculate these conditions. The “extreme conditions” map (Figure 6) was calculated using ninety-seventh percentile weather data. That is to say the weather conditions existing on the four most severe fire weather days in each season for the sixteen-year period were averaged together. It is reasonable to assume that similar conditions may exist for at least four days of the fire season during an average year. In fact, during extreme years such as 2000 and 2002, such conditions may exist for significantly longer periods. Even these calculations may be conservative compared to observed fire behavior. Drought conditions the last few years have significantly changed the fire behavior in dense forest types such as mixed conifer. The current values underestimate fire behavior especially in the higher elevation fuels because the extremely low fuel moistures are not represented in the averages. For a more complete discussion of the fire behavior potential methodology, please see Appendix A.

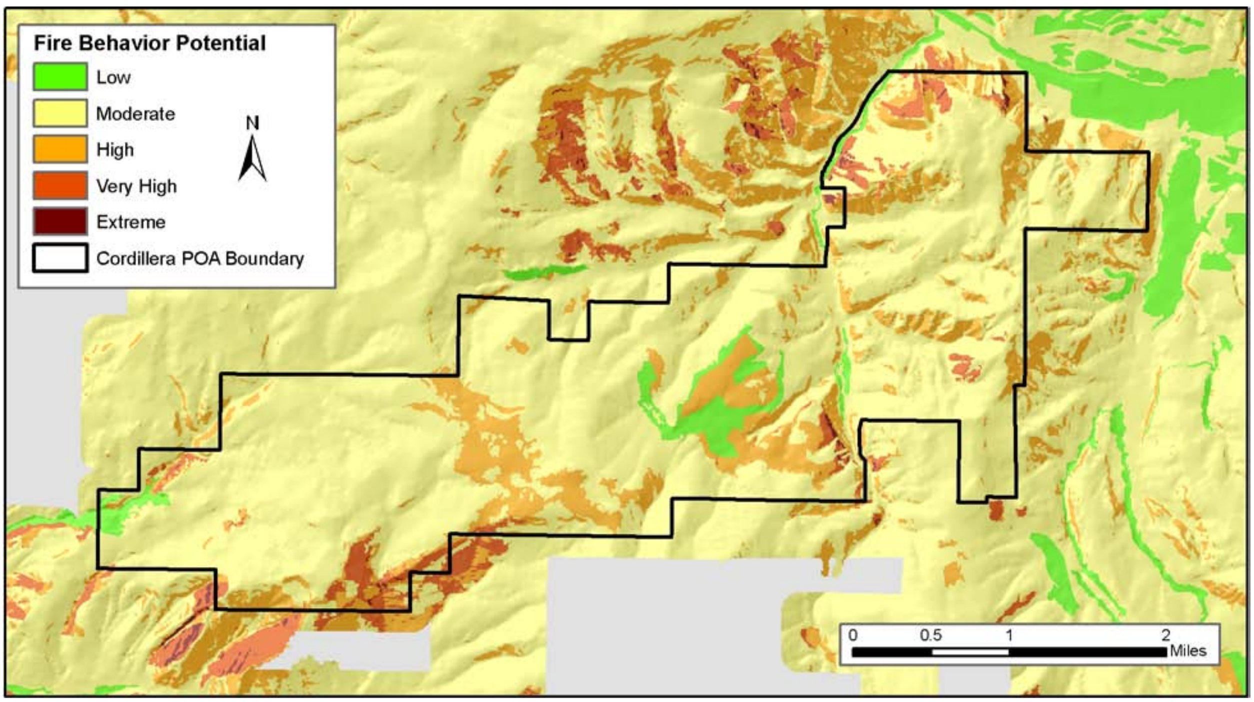


Figure 5: Fire Behavior Potential (Average Weather Conditions)

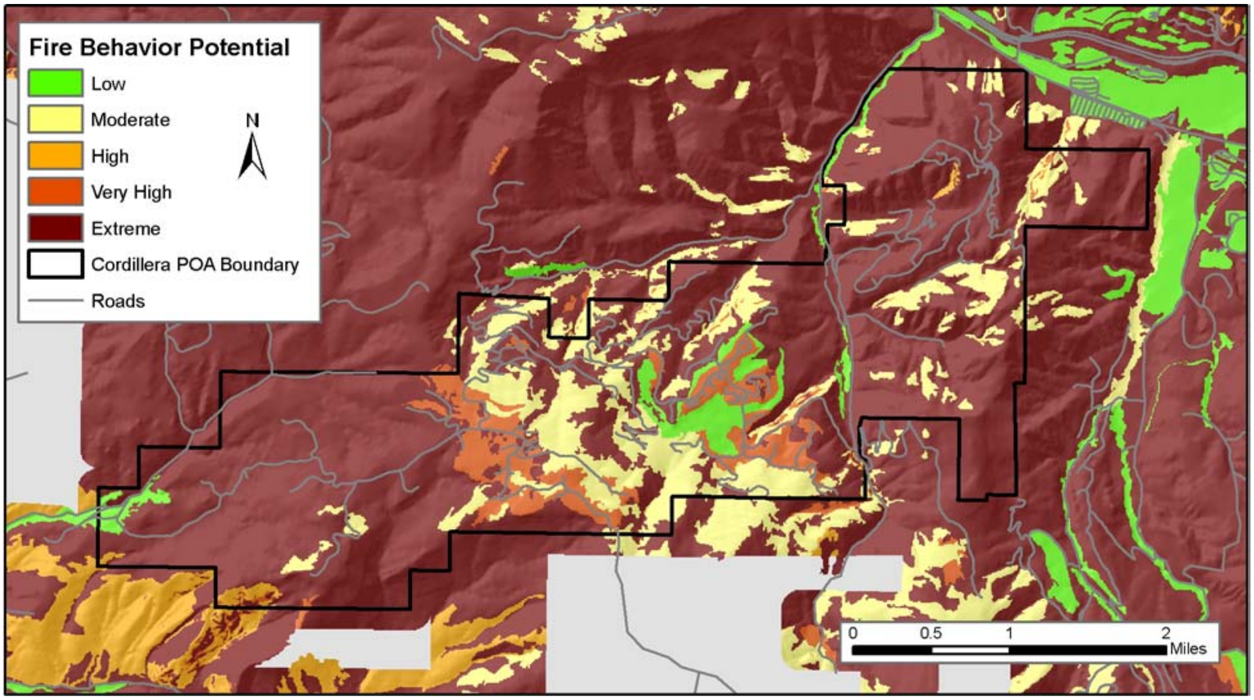


Figure 6: Fire Behavior Potential (Extreme Weather Conditions)

Public Education Efforts

Cordillera is a community that has emphasized planning since its inception. Homes are expensive and well built. An approach to wildfire education that emphasizes safety and hazard mitigation on an individual property level should be undertaken, in addition to community and emergency services efforts at risk reduction. Combining community values such as quality of life, property values, ecosystem protection and wildlife habitat preservation with the hazard reduction message will enhance the enthusiasm of residents.

RECOMMENDATIONS

- Utilize these web sites for a list of public education materials, and for general homeowner education:
  - http://www.nwcg.gov/pms/pubs/pubs.htm
  - http://www.firewise.org
  - http://www.colostate.edu/Depts/CSFS/fire/interface.html
- Provide residents with the findings of this study including:
  - Levels of risk and hazard.
  - Values of fuels reduction programs.
  - Consequences and results of inaction for planned and unplanned ignitions within the study area.
- Create a Wildland Urban Interface (WUI) council of property owners to provide peer level communications for Cordillera. Too often, fire department and government agency advice can be construed as self-serving. Consequently, there is poor internalization of information by the residents. The council should be used to:
  - Bring the concerns of the residents to the prioritization of mitigation actions.
  - Select demonstration sites.
  - Assist with grant applications and awards.
- Request that CPOA, the Squaw Creek Metro District and the Cordillera Design Review Board (DRB) promote the development of defensible space and firewise plantings.

Fire Department Involvement

Cordillera is serviced by two fire departments. Greater Eagle Fire Protection District (GEFPD) provides suppression services for the Territories and Webb Peak & Summit Springs. Eagle River Fire Protection District (ERFPD) provides suppression services for the remainder of Cordillera.

ERFPD operates nine fire stations and 15 pieces of fire apparatus. Six of the fire stations are staffed 24 hours a day by a crew of two to four. Two of these stations are located in Cordillera. Station one is located on Carterville Road near the Cordillera administrative offices and is staffed 24 hours a day. Station two is located on Summit Trail near the intersection with Settler's Loop and is unmanned at the time of this report. Mutual aid is available from the Greater Eagle Fire Department. The type and distribution of ERFPD apparatus was not available for this report.

ERFPD employs 40 full time staff, 26 student resident fire fighters and 40 volunteer fire fighters. The NWCG (National Wildfire Coordinating Group) certification levels for ERFPD fire fighters were not available for this report.

GEFPD runs twenty-four hour staffed shifts from its Shelton Station #9 with an average rolling time of 1 minute from receipt of tone. Mutual aid is available from Eagle River Fire Department.

GEFPD is a volunteer fire department with an average membership of 30. Twenty of GEFPD's firefighters have NWCG (National Wildfire Coordinating Group) S-130/190 training (basic wildland fire fighter training and fire behavior). Six firefighters are qualified as advanced wildland firefighter (Squad Boss level or higher).

Long drive times, especially for GEFPD resources, and limited access (one way in and out of many areas) contribute to the difficulties in defending structures in Cordillera. The ability to add and adequately train additional firefighters will be critical to the successful defense of this rapidly growing and increasingly complex Wildland Urban Interface.

RECOMMENDATIONS

- Provide 24 hour staffing for the current ERFPD station on Summit Trail. This recommendation would greatly improve response time to the Summit, Webb Peak and Territories areas.
- Obtain an easement to use the Territories BLM road described in *"Evacuation Routes"* section on page 9 as an access route for GEFPD resources to respond to fires and smoke reports in western Cordillera.
- Provide continuing education for all firefighters including:
    - NWCG S-130/190 for all department members.
    - Annual wildland fire refresher and “pack testing” (physical standards test).
    - S-215 Fire Operations in the Urban Interface.
    - S-290 Intermediate Fire Behavior.
    - I-200 and I-300 – Basic and Intermediate ICS.
- Equipment:
    - Consider the purchase of an additional type VI (4WD) engine to be located in Cordillera.
    - Provide minimum wildland Personal Protective Equipment (PPE) for all firefighters.
        - (See NFPA Standard 1977 for requirements).
    - Provide gear bags for both wildland and bunker gear to be placed on engines responding to fire calls. This will help ensure that firefighters have both bunker gear and wildland PPE available when the fire situation changes.
    - Provide and maintain a ten-person wildland fire cache at both stations in Cordillera in addition to the tools on the apparatus. The contents of the cache should be sufficient to outfit two squads for handline construction and direct fire attack. Recommended equipment would include:
        - Four cutting tools such as pulaskis or super pulaskis.
        - Six scraping tools such as shovels or combis.
        - Four smothering tools such as flappers.
        - Four backpack pumps with spare parts.
        - Two complete sawyer’s kits including chainsaw, gas, oil, sigs, chaps, sawyer’s hard hat, ear protection, flies, file guides, spare chains and a spare parts kit.
        - MREs and water cubies sufficient for 48 hours.

- Communications:
    - Surveys of GEFPD officers indicated that their primary communications system operates in the 800 MHz band, which is becoming more common for urban fire departments. Systems such as these offer high audio quality, but are easily blocked by terrain features. VHF radios operating in 150 MHz band are still the principle radios for many wildland fire resources and have generally better reception than 800 MHz systems in complex terrain. Although the surveys indicate there is a backup communication system to the primary 800 MHz system, its specifications were not reported. Compatibility with other local resources such as USFS, BLM, CSFS and especially ERFPD should be a high priority.
    - Surveys of GEFPD officers revealed radio communications are generally good on ridge tops, but poor in many of the valleys and drainages in Cordillera. Due to the restrictions of terrain, it is unlikely that more powerful base stations or portable radios would make any impact on this problem. Some areas may see slight improvements in base station reception by increasing the height above average terrain of the base station antenna, particularly at the ERFPD station on Summit Trail; however, communications between most of Cordillera and the permanently staffed station on Carterville Road may often be difficult due to terrain barriers. The best solution is to increase the number of repeaters in the district. One method of assessing potential locations is to conduct communications tests throughout suspect areas. Repeaters should be positioned on ridges or other high points with a clear line of sight into areas of poor communications where homes and other values at risk are likely to require fire operations. If homeowners are resistant to fixed repeater sites, another solution is to construct one or more mobile repeaters in engines or command vehicles. Mobile repeaters allow the vehicle to be positioned for optimum communication for each incident. Repeaters are expensive, but considering the fact that cell phone communications are also patchy in many of the same areas, grants and other sources of funding should be pursued in order to solve this important operational problem. If it is not possible to obtain a repeater frequency, which is likely, satellite phones may be a reasonable solution for emergency-only communications.

Solutions and Mitigation

Establishing and Prioritizing Fire Management Units (FMUs)

An efficient method of prioritizing work efforts is to create Fire Management Units. FMU's should be created prior to planning or initiating fuels management projects and other mitigation. There are unique vegetation and/or mitigation management activities recommended for each unit. Units may be functional or geographic. For the most part CPOA will have the responsibility for determining priority actions, however the involvement of local fire officials and federal land managers, where appropriate, is desirable. Recommendations are not ordered in priority ranking. For information regarding prioritization please refer to the "Cordillera Annual Work Plan". Recommendations are presented for the following items.

- Access, Evacuation and Sheltering-in-Place FMU
- Home Mitigation FMU
- Landscape Scale Fuels Modifications FMU
- Water Supply FMU

Access, Evacuation and Sheltering-In-Place FMU

Addressing

Although street and address signage is generally quite good in Cordillera, many addresses would be difficult to see at night. We consider evening visible signage to be a critical operational need. The time saved, especially at night and in difficult conditions, is not to be underestimated. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true for volunteer operators who do not have the opportunity to train on access issues as often as career firefighters. Recommendations for address markers can be found in Appendix D. It would also be desirable for the DRB to research methods that would enhance nighttime visibility and maintain a uniform look in the neighborhoods.

Evacuation Routes

Four roads have been identified that could serve as alternative evacuation routes to the primary access. These routes are highlighted in the overview of the district shown in Figure 7.

1. **Red Draw Road**: This evacuation route is located at the north end of Red Draw Road. It continues northeast through private property and connects to West Squaw Creek Road. This is an important route as ignitions occurring in the Red Draw and Peregrine and Redtail Ridge areas could easily cut off the primary egress from Red Draw Road. It could also serve as a route for The Ranch and The Summit if they are cut off from Emma's Way or Squaw Creek Road. Currently, it is an unimproved grassy track adjacent to the old irrigation ponds and would require 4WD, especially in wet conditions.
2. **Emma's Way**: This evacuation route is located at the north end of Emma's Way. It continues northeast through private property and connects to West Squaw Creek Road. This is an important route for the Ranch and Summit communities in the event they become cut off from Red Draw Road or Squaw Creek Road. Currently, this dirt two-track is in good condition and would require 4WD only when wet.
3. **Territories BLM Road**: This evacuation route is located at the west end of Territory Trail. It continues west through Bureau of Land Management land and connects to Salt Creek Road. This is an important route for the Summit communities if conditions do not allow the use of the Emma's Way escape route. Currently this dirt two-track is rocky and would require a high clearance vehicle in good conditions and 4WD when wet. An easement should be sought from the BLM to improve and maintain this key escape route.
4. **Gore Trail USFS Road**: This evacuation route is an option for evacuees only if all other routes are compromised. It is suitable for foot travel only. The road extends from Cordillera's southern boundary, at the south terminus of Gore Trail to the interior of the White River National Forest. Approximately 1 mile up the

road is a large meadow that could be used as a helispot for a Type II helicopter or a deployment zone for firefighters. The road continues past the meadow to other openings that may be useful as deployment zones, safety zones or helispots.

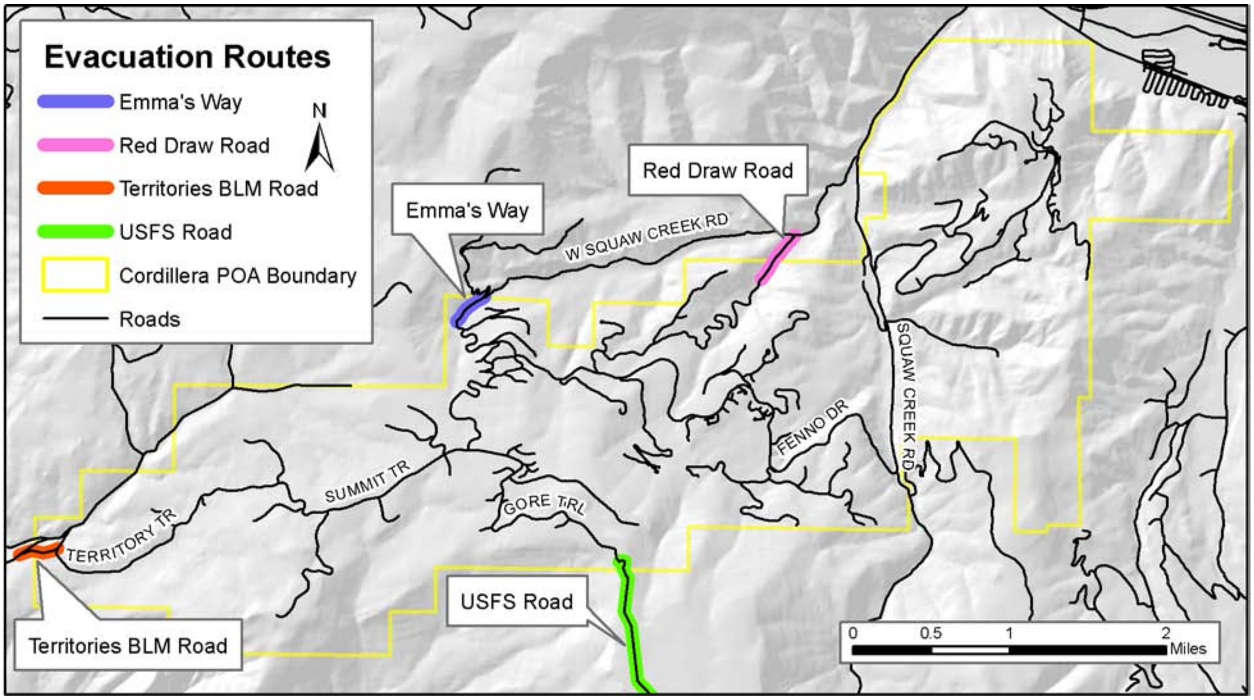


Figure 7

ACCESS ROUTE FUELS MODIFICATION RECOMMENDATIONS

In addition to developing additional escape routes, fuel modification projects for primary access corridors should be implemented. Squaw Creek Road, Cordillera Way, Fenno Drive, Summit Trail, Gore Trail and Territory Trail constitute the primary transportation corridors through the district. In some areas, these roads have inadequate openings (see "Elements of the fuels modification space…" on page 11). Additionally, many of the communities in the study area would benefit from fuels reduction along their principal access routes.

Thinning along primary access roads into communities should include an area of at least 100' on either side of the centerline of the access routes where practical. This distance should be modified to account for increased slope and other topographic features that increase fire intensity (see Table 3). This is especially important in communities with steep narrow roads and few turnouts. In these areas, safer access for firefighters would make an impact in the number of structures that could be defended in a wildfire. Existing and natural barriers to fire should be incorporated into the project dimensions.

The following communities were found to have a high potential for entrapment and significant fuel loadings along critical access roads and consequently should be considered highest priority for fuels reduction along access corridors:

- The Timbers and Fairways
- Red Draw and Peregrine
- Webb Peak and Summit Springs
- Redtail Ridge
- El Mirador
- The Aspens/Black Bear/Whitaker Ponds
- Settler's Loop
- Elk Woods and Springs
- Granite Springs
- Territories

In addition to the escape routes suggested on pages 9 and 10, other possibilities should be defined and similar fuels reduction projects employed. In areas where multiple routes exist, consider separating access routes for responders and escape routes for citizens in your preplanning.

Cooperation between adjacent, contiguous homeowners is imperative to achieve the most effective wildfire mitigation. If this is not possible, more intensive thinning may need to occur within the road easement to compensate for gaps in fuels modification. Homeowner participation allows the project to be more flexible in selecting trees and shrubs for removal. It allows greater consideration for the elements of visual screening and aesthetics. Enlarging the project dimensions, allows more options for vegetative selection while still protecting the access/egress corridor.

- Elements of the fuels modification space for access routes should include:
  - Tree crown separation of at least 10' with groups of trees and shrubs interspersed as desired.
  - Crown separation greater than 10' may be required to isolate adjacent groups or clumps of trees.
  - Limb all remaining trees to a height of 8' or 1/3 of the tree height (whichever is greater).
  - Clean up ground fuel within the project area.
  - Post placards clearly marking "fire escape route". This will provide functional assistance during an evacuation and communicate a constant reminder of wildfire to the community. Be sure to mount signage on non-combustible poles.

OTHER ACCESS ROUTE RECOMMENDATIONS

- In order to reduce conflicts between evacuating citizens and incoming responders, it is desirable to have nearby evacuation centers for citizens and staging areas for fire resources. Evacuation centers should include heated buildings with facilities large enough to handle the population. Schools and churches are usually ideal for this purpose. In the case of Cordillera, the larger public buildings such as the Lodge and Spa at Cordillera, and the Summit Athletic Club may be suitable.

  Fire staging areas should contain large safety zones, a good view in the direction of the fire, easy access and turnarounds for large apparatus, a significant fuel break between the fire and the escape route, topography conducive to radio communications and access to water. Golf courses and large irrigated greenbelts may make good safety zones for firefighting forces. Local responders are encouraged to preplan the use of potential staging areas with CPOA.
- Identify and pre-plan alternate escape routes and staging areas.
- Perform response drills to determine the timing and effectiveness of fire resource staging areas.
- Educate citizens on the proper escape routes, and evacuation centers to use in the event of an evacuation.
- Utilize a reverse 911 system or call lists to warn residents when an evacuation may be necessary. Notification should also be carried out by local television and radio stations. Any existing disaster notification systems, such as tornado warnings, should be expanded to include wildfire notifications.
- Emergency management personnel should be included in the development of preplans for citizen evacuation.

Shelter-In-Place

The access to several communities in the study area could be easily cut off by ignitions in drainages below homes. In addition to improved access/egress, consideration should be given to developing “shelter-in-place” areas that are designed as alternatives to evacuation through hazardous areas. In areas that are under consideration for "shelter-in-place tactics, structures should have ignition resistant construction and good defensible space. Defensible space can be added at anytime, however, once a home is built, ignition resistant materials are difficult if not impossible to retrofit. The communities in Cordillera where "shelter-in-place" tactics may be especially effective are El Mirador, Casteel Ridge, Kensington Green, Andorra/Central Divide and Granada Glen.

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

Shelter–in-place should only be considered when the structure is determined to be “stand alone” in structural triage terms. In order to be "stand alone", homes need to have defensible space and be of ignition resistant construction. Depending on the fuel type and fuel bed depth, it may be necessary to continue treatment beyond the minimum recommended defensible space boundaries in order to make the home stand alone. For a list of defensible space recommendations please see the “General Recommendations” section of Appendix B.

Ignition resistant construction is also necessary for shelter-in-place tactics. Wooden roofs and older structures with untreated wooden sidings are particularly hazardous and should not be considered. Structures with large windows, or other large glass surfaces, that face heavy fuel loads or dangerous topographic features are also not acceptable. It is preferable to have metal, tile or asphalt roofs and ignition resistant materials such as stucco or concrete, especially close to the ground. Heavy timber constructions, such as log homes, are also resistant to surface fires. When combined with an ignition resistant type roof, heavy timber may be acceptable. Eves should be enclosed. Any holes in the foundation, siding, or eves should be covered to prevent embers from entering.

Threats to residents remaining in structures include heat, smoke, and ignition of the structure itself. Several steps can be taken by residents to mitigate the effects of heat exposure. The following list highlights some of the important concepts:

- Close all doors and windows and shut down all ventilation systems such as air conditioning, heating, and attic fans.
- If there is adequate time and water, consider plugging downspouts and filling any gutters with water. The sand bags that mountain residents commonly have are good for this purpose.
- Fill all of the tubs and sinks, and any buckets that are easily handled, with water.
- Remove any lightweight or highly flammable window coverings. Heavy drapes or blinds should be closed in case the windows break.
- Move furniture away from windows, and be sure to remove flammables, such as gasoline and propane, to a safe distance away from the structure. Propane, and other volatile compressed gas, tanks may rocket as high as ½ mile, so they are best removed to an area cleared of fuels, such as a concrete driveway or pad.
- Wear clothes of fire resistant natural fibers such as wool or cotton. Be sure to cover as much exposed skin as possible, and keep water with you for personal protection. Do not wear polyester or other synthetics that may melt to your skin when exposed to high temperatures.
- When the fire arrives retreat to the room in the house farthest away from the flaming front.
- Take drinking water with you and drink often to avoid dehydration.
- Even if it becomes uncomfortably hot and smoky do not run outside while the fire is passing.

Fires consume oxygen and produce toxic gasses and smoke. Much work has been done in the hazardous materials field on the infiltration of toxic gasses into structures. Average homes under average weather conditions may experience indoor concentrations of smoke and contaminants of 45 to 65 percent of the outdoor concentrations in 30 minutes. In two hours the concentrations may reach 60 to 65 percent of the outdoor levels.[2] These numbers are for homes with all doors and windows closed and ventilation systems turned off. Buildings with open windows, doors, or operating ventilation systems will experience contamination levels close to the outdoor levels in minutes. Residents can further slow contamination by blocking gaps around doors and windows with wet towels.

After the fire has passed, the main danger to residents is the home igniting from embers and sparks that entered during the flame front passage. Systematically patrol inside and outside looking for embers and spot fires. Be sure to include attics and other roof spaces. Houses may catch fire several hours after the fire has passed if embers are not found and extinguished. For more information on structural triage and preparation please see Appendix C.

[2] "Handbook of Chemical Hazard Analysis Procedures" (Washington, D.C.: FEMA, 1990).

Home Mitigation FMU

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

The mid-level assessment has identified 10 of the 28 communities in the study area to be at extreme or very high hazard. Construction type, condition, age, the fuel loading of the structure/contents and position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. There is also a likelihood of rapid fire growth and spread in these areas due to steep topography, fast burning or flashy fuel components and other topographic features that contribute to channeling winds and promotion of extreme fire behavior. These areas may also represent a high threat to life safety due to poor egress, the likelihood of heavy smoke and heat and/or inadequate response levels.

Table 2, on page 15, illustrates the relative hazard rankings for communities in the study area.

- A rating of 5 or less indicates an area of extreme hazard.
- A rating of 6 to 10 indicates a very high hazard.
- A rating of 11 to 20 indicates high hazard.
- A rating of 21 to 29 indicates moderate hazard.
- A rating of 30 or greater indicates a low hazard.

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

In the parcel level analysis, RedZone Software would be utilized to organize and display individual structure assessments. This tool allows the user to collect, maintain and use preplanning data. This data includes information concerning homes, roads and other GIS data. It can be utilized to assist with fire education, developing and prioritizing future projects and to support an incident in size-up, stabilization, property conservation and fire control. The software is designed specifically for firefighters in the field. Data elements collected for the Wildfire Hazard-Risk Assessment can be integrated into RedZone Software. The software package that would be utilized in the parcel level analysis and provided to the fire district has three distinct elements.

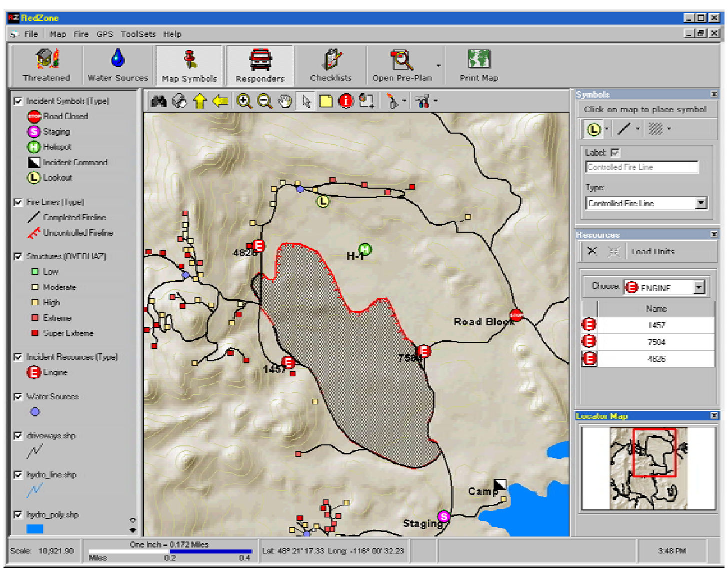


Figure 8: RedZone Software

RZSURVEY The project field staff would utilize comprehensive field surveys, which are integrated into a Personal Digital Assistant (PDA). Diverse types of preplanning data are collected. Custom questionnaires would be developed, in cooperation with the fire district, for structure, water source, helispot and other preplanning elements.

UTILITIES This program allows the fire district to not only collect information, but also maintain it over time. Utilities provides tools to update field data as well as to collect complex GPS data, customize and print maps, analyze homes based on hazard criteria, and many other tools.

One exceptional feature of Utilities is the ability to instantly generate a mitigation report for any home surveyed.

Data elements that would be collected in a parcel level analysis:

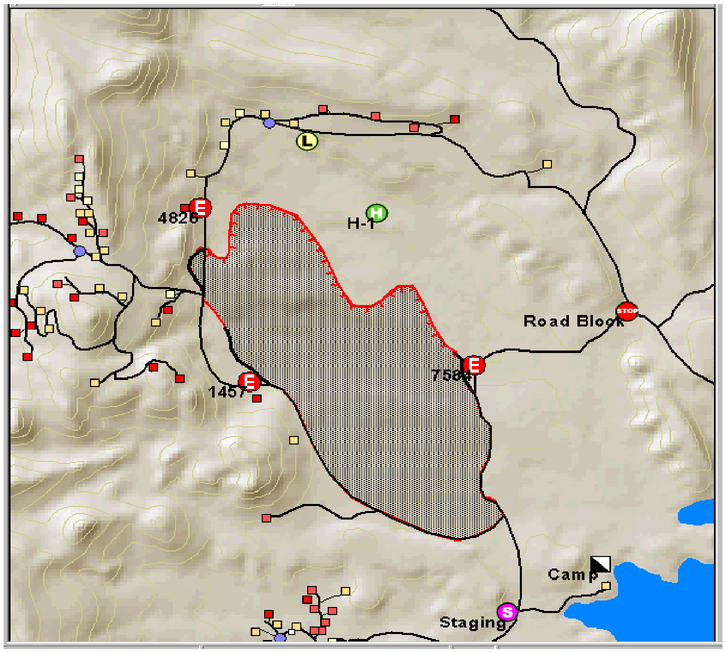


Figure 9: RedZone Fire Direct

- Topography
- Aspect class (N-S-E-W)
- Defensible space
- Vegetation/fuel types
- Predominant fuel model class
- Firewood storage
- Determination of vegetation near chimney or stovepipe
- Ownership
  - Street address
- GPS of house footprint locations
- Photographs of structure
- Roofing material classification
- Balcony & deck classification
- On-site access classification
- Water supply
- Off site access
  - Ingress/egress to driveway
  - Road width
  - Maximum grade

FIREDIRECT

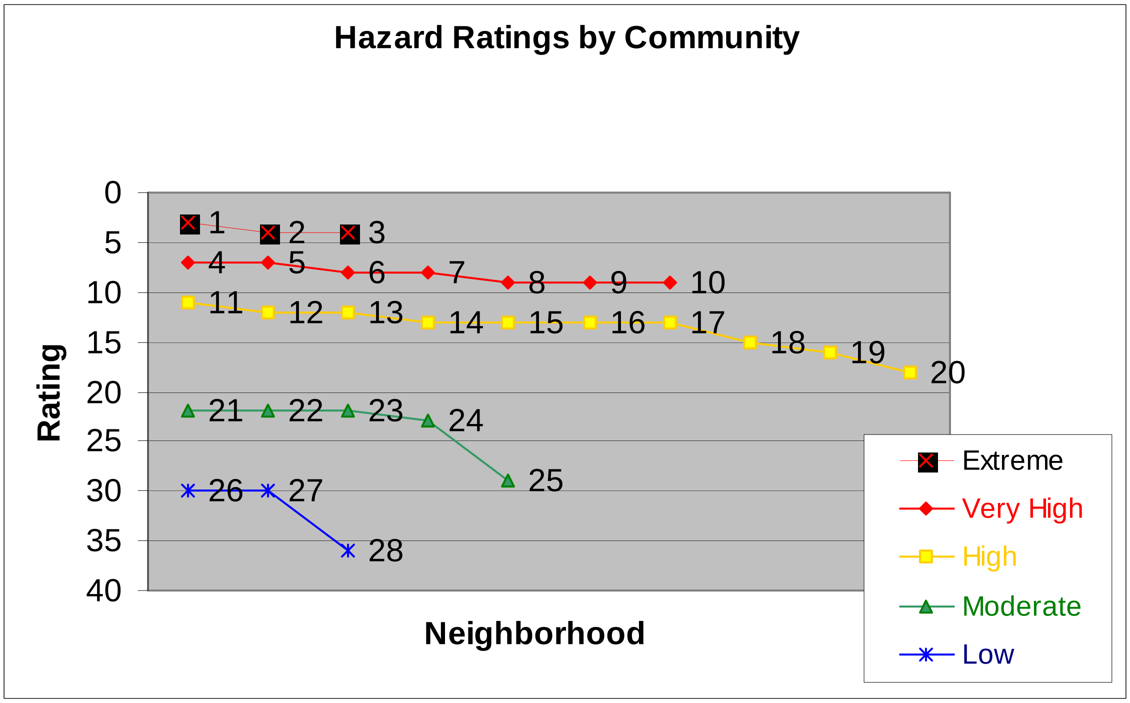
During fires, this program is an invaluable tool for providing spatial data. From access restrictions to water availability for individual structures, it provides critical information to firefighters in the field. FireDirect also has the capability of tracking responding apparatus and crews, importing fire perimeters and creating standard ICS maps and forms. The software would be customized with a comprehensive database specific to Cordillera. It is configured to accept an ever increasing and wide-ranging database.

RECOMMENDATIONS

- Conduct a parcel level wildfire hazard analysis for the homes in the study area. Completing this process will facilitate the following important fire management practices.
  - Establish a baseline hazard assessment for homes in these communities.
  - Education of the community through the presentation of the parcel level Hazard-Risk Analysis at neighborhood public meetings.
  - Identification of defensible space needs and other effective mitigation techniques.
  - Identification and facilitation of "cross-boundary" projects.
  - Community achievement of national FIREWISE status.
  - Development of a Pre-Attack/Operational Plan for the FMU and eventually the entire study area. A pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate incidents that occur.
- ***The most important goal for the Home Mitigation FMU is for every home in Cordillera to have conforming defensible space.*** This is especially important in the Ranch and the Summit where many homes have flammable roofs and sidings. ***An aggressive program of evaluating and implementing defensible space for homes in the highest hazard neighborhoods will do more to limit fire related property damage than any other single recommendation in this report.*** (For more information on defensible space see Colorado State Forest Service fact sheet number 6.302 "Creating Wildfire-Defensible Zones".)
- Utilize the structure triage methodology provided in Appendix C to identify homes not likely to be defendable.

- Add pullouts and turnarounds for emergency apparatus to dead end access roads and long driveways to create safe access for firefighting resources. See Cordillera Hazard Assessment Emergency Access and Water Supply (Appendix D).
- Coordinate with the DRB to research methods that would enhance nighttime visibility of addressing while maintaining a uniform look in the neighborhoods.
- Utilize Firewise plants in landscaping near homes. The use of pines, firs, junipers and other flammable conifers to landscape yards is strongly discouraged.

Table 2



1. Webb Peak and Summit Springs	**15. Settler's Woods**
2. Redtail Ridge	**16. Elk Woods and Springs**
3. El Mirador	**17. Summit Club**
4. The Ridge	**18. Granada Glen**
5. The Timbers and Fairways	**19. Settler's Loop**
6. Granite Springs	**20. Territories**
7. Grey Hawk	**21. Gold Dust/Murphy's Creek**
8. Casteel Ridge	**22. Cimarron**
9. The Aspens/Black Bear/Whitaker Ponds	**23. Bearcat**
10. Red Draw and Peregrine	**24. Summit Fairways**
11. Kensington Green	**25. Founder's Preserve**
12. Bearden Meadows	**26. Club Cottages**
13. Andorra/Central Divide	**27. Bentgrass**
14. Red Draw Meadows	**28. Martingale**

Extreme Very High High Moderate Low

Landscape Scale Fuels Modifications FMU

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as "shaded fuelbreak"). A fuelbreak is an easily accessible strip of land of varying width, depending on fuel and terrain, in which fuel density is reduced, thus improving fire control opportunities. Vegetation is thinned removing diseased, fire-weakened and most standing dead trees. Thinning should select for the more fire resistant species. Ladder fuels, such as low limbs and heavy regeneration are removed from the remaining stand. Brush, dead and down materials, logging slash and other heavy ground fuels, are removed and disposed of to create an open park-like appearance. The use of fuelbreaks under normal burning conditions can limit uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions where spotting occurs for miles ahead of the main fire and probability of ignition is high, even the best fuelbreaks are not effective. That being said, however, fuelbreaks have proven to be effective in limiting the spread of crown fires in Colorado.[3] Factors to be considered when determining the need for fuelbreaks in mountain subdivisions include:

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

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

Fuelbreaks should always be connected to a good anchor point like a rock outcropping, river, lake, or road. The classic location for fuelbreaks is along the tops of ridges to stop fires from backing down the other side or spotting into the next drainage. This is sometimes not practical from a WUI standpoint as the structures firefighters are trying to protect are usually located at the tops of ridges or mid-slope. Mid-slope positioning is considered the least desirable for fuelbreaks, however it may be easiest to achieve as an extension of defensible space work or an extension of existing roads and escape routes. One tactic would be to create fuelbreaks on slopes below homes located mid-slope and on ridge tops so that the area of continuous fuels between the defensible space of homes and the fuelbreak is less than ten acres. Another tactic that is commonly used is to position fuelbreaks along the bottom of slopes. In most of the study area this would require the cooperation of many individual landowners. In some areas, like Red Draw Meadows, the only way to separate residences from fuels is to locate the fuelbreak mid-slope above homes. This would provide some protection from backing fires and rolling materials. It would make sense to locate fuelbreaks mid-slope below homes, where this is possible, to break the continuity of fuels into the smaller units mentioned above. Even though this position is considered the least desirable from a fire suppression point of view, it would be the most effective approach in some portions of the study area.

Fuelbreaks are often easiest to locate along existing roadbeds (see the description of the fuels modification project for primary access corridors on page 11 of this report). The minimum recommended fuelbreak width is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuel break should also be increased with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = 100' + (1.5 x slope %), above road distance = 100' – slope % (see Table 3).[4] Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%. Since fuelbreaks can have an undesirable effect on the esthetics of the area, crown separation should be emphasized over stand density levels. That is to say that isolating groupings rather than cutting for precise stem spacing will help to

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[3] Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" Colorado State Forest Service, Colorado State University [CSFS #102-1083], 1983.

[4] Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" Colorado State Forest Service, Colorado State University [CSFS #102-1083], 1983.

mitigate the visual impact of the fuelbreak. Irregular cutting patterns that reduce canopy and leave behind islands with wide openings are effective in shrub models. This is often referred to as mosaic cutting or clumping.

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

It is also important to note that fuelbreaks must be maintained to be effective. Thinning usually accelerates the process of regenerative growth. **The effectiveness of the fuelbreak may be lost in as little as three to four years if ladder fuels and regeneration are not controlled.**[5]

One of the most difficult issues in establishing and maintaining fuelbreaks is securing cooperation and participation of adjoining landowners. Although most of the fuel breaks recommended in this report are entirely within Cordillera, at least one important recommendation would require the support of the USFS. There are also some potential fuel breaks that would require the participation of adjacent landowners. Such fuel breaks would represent a reasonable cost/benefit to Cordillera only if agreements could be secured easily.

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

Table 3: Recommended Treatment Distances For Mid-Slope Roads

Special Considerations for Fuel Treatments in Oak Brush

In some communities in the study area there is a notable quantity Gambel's oak (fuel models 4 and 6). In the Territories, Gambel's oak stands reach a height of 15 feet and are a threat to the primary access road. When burned, Gambel's oak produces significantly more energy than other common southwestern trees: 52% more than aspen, 42% more than ponderosa pine, 36% more than lodgepole pine and 24% more than Rocky Mountain juniper.[6]

Gambel's oak is extremely fire tolerant and is seldom actually killed by fire. The USFS Fire Effects Information website reports that following a fire that had consumed all aboveground vegetation, herbaceous plants and litter, Gambel's oak quickly reestablished in densities greater than those present before the burn. In a Colorado study Gambel's oak increased 100% to 150% in density and 10% to 40% in frequency following a single burn. Fuels reduction by prescribed fire seems to be most effective in Gambel's oak when performed during the summer growth period when the plant's carbohydrate reserves are at their lowest. This, of course, is the time when prescribed burning would be least desirable from a control standpoint. Even if it were possible to burn during this period, evidence suggests that it would still require repeated, high-severity fires to reduce Gambel's oak.[5]

The preferred method of control is mechanical thinning combined with herbicide application to prevent sprouting and new growth. Thinning with heavy machinery is not likely to be a popular tactic in interface areas. Hand thinning with chainsaws is likely to be the most acceptable method to residents. Ideally herbicide should be applied within the first

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[5] Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" Colorado State Forest Service, Colorado State University [CSFS #102-1083], 1983.

[6] USDA Forest Service Fire Effects Information website (http://www.fs.fed.us/database/feis/index.html), 2000.

hour after cutting to prevent sprouting or alternatively, to emerging sprouts three to six weeks after cutting. USFS information indicates that treatment is most effective if done during the period of low carbohydrate reserves just prior to the full leaf stage (usually early summer). Evidence indicates that herbicides that are applied during periods when carbohydrate reserves are high may actually stimulate root sprouting in Gambel's oak therefore, the timing of fuels reduction efforts becomes more important in oak brush than other fuels. Coordinated efforts between landowners and public land managers are critical to prevent fuels reduction efforts that actually result in an increased fuel load.[7]

Special Considerations for Fuel Treatments in Serviceberry

Serviceberry (*Amelanchier spp.)* is an understory shrub found throughout the Cordillera project area. It is typically located in aspen (*Populus tremuloides*) stands intermixed with snowberry (*Symphoricarpos spp.*) In May 2004, a Wildland Fire Behavior Alert was issued stating that "prescribed fire behavior in newly 'leafed out' Serviceberry (sic) may be characterized as extreme!" and that flame lengths of 40 plus feet and rapid rates of spread were observed.[8] In response to this alert, we recommend treating serviceberry, using the techniques for oak brush discussed above, where appropriate within the project area. Especially in areas designated as very high or extreme risk.

BLM/USFS Involvement

The Upper Colorado River Interagency Fire Management Group is composed of the BLM Glenwood Springs and Grand Junction Field Offices and the USFS White River and Grand Mesa National Forests. The Fire Management Group supports city and county WUI hazard reduction efforts through fuels reduction on adjacent federal lands and by funding WUI planning efforts. At the time of this report there is only one planned fuels reduction project that could impact Cordillera.

- **Salt Creek WUI**: (Proposed for planning in fiscal year 2005.) This project involves possible fuels reduction in large pinion/juniper (20'-30') trees and sage along a 40% south-facing slope to the south of Cordillera. This project is of concern to Cordillera because an ignition occurring in the private land located along the bottom of Salt Creek canyon could burn quickly up slope to the BLM/Cordillera boundary at the top of the ridge.

For the purpose of BLM/USFS project descriptions; "planning" involves project design and coordination with adjacent property owners, fire districts and other stakeholders. Other activities included in the planning stage would be any resource work and inventories necessary for compliance with the National Environmental Policy Act (NEPA).

In accordance with the National Fire Plan, federal land managers in this area have demonstrated a willingness to preplan treatments with local fire departments and landowners to create cross-boundary hazard reduction efforts. It is important for Cordillera and other private landowners to coordinate all fuels reduction projects so they complement these efforts.

RECOMMENDATIONS

The following recommendations are in addition to, not in place of, the fuels reductions mentioned in the "*Home Mitigation Recommendations"* section of this report and the BLM project listed above:

- **Linked D-space and "overlot thinning" on East Timber Draw, West Timber Draw and Timber Trail. (Demonstration project)** - Recommended for implementation in 2004. See "Cordillera Annual Work Plan" for project details.
- **Fuels break in Red Draw along the existing two-track from Fenno Road to Timber Draw. (Demonstration project)** - Recommended for implementation in 2004. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Webb Peak Road. (Demonstration project)** - Recommended for implementation in 2004. See "Cordillera Annual Work Plan" for project details.

[7] USDA Forest Service Fire Effects Information website (http://www.fs.fed.us/database/feis/index.html), 2000.
[8] USDA Forest Service Region 3 website (http://www.fs.fed.us/r3/fire/swapredictive/swaintel/daily/swaintnn_files/rma_fire_behavior_alert_051404.pdf), 2004

- **Investigate the use of the old road cut as a fuel break in The Ridge community.** - Recommended for implementation in 2005. See "Cordillera Annual Work Plan" for project details.
- **Investigate the use of the old road cut as a fuel break in the Redtail Ridge community.** - Recommended for implementation in 2005. See "Cordillera Annual Work Plan" for project details.
- **Fuels reduction along power line #1.** - Recommended for implementation in 2005. See "Cordillera Annual Work Plan" for project details.
- **Fuels reduction along power line #2. (Gully between Grey Hawk and Fenno Drive)** - Recommended for implementation in 2005. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Fenno Road.** - Recommended for implementation in 2005. See "Cordillera Annual Work Plan" for project details.
- **Removal of oak brush from within 100' of Territories Trail and from the potential building footprint of Lot 16.** - Recommended for implementation in 2006. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along The Summit Trail.** - Recommended for implementation in 2006. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Redtail Ridge Road.** - Recommended for implementation in 2006. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Granite Springs Trail.** - Recommended for implementation in 2007. See "Cordillera Annual Work Plan" for project details.
- **Shaded fuel break to tie abandoned spur road off Granite Springs Trail into Gore Trail.** - Recommended for implementation in 2007. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Black Bear Trail.** - Recommended for implementation in 2007. See "Cordillera Annual Work Plan" for project details.
- **Shaded fuel break treatment for "Arabian Loop", "Get-A-Long Trail" and "Quarter Horse/Fox Trotter Loop" equestrian trails.** - Recommended for possible planning in 2007. Field investigation of these projects showed they would not represent an acceptable cost benefit ratio at this time. There were also barriers to completion such as gates through non-Cordillera private property and gaps in the existing trail system. Rather than eliminating these possibilities entirely, it is our recommendation that these potential fuel breaks be reevaluated in 2007 if annual work plans for higher priority projects are on schedule. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Peregrine Road.** - Recommended for implementation in 2008. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Elk Woods Road.** - Recommended for implementation in 2008. See "Cordillera Annual Work Plan" for project details.
- **Thinning where necessary to conform to guidelines for mid-slope shaded fuel breaks along Settler's Loop.** - Recommended for implementation in 2008. See "Cordillera Annual Work Plan" for project details.

There are some communities in the study area that have a notable amount of standing dead trees. We recommend an annual insect and disease inventory of stands in these areas be conducted between October and May.

Water Supply FMU

In the study area, like many of the mountainous areas of Colorado, water is a critical fire suppression issue. Cordillera has a complex water system, parts of which are approaching 20 years old. This system includes an excellent network of hydrants. Approximate locations of hydrants within the study area are shown in Figure 9.

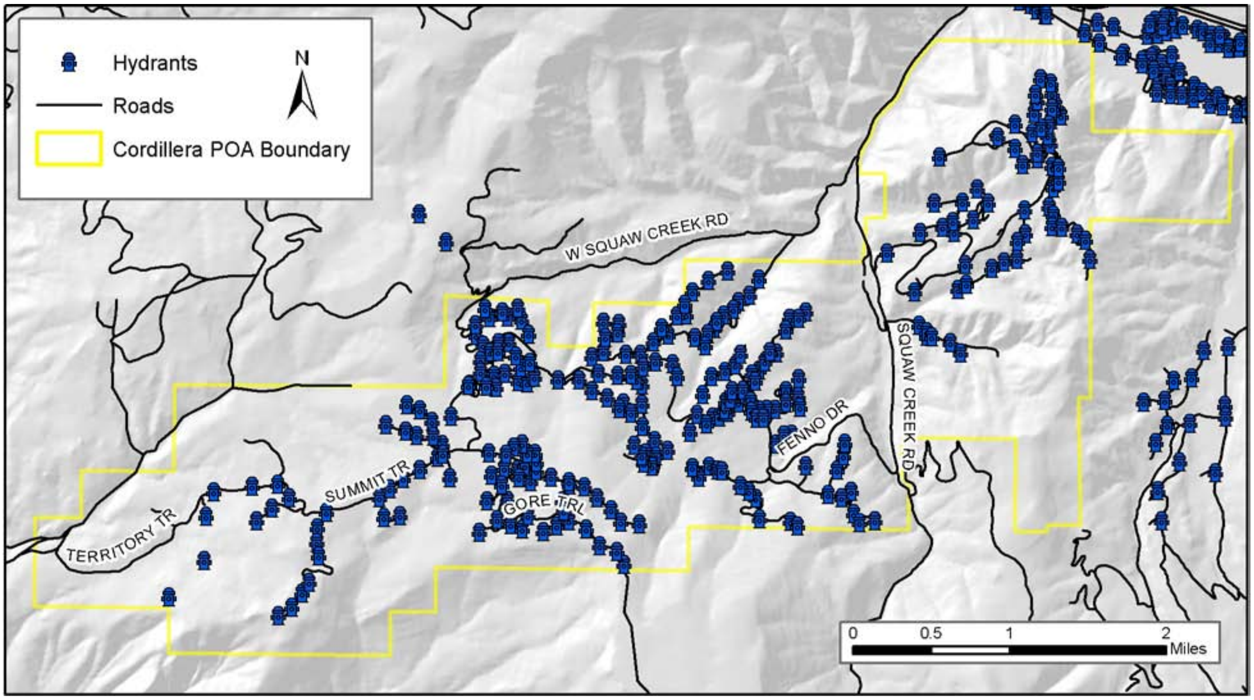

Figure 10: Hydrant Locations in the Study Area

Field verification showed that the hydrants listed on this map, which was provided by the Eagle County GIS Department, did indeed exist in the areas depicted. Although some of the hydrants in Cordillera are quite new, a program of periodic hydrant testing should be established. Periodic hydrant testing is necessary for all areas utilizing municipal hydrants as their principle water source for fire suppression.

The entire water system for Cordillera was studied by an independent engineering firm in the spring of 2003. The Cordillera water system was evaluated against current Eagle River Water Supply District (ERWSD) performance criteria and commonly accepted industry standards. This study resulted in a master plan for the Cordillera water system that was revised in June of 2003.[9] Even though the majority of the system was found to be functioning in an acceptable manner, this study reported several problems, some of which influence the supply of water for fire suppression. The important points are listed below, however issues raised in the report that are known to have been resolved have been omitted.

- There are approximately 1,700 feet of 4-inch diameter pipe and 42,215 feet of 6-inch diameter pipe, the majority of which would need to be replaced with 8-inch pipe to meet current fire flow requirements.
- The Silfers Booster Pump Station is undersized and operating with dangerously high discharge pressures.
- There is a concern that the Gifford Pump Station may not provide reliable fire protection due to its reliance on electrical service. If electricity to this station is interrupted, no automatic fire flow is available to the Gifford service area.

[9] Master Plan for the Cordillera Water System, Schmueser Gordon Meyer, Engineers Inc., June 2003.

- Cordillera West Booster Pump Station #1 firm capacity is well below current and future needs. Additional water from the Fenno Wells may be adequate to cover current needs, however the future deficit needs to be addressed with increased pump station and/or well field capacity.
- A minimum of 350,000 gallons of additional storage is needed to meet current and future demands in Cordillera West Zone 1.
- A minimum of 250,000 gallons of additional storage is needed to meet future demands in Cordillera West Zone 3.
- Several areas within the current system cannot meet specified fire flows without detriment to the distribution system. Several zone-specific remedies are discussed in the report the majority of which involve upgrading 4-inch and 6-inch lines to the 8-inch lines requires to meet current ERWSD standards.
- There are unaccountable losses averaging around 30% in the system (acceptable losses are usually 10%-15% maximum). There are areas in the system which are suspected of leaking water.

RECOMMENDATIONS

- The Gilford Pump Station should be fitted with an emergency backup generator and automatic transfer switch. The alternative recommendation of equipping this station with a quick connect for a portable generator that was proposed in the Cordillera Water System Master Plan is inadequate and should not be considered.
- If it has not already been done, the upgrades to the Silfers BPS should be implemented. According to the Cordillera Water System Master Plan this work was scheduled for fall 2003 to spring 2004.
- Adopt the recommendations in the Cordillera Water System Master Plan to increase the fire flows to the required 1100 GPM to 1500 GPM in deficient areas. Most of these recommendations involve replacing 4-inch and 6-inch lines with 8-inch lines, which would also comply with current ERWSD standards.
- Adopt the additional storage and pump capacity upgrade recommendations for Cordillera West Zones 1 and 3 as outlined in the Cordillera Water System Master Plan.
- The pond at Gore Trail and Granite Springs Trail (39° 37.003', 106° 41.358) is 12' deep and has a rubber and concrete liner. It has perennial water and should have a draft hydrant. It would be good to schedule this work in the summer.
- Investigate the possibility of installing draft hydrants in other all-season ponds in the Summit and the Territories as alternative water supplies.
- There are currently no hydrants in the Territories west of Winchester Trail. Although all of the homes in this area are required to have sprinklers, this is not an adequate water supply for suppressing interface fires. If hydrants cannot be added to this area, at least two large community cisterns (10,000 to 30,000 gallons should be considered. One of these should be located at the end of Walking Stick Trail and one at the end of Territory Trail near the Metro Sub-station.
- Replace the 22,800 feet of PVC pipe in the Divide Zone with Ductile Iron Pipe, which is the current ERWSD standard.
- Standardize connection size, sex and thread type for dry hydrants and cisterns. A standard for new construction and refitting of existing water supplies, where possible, is recommended. Standardization would result in a smoother, faster and more reliable connection. In most areas the water district supplying service to the area specifies fitting sizes and types. A standard should be adopted by a cooperative effort between ERWSD, SCMD, Eagle River Fire Department and mutual aid agencies. Our recommendation would be to use the construction standards proposed in the Summit County Dry Hydrant Manual. This manual was developed specifically for rural fire protection in the mountains of Colorado. A copy of the manual has been included with this report.
- Annual line replacement to systematically replace infrastructure over fifty years old should be initiated as per the recommendation in the Cordillera Water System Master Plan.

Fuel Models And Fire Behavior

Fuel models are a set of numbers that describe the fuel in terms that a fire behavior model can use. There are seven characteristics that are used to categorize fuel models.

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

The study area is represented primarily by six fuel models (FM): FM 1, 2, 4, 6, 8 and 10 (Anderson, 1982). The Cordillera fuel map also contains a custom fuel model (FM 28) to represent aspen groves with a continuous understory of flammable shrubs. These areas are modeled as FM 8, typical aspen stand, under average burning conditions and as FM 4, flammable mature shrub stands, under extreme conditions to more accurately reflect the primary vegetative carrier of the fire. FM 99 is used to indicate an area considered to be non-combustible such as water, unbroken rock faces, permanent snowfields, etc. Each of the major fuel types present are described below with a table showing a range of fire behavior based on the **BEHAVE** system. Figure 10 displays the fuel types graphically for Cordillera.

The **BEHAVE** Fire Behavior Prediction and Fuel Modeling System was utilized to help determine the wildfire hazard for this study. It has been used for a variety of applications including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space given simple user-defined fuel, weather, and topography. Requested values depend on the modeling choices made by the user. For example, fuel model, fuel moisture, wind speed and direction, terrain and slope are used to calculate rate of spread, flame length and intensity. For a complete discussion of the fuel typing and **BEHAVE** modeling used in this study please refer to Appendix A.

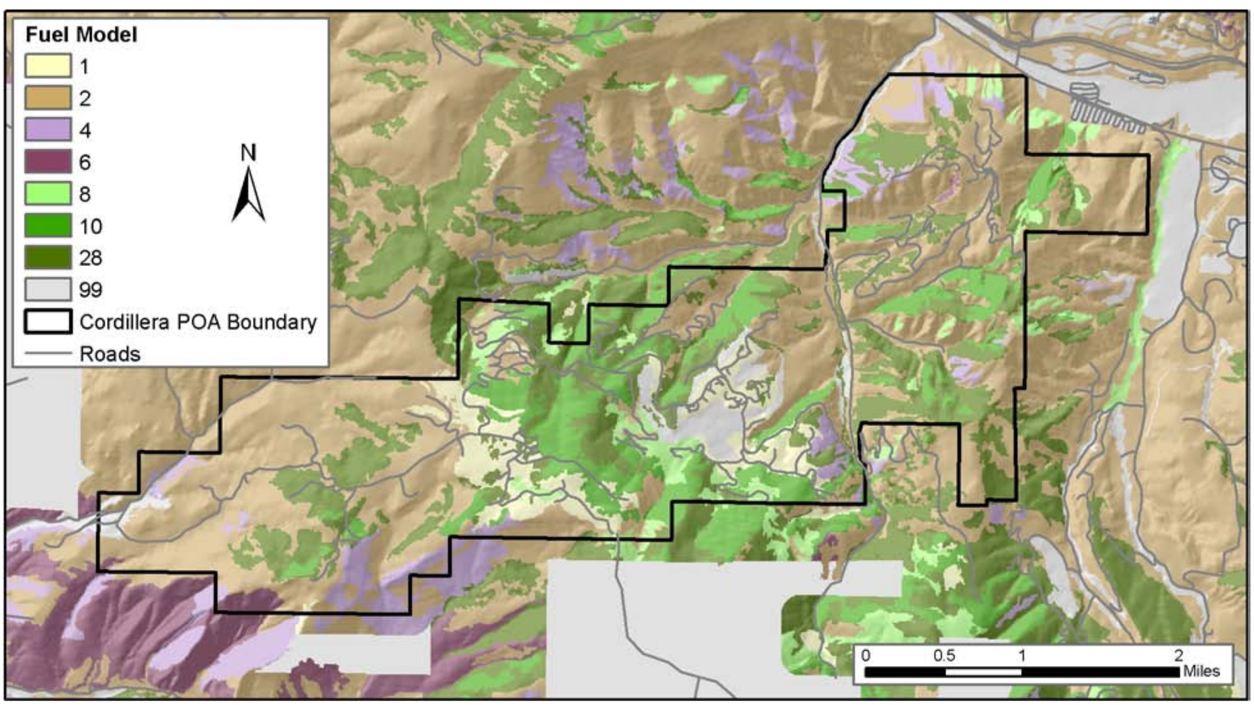

Figure 11: Cordillera Fuel Models

FUEL MODEL 1[10]

Figure 12: Short grasses

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

Common Types/Species
Annual and perennial grasses are included in this fuel model.

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

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

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

10 hr fuel=5%, 100 hr fuel=6%, herbaceous fuel moisture=100%, slope=10%, wind direction=upslope

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

Flame Length in Feet

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

FUEL MODEL 2[11]

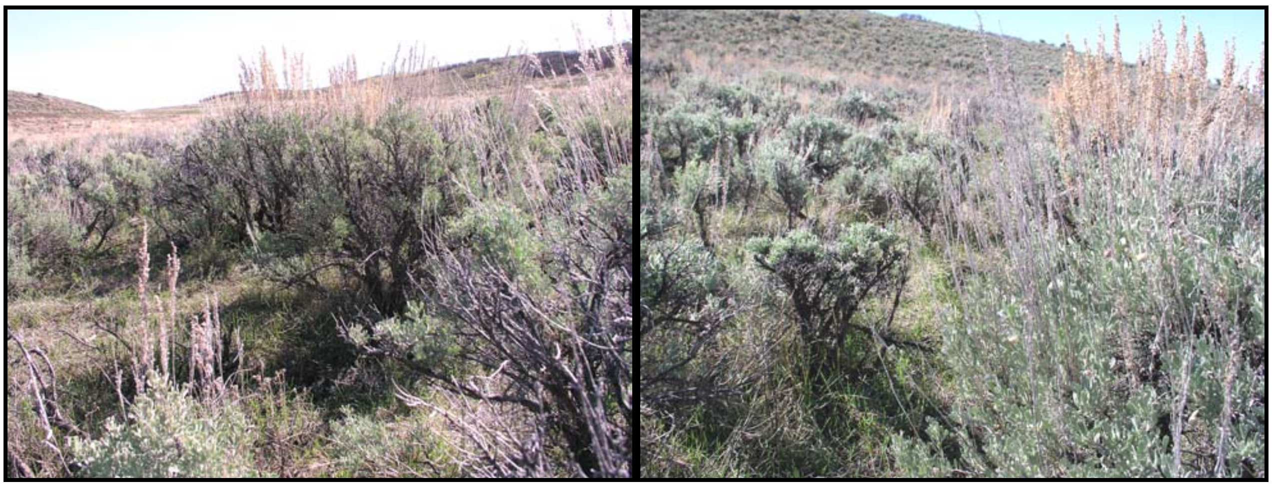

Figure 13: Shrub canopy with grass understory

Characteristics

This type consists of open grown pine stands. Trees are widely spaced with few understory shrubs or regeneration. Ground cover consists of mountain grasses/and or needles and small woody litter. This model occurs in open-grown and mature Ponderosa pine stands in the foothill to montane zones.

Common Species/Species

The predominate tree species is Ponderosa pine. This type may include some scattered Douglas-fir. Other tree and shrub species include common and Rocky Mountain Juniper, buckbrush, bitter brush, and mountain mahogany. Mountain grasses are included in this model.

Fire Behavior

Surface fires that spread easily. Clumps of fuel may generate higher fire intensities. Fire is carried by grasses and/or woody litter.

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

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	12.4	34.2	67.5	111.6	166.0	230.2
	4.0	10.2	28.0	55.3	91.4	135.9	188.5
	6.0	9.0	24.9	49.1	81.2	120.8	167.6
	8.0	8.3	22.9	45.3	74.9	111.3	154.4
	10.0	7.4	20.5	40.5	67.0	99.7	138.3
	12.0	5.9	16.3	32.3	53.3	79.3	110.0

10 hr fuel=5%, 100 hr fuel= 6%, woody fuel moisture= 100%, slope=10%, wind direction=upslope

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	4.3	6.9	9.4	11.8	14.2	16.5
	4.0	3.7	5.8	8.0	10.1	12.1	14.0
	6.0	3.4	5.4	7.3	9.2	11.1	12.9
	8.0	3.2	5.1	6.9	8.7	10.5	12.2
	10.0	2.9	4.7	6.4	8.1	9.7	11.2
	12.0	2.4	3.9	5.3	6.7	8.0	9.3

FUEL MODEL 4[12]

Figure 14: Mature oak brush stands greater than 6 feet high.

Characteristics

This model consists of stands of small diameter trees or large shrubs with continuous closed crowns. There may be high amounts of small dead limbs retained on the lower portion of trees. There may also be high amounts of woody and needle litter associated with the stand.

Common Types/Species

Stands of mature shrubs, 6 or more feet tall, such as California mixed chaparral, the high pocosin along the east coast, the pinebarrens of New Jersey, shrubs such as common juniper or the closed jack pine stands of the north-central States are typical candidates.

Fire Behavior

High rates of spread can be experienced in this model. Fire is carried through the foliage as well as the fine live and dead woody material of tree crowns. Fire spread is also enhanced by the amount of dead woody material on the ground.

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

	Mid-flame Wind Speed					
Fine Dead Fuel moisture %	2.0	4.0	6.0	8.0	10.0	12.0
2.0	30.4	70.6	120.4	177.9	241.8	311.3
4.0	27.0	62.6	106.8	157.7	214.4	276.0
6.0	24.8	57.5	98.1	145.0	197.0	253.7
8.0	23.5	54.4	92.8	137.1	186.3	239.9
10.0	22.6	52.3	89.2	131.8	179.1	230.6
12.0	21.7	50.2	85.8	126.7	172.2	221.7

10 hr fuel=5%, 100 hr fuel=6%, woody fuel moisture=100%, slope=10%, wind direction=upslope

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

Flame Length in Feet

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	13.9	20.5	26.2	31.3	36.1	40.5
	4.0	12.6	18.5	23.6	28.3	32.6	36.6
	6.0	11.7	17.2	22.0	26.4	30.4	34.1
	8.0	11.2	16.5	21.1	25.2	29.1	32.7
	10.0	10.9	16.0	20.5	24.5	28.3	31.7
	12.0	10.6	15.6	19.9	23.8	27.4	30.8

FUEL MODEL 6[13]

Figure 15: Shrubs of intermediate stand height, (note dead component in the stem wood).

Characteristics

The shrubs are older but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4.

Common Types/Species

This model covers a broad range of shrub conditions. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrub-lands may be represented but may over-predict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.

Fire Behavior

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand.

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

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

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	17.2	38.5	63.9	92.4	123.5	156.8
4.0	13.9	31.1	51.7	74.8	99.9	126.9
6.0	11.7	26.2	43.5	62.9	84.1	106.8
8.0	10.2	22.9	38.1	55.0	73.6	93.4
10.0	9.2	20.7	34.4	49.7	66.5	84.4
12.0	8.5	19.1	31.7	45.9	61.4	77.9

10 hr fuel=5%, 100 hr fuel=6%, herbaceous fuel moisture=100%, slope=10%, wind direction=upslope

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed 2.0	4.0	6.0	8.0	10.0	12.0
2.0	5.0	7.3	9.2	10.9	12.4	13.9
4.0	4.3	6.2	7.8	9.3	10.6	11.8
6.0	3.8	5.5	6.9	8.2	9.3	10.4
8.0	3.4	5.0	6.3	7.4	8.5	9.5
10.0	3.2	4.7	5.9	7.0	8.0	8.9
12.0	3.1	4.4	5.6	6.7	7.6	8.5

FUEL MODEL 8[14]

Figure 16: Timber litter, light surface fuel load

Characteristics
This fuel model is represented by closed canopy stands of lodgepole pine or ponderosa pine with little under growth. Amounts of needle and woody litter are also low. This fuel model occurs at higher elevations in the Montane zone.

Common Types/Species
This fuel model is most often represented by lodgepole pine but ponderosa pine can be included. There are little or no understory plants.

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

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

		Mid-flame Wind Speed					
		2.0	4.0	6.0	8.0	10.0	12.0
Fine Dead Fuel moisture %	2.0	1.1	2.3	3.9	5.7	7.8	10.1
	4.0	0.9	1.9	3.2	4.7	6.4	6.9
	6.0	0.7	1.6	2.6	3.9	4.9	4.9
	8.0	0.6	1.4	2.3	3.4	3.8	3.8
	10.0	0.6	1.2	2.0	3.0	3.1	3.1
	12.0	0.5	1.1	1.8	2.7	2.7	2.7

10 hr fuel=5%, 100 hr fuel=6%, herbaceous fuel moisture=100%, slope=10%, wind direction=upslope

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

Flame Length in Feet

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	0.9	1.3	1.7	2.0	2.3	2.6
	4.0	0.8	1.1	1.4	1.7	2.0	2.0
	6.0	0.7	1.0	1.2	1.5	1.7	1.7
	8.0	0.6	0.9	1.1	1.3	1.4	1.4
	10.0	0.6	0.8	1.0	1.2	1.3	1.3
	12.0	0.6	0.8	1.0	1.2	1.3	1.3

FUEL MODEL 10[15]

Figure 17: Timber litter, (note heavier surface fuels).

Characteristics

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

Common Types/Species

All types of vegetation can occur in this model, but primary species are, Douglas-fir, ponderosa pine, and lodgepole pine.

Fire Behavior

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

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

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

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.8	8.2	13.7	20.1	27.3	35.1
	4.0	3.3	7.2	12.1	17.8	24.1	31.0
	6.0	3.0	6.6	11.0	16.1	21.8	28.0
	8.0	2.8	6.1	10.2	14.9	20.2	26.0
	10.0	2.6	5.7	9.6	14.1	19.1	24.5
	12.0	2.5	5.5	9.2	13.4	18.2	23.4

10 hr fuel=5%, 100 hr fuel=6%, herbaceous fuel moisture=100%, slope=10%, wind direction=upslope

Flame Length in Feet

		Mid-flame Wind Speed					
Fine Dead Fuel moisture %		2.0	4.0	6.0	8.0	10.0	12.0
	2.0	3.8	5.5	7.0	8.3	9.5	10.7
	4.0	3.5	5.0	6.3	7.5	8.6	9.7
	6.0	3.2	4.6	5.8	6.9	7.9	8.9
	8.0	3.0	4.3	5.5	6.5	7.5	8.4
	10.0	2.9	4.1	5.2	6.2	7.2	8.0
	12.0	2.8	4.0	5.1	6.0	6.9	7.8

Appendix A

Wildfire Hazard Analysis Methodology

Purpose

The purpose of this appendix is to describe the methodology used to estimate the potential behavior of wildland fire in the study area in order to evaluate the severity of undesirable fire effects to values at risk.

Model Description

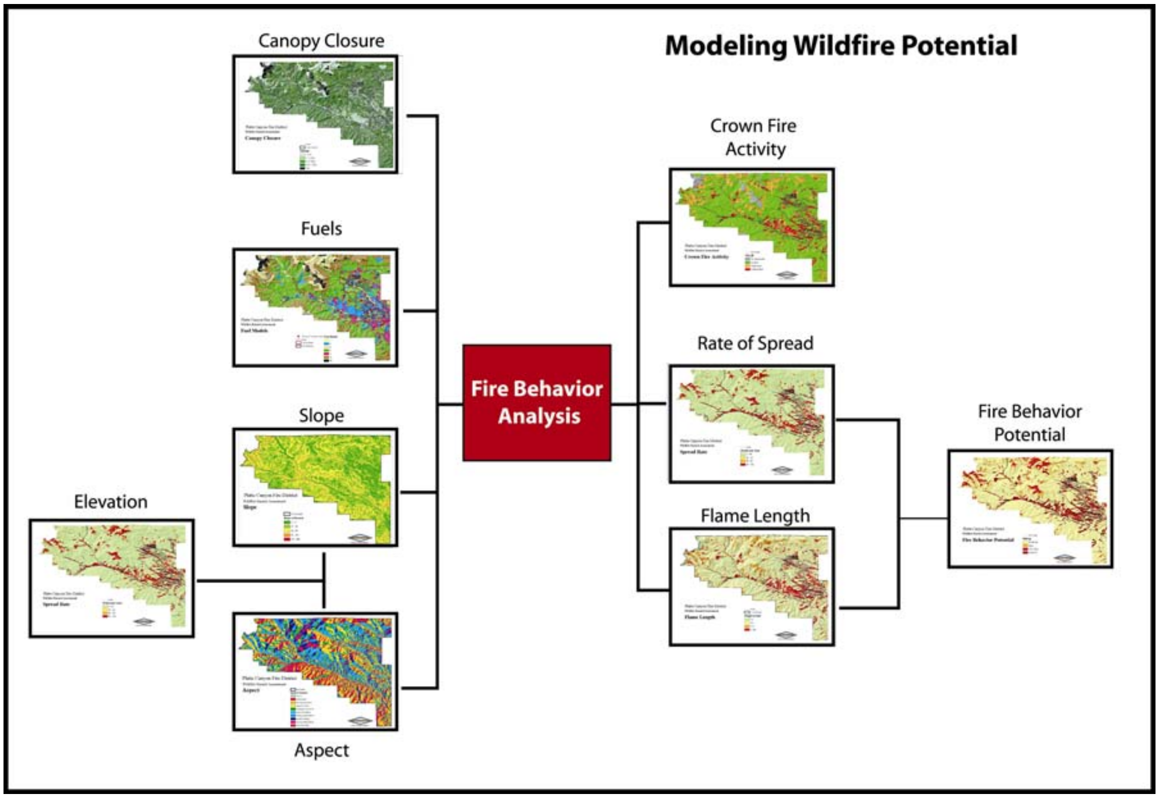


Figure 1: Model Description

The Wildfire Hazard classification represents a relative ranking of locations based upon expected surface fire intensity. The model inputs for surface fire behavior include aspect, slope, elevation, canopy cover and fuel type. The hazard level is determined using **FlamMap** which models wildfire behavior potential. Calculations are based on the USDA Forest Service's fire behavior model **BEHAVE**. **BEHAVE** is a nationally recognized set of calculations to estimate a fire's intensity and rate of spread given certain conditions of topography, fuels and weather.

FlamMap

RedZone Software uses **FlamMap** developed by Systems for Environmental Management (Missoula, Montana) and the Fire Sciences Laboratory of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) to evaluate the potential fire conditions in the study area. The Cordillera study area encompasses approximately 6,139 acres, which are broken down into 10 meter (m) grids. Using **FlamMap**'s spatial analysis capabilities, each 10 meter square (sq) grid is queried for its elevation, slope, aspect and fuel type. These values are input into **FlamMap,** along with reference weather information. The outputs of **FlamMap** include the estimated Rate of Spread (ROS), Flame Length (FL) (from **BEHAVE**) and Crown Fire Activity for a fire in that 10m sq grid. The model computes these values for each grid cell in the study area. These values are then reclassified into Wildfire Hazard classes of None, Low, Moderate, High, Very High and Extreme.

BEHAVE Modeling

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

Assumptions of **BEHAVE**

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

Fire Behavior Inputs

Fire behavior is dependant upon aspect, slope, elevation, canopy cover and fuel type. The following pages contain an explanation of each.

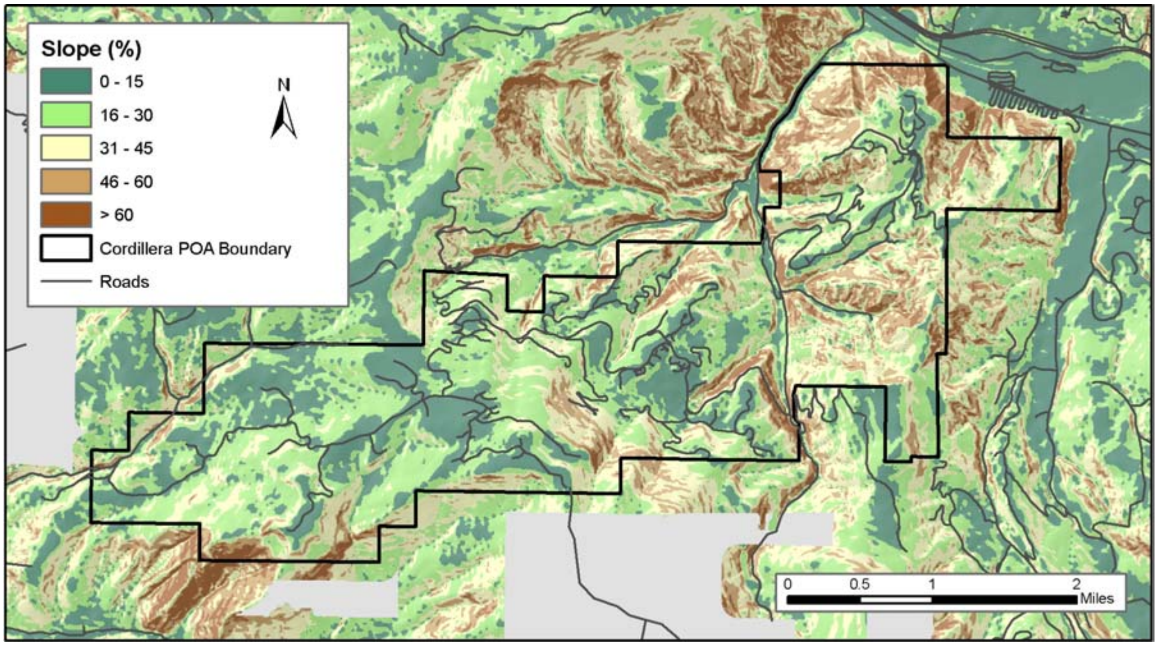


Figure 2: Slope

Slopes are shown here as percent (rise/run x100). Steeper slopes intensify fire behavior and thus will contribute to a high wildfire hazard rating.

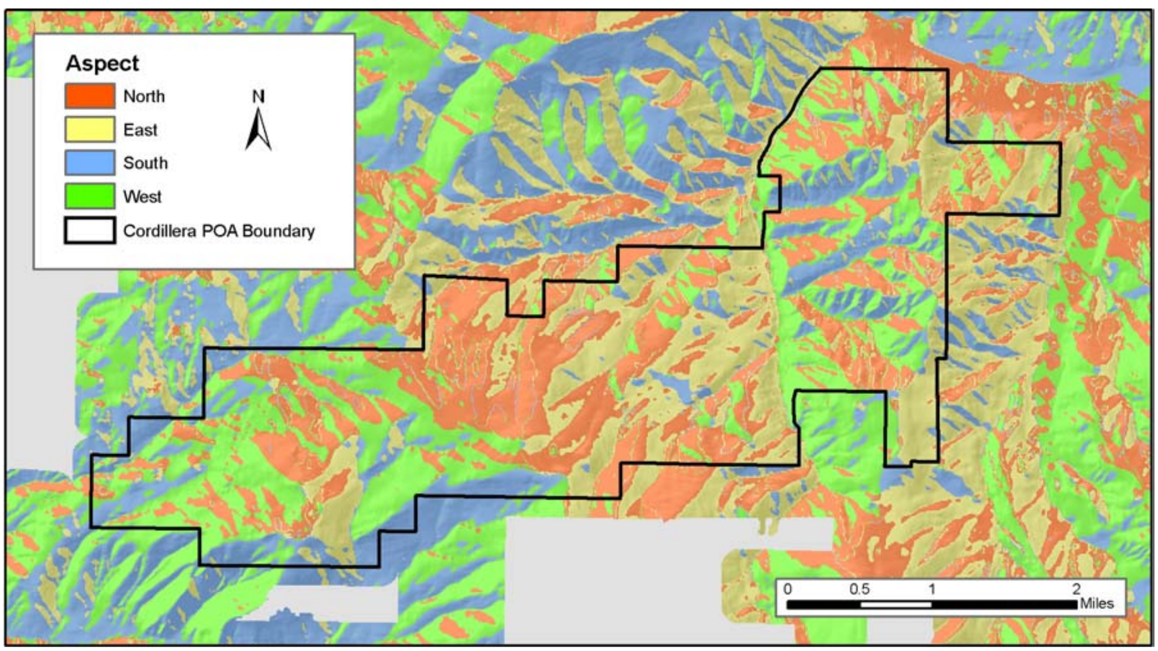


Figure 3: Aspect

Aspects are shown as degrees from North ranging from 0 to 360 according to their orientation.

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

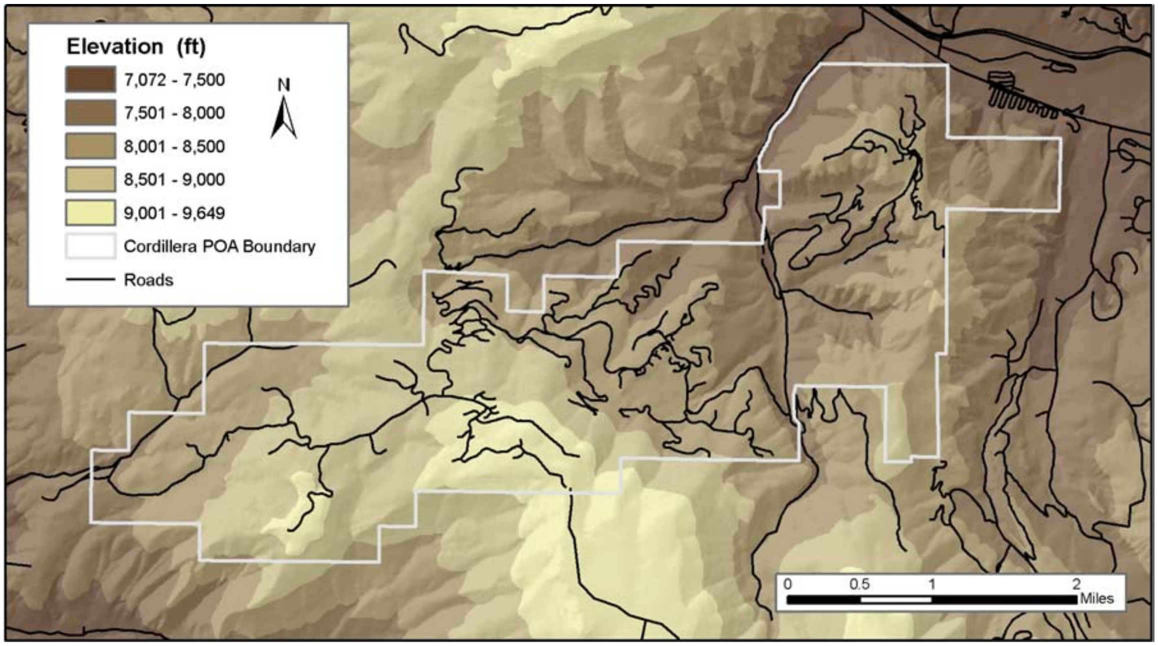


Figure 4: Elevations

Elevations within Cordillera vary from 7,000' to over 9,000'. As elevation increases, fuel loading and available oxygen for combustion change. Above tree line fuels become sparse and the natural burn interval is measured in centuries.

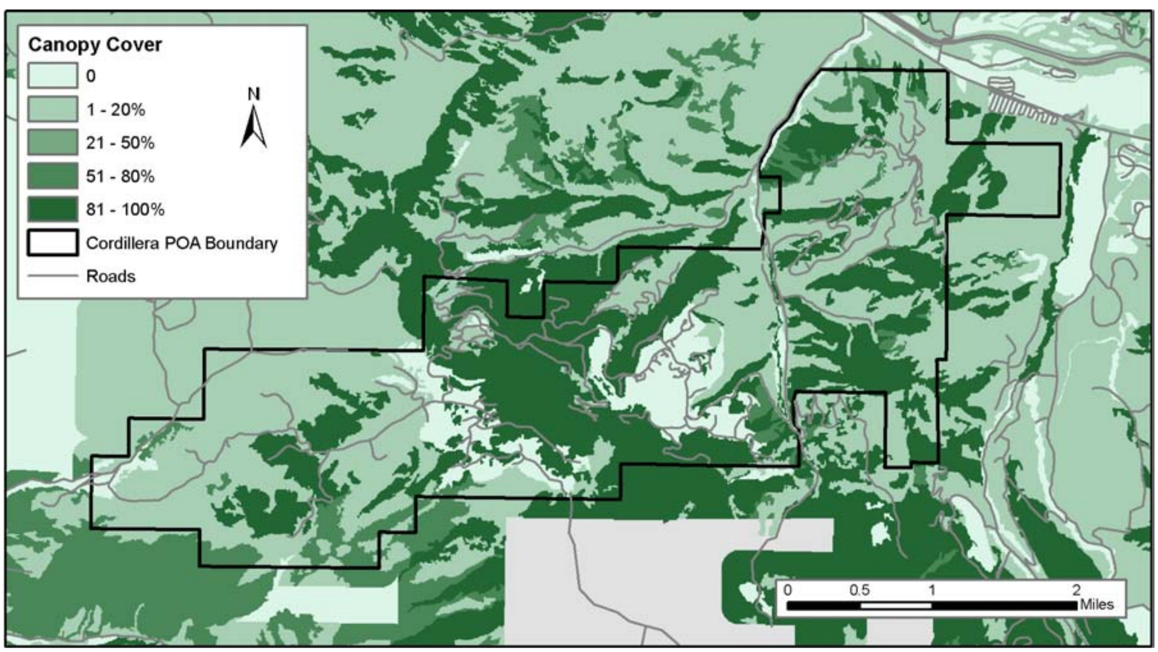


Figure 5: Canopy Cover, Average Conditions

Canopy cover is the horizontal percentage of the ground surface that is covered by tree crowns. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy. Coverage units are in four categories. 1=1-20%. 2=21-50%. 3=50-80%. 4= 81-100%.

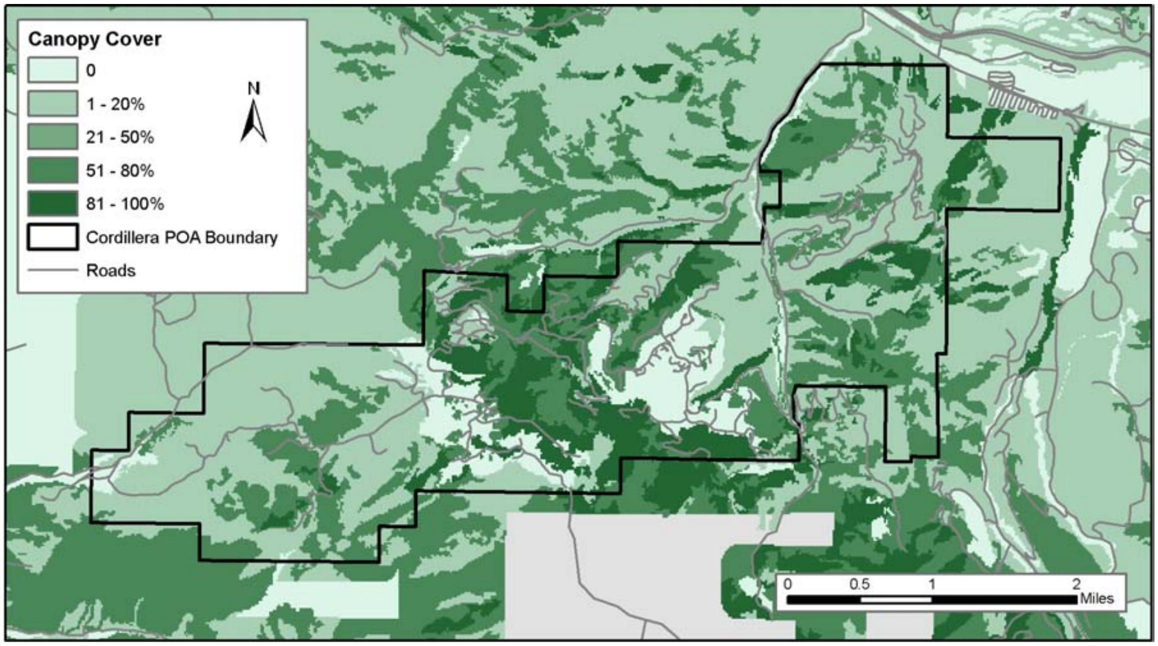


Figure 6: Canopy Cover, Extreme Conditions

In order to correctly reflect the primary vegetative carrier of fire during extreme conditions, a custom fuel model was employed for Aspen stands with a heavy shrub understory. During average conditions the understory would not contribute significantly to fire spread or flame lengths, however, during peak burning conditions shrubs, particularly Serviceberry and Gambel Oak, would become the primary carrier of fire in this fuel model.

Fuel Models

Fuel models are a set of numbers that describe the fuel in terms that a fire spread model can use. There are 7 characteristics that are used to categorize fuel models.

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

There are 13 fuel models that are used to represent the entire United States. While many fuel types fall into these models, there are many more that do not. However, the critical components can be matched as closely as possible to fit into one of the models. Users should compare the outputs of **FlamMap** to actual fire behavior observed in the field and adjust accordingly. Selection of fuel models is subjective as they can be delineated at different scales and many are related to height and % cover, both of which vary throughout a given unit. Also, the evaluator's experience and accuracy in estimating these units varies.

Reference Weather Used in the Wildfire Hazard Evaluation

The Wildfire Hazard classification represents a relative ranking of locations based upon expected surface fire intensity. Weather for **FlamMap** was created by using weather data collected by the Dowd Junction Remote Automated Weather Station (RAWS).

Latitude (dd mm ss)	39 ° 37 ' 37 " N
Longitude (dd mm ss)	106 ° 27 ' 06 " W
Elevation (ft.)	8,998'

The mean for each variable (1 hr, 10 hr, and 100 hr fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed) was calculated for the months of May-October for the years 1987-2003. Then, the average of each mean/month was calculated to represent an average fire season day.

The “extreme conditions” maps were calculated using ninety-seventh percentile weather data. That is to say the weather conditions existing on the four most severe fire weather days in each season for the sixteen-year period were averaged together. It is reasonable to assume that similar conditions may exist for at least four days of the fire season during an average year. In fact, during extreme years such as 2000 and 2002, such conditions may exist for significantly longer periods. Even these calculations may be conservative compared to observed fire behavior. Drought conditions the last few years have significantly changed the fire behavior in dense forest types such as mixed conifer. The current values underestimate fire behavior especially in the higher elevation fuels because the extremely low fuel moistures are not represented in the averages. The following values were used in **FlamMap**:

Average Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	9 mph
Herbaceous fuel moisture	53%
Woody fuel moisture	104%
100 hr fuel moisture	12%
10 hr fuel moisture	8%
1 hr fuel moisture	6%
Canopy height	25 m
Crown base height	5 m
Crown bulk density	0.1 kg/m3
Foliar moisture content	100%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	10 mph
Herbaceous fuel moisture	27%
Woody fuel moisture	54%
100 hr fuel moisture	6%
10 hr fuel moisture	4%
1 hr fuel moisture	3%
Canopy height	25 m
Crown base height	5 m
Crown bulk density	0.1 kg/m3
Foliar moisture content	100%

Fire Behavior Analysis Outputs

From the fire behavior analysis predictions of crown fire activity, rate of spread and flame length are derived. Rate of spread and flame length predictions are combined to produce the Fire Behavior Potential map that shows the results of the Wildfire Hazard Evaluation.

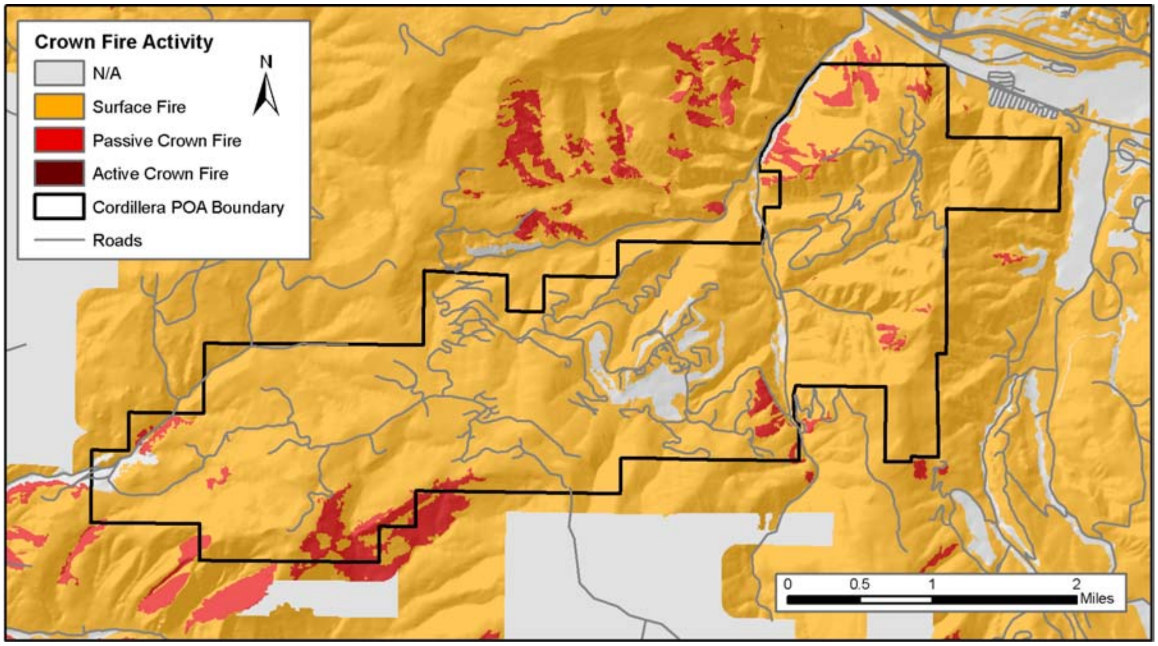


Figure 6: Predictions of Crown Fire Activity (Average Weather Conditions)

Crown fire activity values are generated by the FlamMap model and classified into 4 categories based on standard ranges: active, passive, surface, and not applicable. In the surface fire category little or no tree torching will be expected. During passive crown fire activity isolated torching of trees or groups of trees will be observed and canopy runs will be limited to short distances. During active crown fire activity sustained runs through the canopy will be observed that may be independent of surface fire activity.

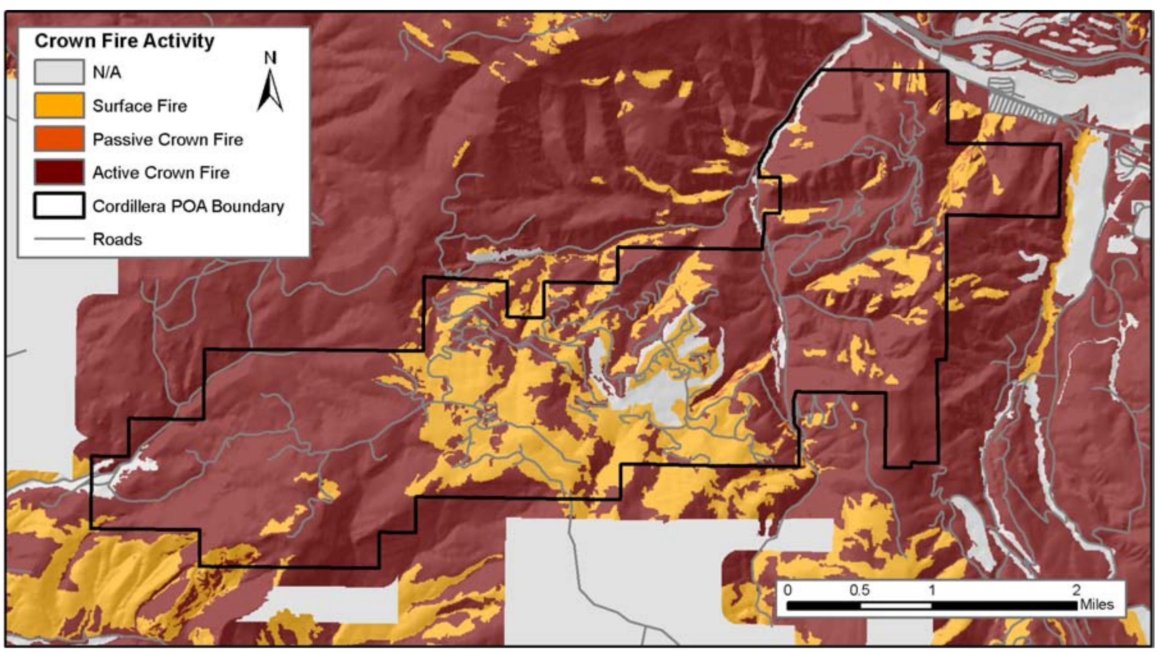


Figure 7: Predictions of Crown Fire Activity (Extreme Weather Conditions)

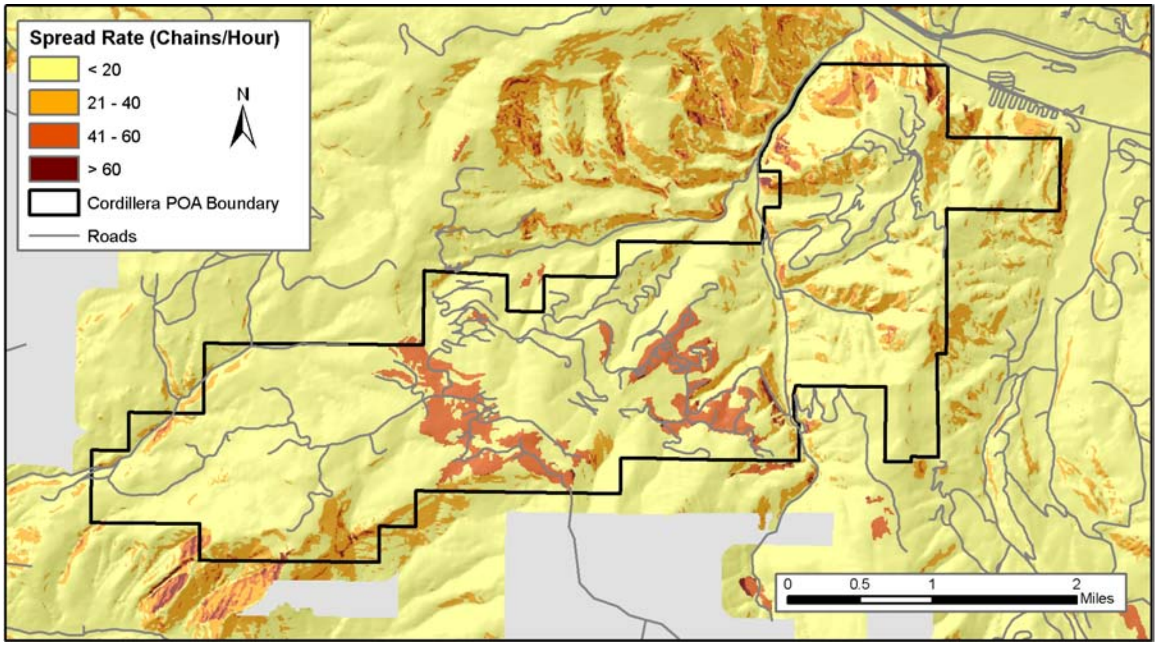


Figure 8: Spread Rate Predictions (Average Weather Conditions)

Spread rate values are generated by the FlamMap model and classified into four categories based on standard ranges: 0-20 chains/hour (CPH), 20.1-40 CPH, 40.1-60 CPH, and 60.1-450 CPH. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains.

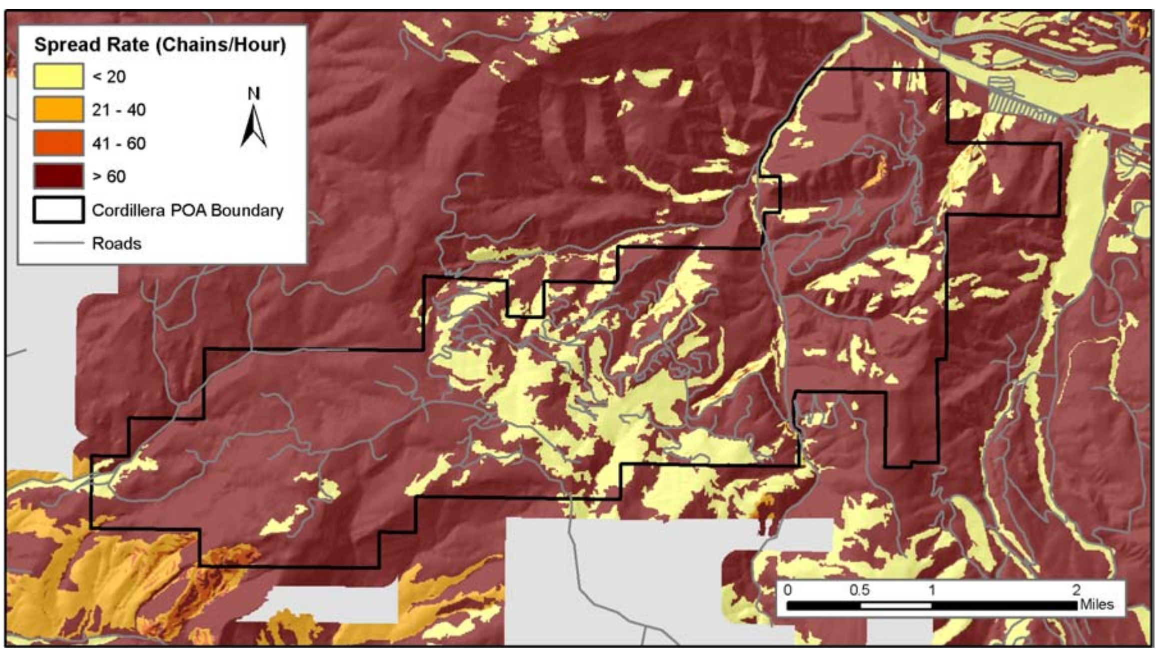


Figure 9: Spread Rate Predictions (Extreme Weather Conditions)

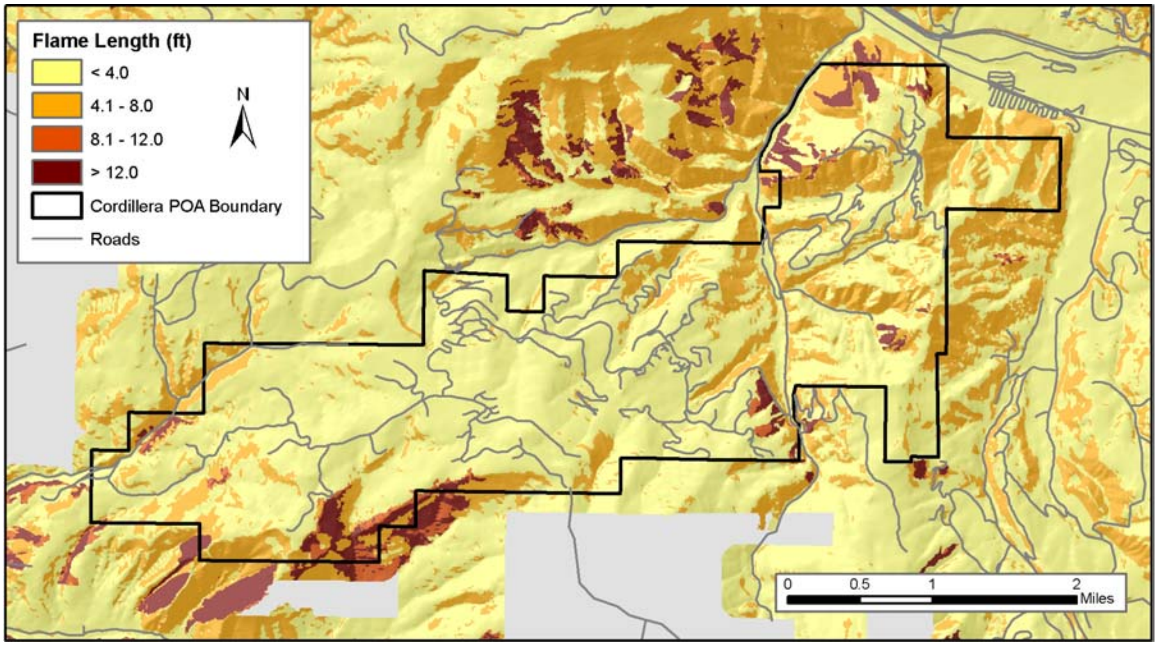


Figure 10: Flame Length Predictions (Average Weather Conditions)

Flame length values are generated by the FlamMap model and classified in the four categories based on standard ranges: 0-4 feet, 4.1-8 feet, 8.1-11 feet and 11.1-60 feet.

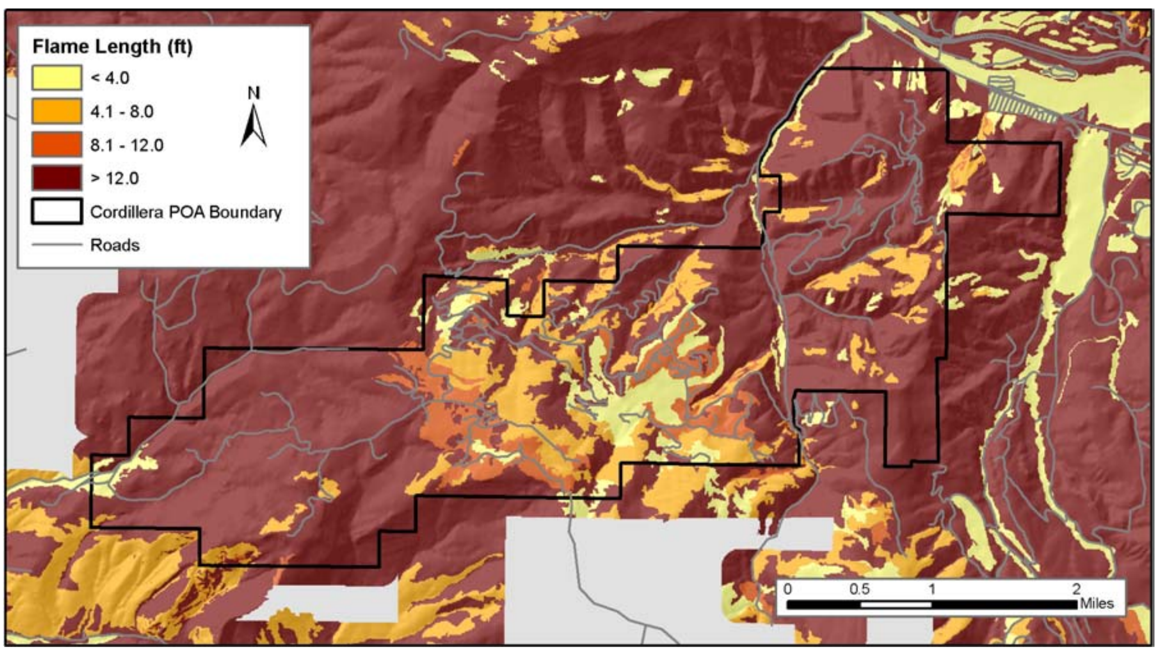


Figure 11: Flame Length Predictions (Extreme Weather Conditions)

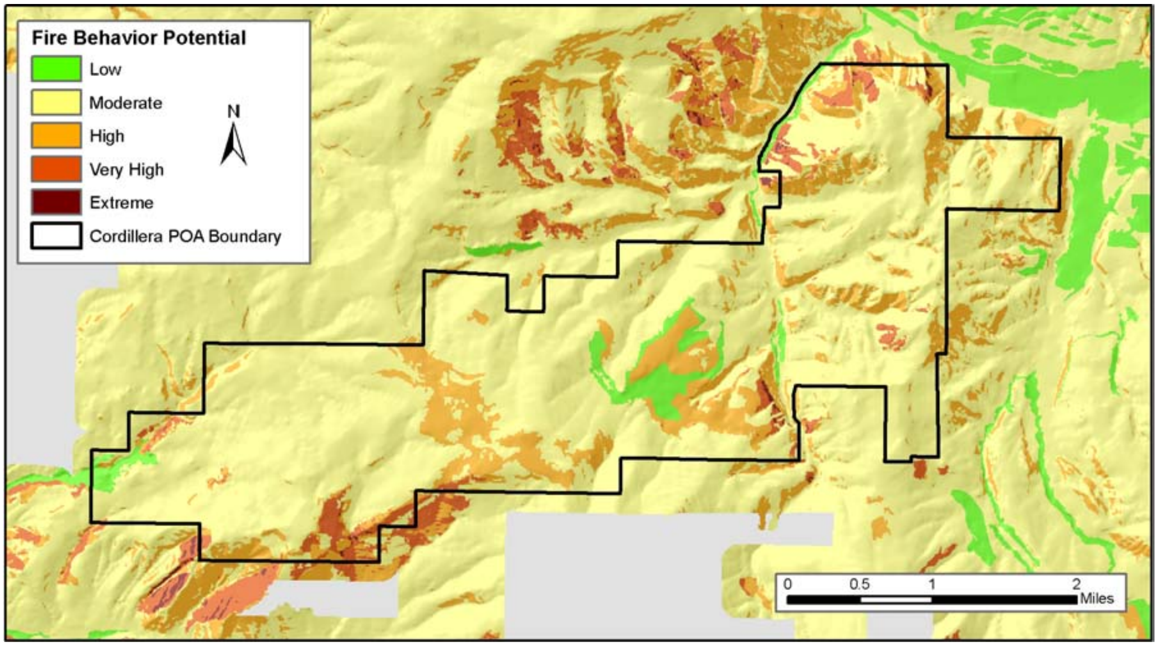


Figure 12: District Wide Fire Behavior Potential (Average Weather Conditions)

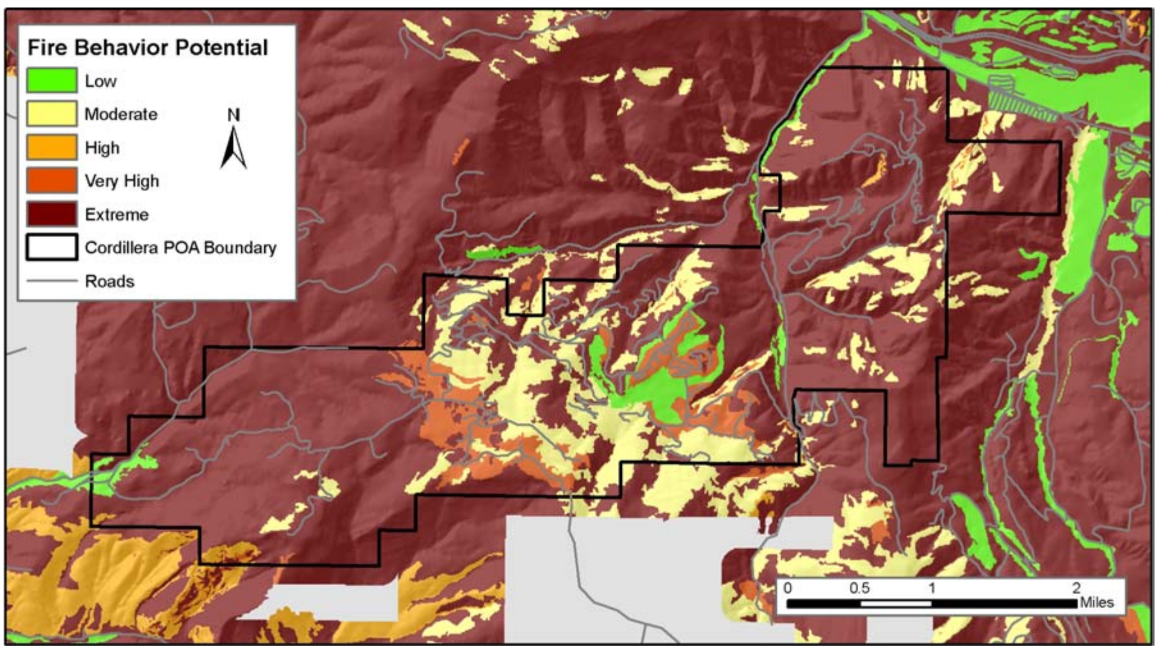


Figure 13: District Wide Fire Behavior Potential (Extreme Weather Conditions)

Fire Behavior Interpretation and Limitations

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

Appendix B

Communities

Purpose

The purpose of this appendix is to examine, in greater detail, the communities in the study area. Of the twenty-eight communities in the study area, three were found to represent an extreme hazard, seven were rated as very high hazard, ten as high hazard, five as moderate hazard and three as low hazard (see figure1). For easy reference, the map of communities presented in the main text has been reproduced here as Figure 2. Figure 3 displays this grouping graphically. Table 1 has been included for quick identification.

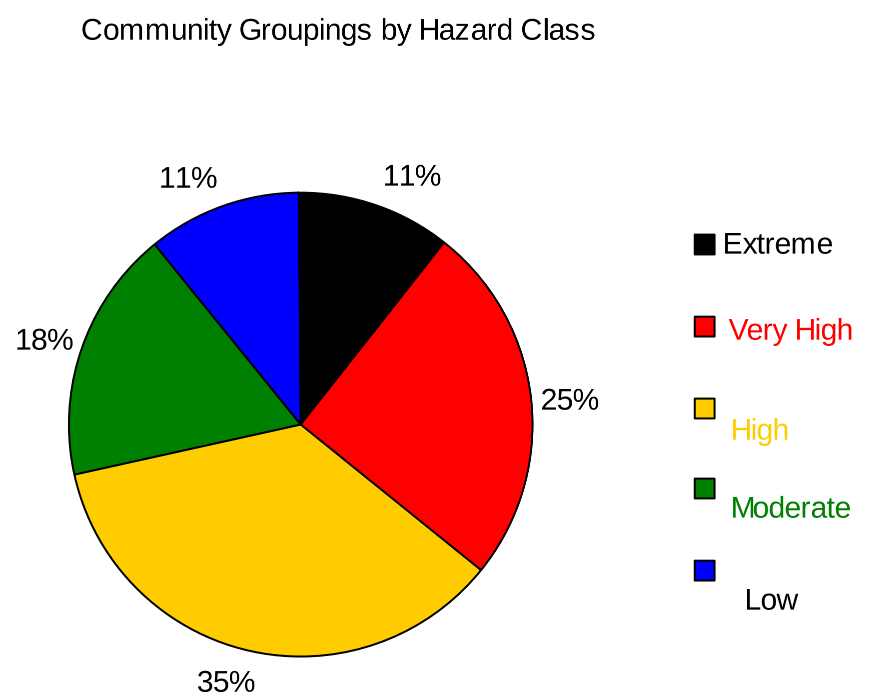
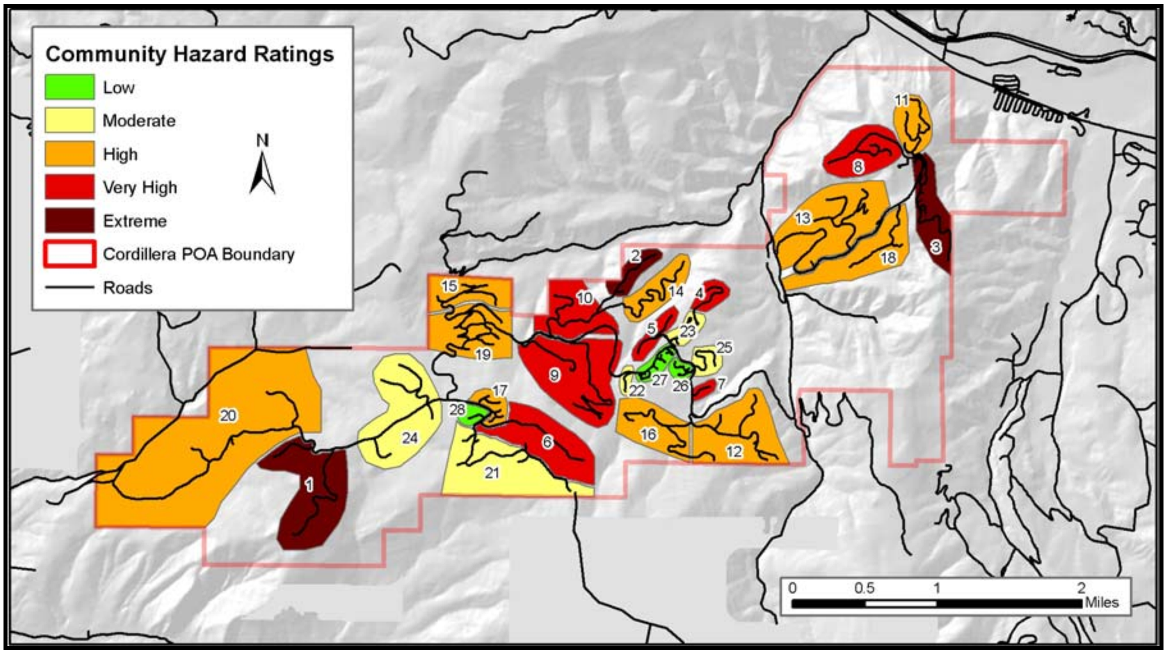


Figure 1



1. Webb Peak and Summit Springs	15. Settler's Woods
2. Redtail Ridge	16. Elk Woods and Springs
3. El Mirador	17. Summit Club
4. The Ridge	18. Granada Glen
5. The Timbers and Fairways	19. Settler's Loop
6. Granite Springs	20. Territories
7. Grey Hawk	21. Gold Dust/Murphy's Creek
8. Casteel Ridge	22. Cimarron
9. The Aspens/Black Bear/Whitaker Ponds	23. Bearcat
10. Red Draw and Peregrine	24. Summit Fairways
11. Kensington Green	25. Founder's Preserve
12. Bearden Meadows	26. Club Cottages
13. Andorra/Central Divide	27. Bentgrass
14. Red Draw Meadows	28. Martingale

Extreme Very High High Moderate Low

Figure 2

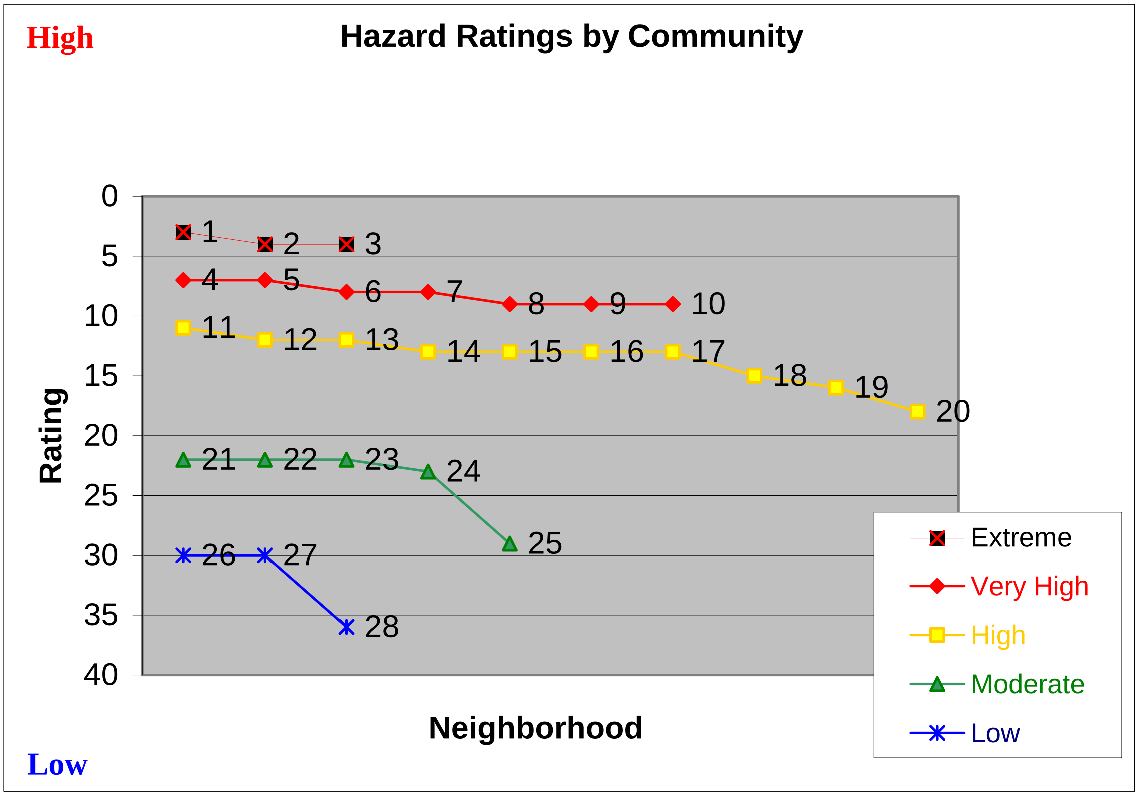


Figure 3

Table 1: Communities by Hazard Rating

1. Webb Peak and Summit Springs	**15. Settler's Woods**
2. Redtail Ridge	**16. Elk Woods and Springs**
3. El Mirador	**17. Summit Club**
4. The Ridge	**18. Granada Glen**
5. The Timbers and Fairways	**19. Settler's Loop**
6. Granite Springs	**20. Territories**
7. Grey Hawk	**21. Gold Dust/Murphy's Creek**
8. Casteel Ridge	**22. Cimarron**
9. The Aspens/Black Bear/Whitaker Ponds	**23. Bearcat**
10. Red Draw and Peregrine	**24. Summit Fairways**
11. Kensington Green	**25. Founder's Preserve**
12. Bearden Meadows	**26. Club Cottages**
13. Andorra/Central Divide	**27. Bentgrass**
14. Red Draw Meadows	**28. Martingale**

Extreme Very High High Moderate Low

General Recommendations

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

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

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

Note

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

Technical Terms

The following definitions apply to terms used in the “Wildland Urban Interface, Wildland Hazard-Risk Assessment of Cordillera".

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

Community Assessment: A fifty-point scale analysis designed to identify factors that increase the potential and/or severity of undesirable fire outcomes in WUI communities.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared or reduced to slow the spread of wildfire toward or from the structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure. For the purposes of this study, defensible space is said to be "conforming" if it meets the requirements of the Colorado State Forest Service Fact Sheet #6.302 "Creating Wildfire-Defensible Zones".

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

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

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

Fire Hazard: The likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people property and/or the environment. Derived from the Community Assessment and the Fire Behavior Potential.

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

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

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

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

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

Values-at-Risk: People, property and environmental features within the project area which are susceptible to damage from undesirable fire outcomes.

Community Assessment Methodology

The community level methodology for this assessment uses a Wildfire Hazard Rating (WHR), (White/CSFS, 1986) that was developed specifically to evaluate communities within the Wildland Urban Interface (WUI) for their relative wildfire hazard. The WHR model combines physical infrastructure such as structure density and roads and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. It has been proven and refined by use in rating over 1,400 neighborhoods throughout the United States.

Numerous fire management professionals were queried regarding their knowledge about, and experience with, specific environmental and infrastructure factors, and wildfire behavior and hazards. Weightings within the model were established through these queries. The model was designed to be applicable throughout the western United States.

The model was developed from the perspective of performing a triage on a threatened community in the path of an advancing wildfire with moderate fire behavior. The WHR survey and fuel model ground truthing are accomplished by field surveyors with WUI fire experience. The rating system assigns up to a maximum of 50 points based on six categories: average lot size, slope, primary aspect, average fuel type, fuel continuity and surface fuel loading. The higher the community scores, the lower its wildfire hazard. For example, a community with an average lot size of less than 1 acre and slopes of greater than 30% would receive 0 points for those factors whereas a community with an average lot size of 5 acres and slopes of less than 15% would receive 16 points for the same factors. Additional hazards are then subtracted from the subtotal of points earned in the six categories to give a final numeric value. The final value is then used to group communities into one of five hazard ratings: Extreme, Very High, High, Moderate or Low.

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

1. Webb Peak and Summit Springs

Figure 4

Hazard Rating:	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	4,8
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, shake roofs and heavy fuel loads.

Description:

Webb Peak is a ridge that rises to the south at about a 10% to 15% slope. The end of the slope, as well as the east and west sides, have slope angles of about 35%. Most of the existing homes and lots are located on the ridge top or mid slope on the west aspect. There are fairways at the bottom of the ridge on its east side, however there are no fuel breaks between the fuel loads on the east, west and south slopes and the homes on the ridge top. Fuels here vary, but are heavy throughout the area. The west facing slopes consist mostly of aspen with a heavy understory of serviceberry and a copious volume of large diameter dead and down materials (FM8). The east aspect has the same type of aspen stands throughout the lower 1/3 of the slope. Farther up slope, the aspen stands are broken by heavy shrubs and large sage. There are also significant patches of decadent spruce/fir (FM10) on the north side below homes.

Comments & Mitigation Notes:

There are only a few homes built at this time, but most need defensible space. Future homes should avoid shake roofs and wood siding materials. Extended defensible space and adequate shelter-in-place areas are highly recommended. The fairways to the east provide no break in the fuel continuity below homes, so fuel breaks are advisable for the east, south and west sides. Aspen stands should be thinned of serviceberry and the large dead and down fuels removed. Since there is only one-way in and out, the roadway should be thinned to 100 feet from the centerline and an adequate safety zone for firefighters should be considered. A parcel level analysis of this neighborhood is recommended.

2. Redtail Ridge

Figure 5

Hazard Rating:	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	4,6,8
Water supply:	Hydrants
Hazards:	Ravines, inadequate access roads, shake roofs and steep slopes.

Description:

Unlike Red Draw Meadows, which is immediately to the southeast, this area is built on a narrow ridge top that ends abruptly. Fuels are heavy and continuous on both sides of the ridge. Slopes of up to 40% would cause rapid runs in the heavy shrub fuels that surround this area. Turnarounds would be difficult in many places and the single access road would be quickly threatened by an ignition in either drainage. All homes have cedar roofs, which are very vulnerable to ignitions from embers. Homes would be difficult and dangerous to defend due to steep terrain, heavy fuels, the lack of adequate safety or deployment zones and an easily compromised escape route.

Comments & Mitigation Notes:

Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. Since there is only one-way in and out, the roadway should be thinned to 100 feet from the centerline. There is an old road cut (visible in figure 5) that should be expanded and continued all the way around the ridge to provide a fuel break below the homes. Pull-outs and improved turnarounds are recommended. Some homes in this area need defensible space and extended defensible space is highly recommended for all homes. A parcel level analysis of this neighborhood is recommended.

3. El Mirador

Figure 6

Hazard Rating:	**Extreme**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,10
Water supply:	Hydrants.
Hazards:	Steep slopes and inadequate driveways.

Description:

El Mirador is another isolated ridge top surrounded by heavy fuels on all sides. El Mirador's steep eastern slope contains primarily shrub fuels (serviceberry, choke cherry and sage with grass understory). The ravines and slopes leading up to homes on the south and west sides contain spruce/fir (FM10) and aspen (FM 8) with heavy shrub understory, principally of serviceberry. The spruce/fir and aspen stands have dense ladder fuel components and heavy dead and down materials. The north end of Granada Hill Road, where the El Mirador Ridge joins the central divide ridge top, has 23 cluster homes that are in similar fuels and topography, but are also built with only 10 to 15 feet apart. Access is especially difficult here as the street is narrow and larger apparatus would be difficult if not impossible to maneuver.

Comments & Mitigation Notes:

Since there is only one-way in and out, the roadway should be thinned to 100 feet from the centerline. Aspen stands should be thinned of serviceberry and the large dead and down fuels removed. Standing dead and diseased trees should be removed to reduce fire danger and improve forest health on the slopes below homes particularly in the spruce/fir stands. Most homes have address markers that are chiseled into contrasting stone. These are very visible in daylight, but illumination should be added to improve nighttime visibility. Some homes in this area need defensible space and extended defensible space is highly recommended for all homes. Discourage the planting of ornamental conifers within 30 feet of homes. A parcel level assessment is recommended for this community.

4. The Ridge

Figure 7

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acre
Fuel models found in the neighborhood:	2,8,10
Water supply:	Hydrants.
Hazards:	Steep slopes, shake roofs and ravines.

Description:

This community is located on the point of the ridge northeast of the Bearcat community. It is isolated from Bearcat by a narrow neck that is the only way in and out; however, fuels are light along this section of the road. Fuels on the south side are moderate loads of sage with grass understory (FM2), but on the north and west sides there are heavy loads of aspen with shrub understory (FM8) and mixed conifer (FM10). These fuel loads are continuous on slopes that average over 30%. Many homes have ornamental conifers planted within 15 feet of the structure. All homes have cedar roofs, which are very vulnerable to ignitions from embers.

Comments & Mitigation Notes:

Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. Since there is only one-way in and out, the roadway should be maintained to prevent fuel buildup within 100 feet of the centerline. There is an old road cut that should be expanded and continued all the way around the ridge to provide a fuel break below the homes. Many homes in this area need defensible space. Extended defensible spaces should be considered for the homes above the heavy fuel loads to prevent ignitions occurring in the ravines from quickly involving these homes. A maintained clearing on the south side where the fuels are lighter should be considered to provide a safety zone. A parcel level analysis of this neighborhood is recommended.

5. The Timbers and Fairways

Figure 8

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8,10
Water supply:	Hydrants
Hazards:	Steep slopes and many shake roofs.

Description:

Most of the homes in this community are located mid-slope on slopes of over 30% with heavy loads of decadent lodgepole pine (FM 10) and aspen stands with heavy shrub understory (FM 8). Most homes have no defensible space and have cedar roofs, which are very vulnerable to ignitions from embers. There is only one way into this community and there are heavy fuels along both sides of the road. There are fairways separating The Timbers and Fairways from Bearcat and Bentgrass, but they do not provide a fuel break for this community. They may, however, serve as a deployment zone, particularly if the sprinklers were activated. Homes would be difficult and dangerous to defend due to steep terrain, heavy fuels and an easily compromised escape route.

Comments & Mitigation Notes:

Stand limbing and thinning and the removal of dead and down materials should be done downhill of homes and along West Timber Draw and East Timber Draw for a distance of 200 feet due to the steepness of the terrain and the volume and type of fuels. Future homes should avoid shake roofs and wood siding materials. Most homes need defensible space and extended defensible space is highly recommended for all homes. A parcel level analysis is recommended.

6. Granite Springs

Figure 9

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	10
Water supply:	Hydrants and a draft pond at 737 Granite Springs Road
Hazards:	Steep slopes and shake roofs.

Description:

This area includes the homes and lots along Granite Springs Trail (there is only one built home) as well as the homes in Jackson's Point and the other homes on the north side of Gore Trail. All of these homes are located on or at the top of the steep slope above the south end of Red Draw. A large portion of this slope has continuous heavy loads of lodgepole pine (FM 10) with plentiful ladder fuels and heavy loads of dead and down materials. Granite Springs Trail is one way in and out and has these heavy fuels right up to the roadway. The homes in this area have shake roofs, which are very vulnerable to ignitions from embers.

Comments & Mitigation Notes:

Future homes should avoid shake roofs and wood siding materials. Since there is only one-way in and out, Granite Springs Trail should be thinned to 100' from the centerline. There is an abandoned road that would make a good fuel break if fuels were removed to 100' from the centerline and the road continued to tie into the end of Gore Trail. This would provide a fuel break below the homes in Jackson's Point and on the north side of Gore Trail. Most homes in this area need defensible space and extended defensible space is highly recommended for all homes. Since there is only one home currently built along Granite Springs Trail, it would be desirable to require conforming defensible space and extended limbing, thinning and the removal of dead and down materials for 200 feet on the slope downhill of any planned residence. This is the most hazardous portion of this community and slowing fire spread here improves the safety of all of the residences uphill. A parcel level analysis is recommended.

7. Grey Hawk

Figure 10

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	1,2,10.
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, power line and shake roofs.

Description:

This group of "cluster homes" is built above a ravine with heavy loads of mixed conifer (FM 10) and some shrub fuels located on the upper slopes near homes. One of only two above ground power lines in Cordillera crosses this ravine into this community, so the potential of an ignition from a downed line threatening these homes is a consideration. The fuel load in this drainage also threatens Fenno Drive, which is the primary access to the Summit and the Ranch sections of Cordillera. Fairways border the north side of this community and may be large enough for a safety zone if the sprinklers were operational. Homes here have shake roofs and wood siding. There are also several homes with ornamental conifers within 15 feet of the structure. Most have wooden decks that extend out over the ravine to the south. These homes are only about 20 feet apart, so house-to-house fire spread is a concern.

Comments & Mitigation Notes:

This community is fully built, so it will be some time before it will be feasible to replace the shake roofs with less flammable types. Most homes have some defensible space, but the close spacing is a problem. Reduction of the fuel load in the drainage, especially under the power line, should be a high priority. All homes above the ravine need extended defensible space and non-flammable ground cover under decks. Any future additions, such as decks, should use fire resistant materials. The planting of ornamental conifers within 30 feet of homes should be discouraged. A parcel level analysis is recommended.

8. Casteel Ridge

Figure 11

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	No
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	2,6,8.
Water supply:	Hydrants
Hazards:	Steep slopes and ravines.

Description:

This is a community of large homes on large lots built on the top of a steep and narrow ridge. There are only two turnarounds suitable for apparatus and there are homes on dead ends past both of these. Fuels on the south slopes are sage and pinyon/juniper with a grass understory (FM 2 and 6). Fuels on the northwest slopes are primarily aspen and mixed conifer with a heavy shrub understory (FM 8). There are plentiful ladder fuels in the timber. Most of the homes have ignition resistant roofs and walls, but do not have defensible space or adequate addressing.

Comments & Mitigation Notes:

Most homes need defensible space and extended defensible space is strongly recommended for homes above the timber fuel loads. Fuel breaks would be difficult to construct due to the steepness of the terrain and the volume and type of fuels on the northwest side. The best option here is for large defensible spaces and ignition resistant construction. Turnarounds adequate for large apparatus should be added at the end of Alhambra Place and Casteel Ridge Road. Improve address markings. A maintained clearing large enough to function as a safety zone would be a good idea in this area. A parcel level analysis is recommended.

9. The Aspens/Black Bear/Whitaker Ponds

Figure 12

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8,10
Water supply:	Hydrants.
Hazards:	Steep slopes, ravines and shake roofs.

Description:

The homes in this area are built along the slopes of the steep cirque that forms the western end of Red Draw and is directly below the Granite Springs community. This area is separated from Red Draw by fairways. Homes here are large and although siding materials are primarily wood some homes are of heavy timber (more ignition resistant) construction. Most roofs are shake, but there is one ignition resistant roof in this community (a trend that should be encouraged). Most homes are located mid-slope in continuous loads of aspen with heavy understory (FM 8) and mixed conifer (FM 10). Lots get smaller and density increases near the bottom of the slope.

Comments & Mitigation Notes:

This community has steep topography, slopes of 25% to 30%, and continuous loads of heavy fuels. Creating a shaded fuel break along the existing roads and proper defensible space would go a long way toward reducing the threat to homes. Extended defensible space for homes in The Aspens would also have the added benefit of reducing the fuel loads below the Granite Springs community. Some homes need better addressing. It may be possible to create an escape route by linking Elk Woods and Springs Road to the first hairpin turn on Forrest Trail. This alternate access is highly recommended if feasible. A parcel level analysis is recommended.

10. Red Draw and Peregrine

Figure 13

Hazard Rating:	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8,10
Water supply:	Hydrants
Hazards:	Ravines and shake roofs.

Description:

This area has been designated as Red Draw and Peregrine so that references to it are clearly distinct from the topographic feature, which is referred to in this document as Red Draw. This community is built along two ridges formed by ravines that slope down to the West Squaw Creek drainage. The only access to Redtail Ridge and Red Draw Meadows is from the eastern ridge of this community. In the event of an evacuation, this area could become a logjam. Fuels in the ravines are primarily aspen with heavy shrub understory (FM 8), but there is also a considerable amount of mixed conifer (FM 10) especially on north facing slopes and in the upper sections of this community. Both ravines have the potential to exhibit extreme fire behavior due to fuel loads and topography. The homes in this area have shake roofs, which are very vulnerable to ignitions from embers. Few homes have conforming defensible space.

Comments & Mitigation Notes:

Fuels reduction in both drainages should be a high priority. Defensible space is recommended for all homes and extended defensible space is recommended for homes directly above the ravines. Additional pullouts and turnarounds on Redtail Ridge Road would be desirable. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. Since there is only one-way in and out, Peregrine Drive and Red Draw Road should be thinned to 100' from the centerline. A parcel level analysis is recommended.

11. Kensington Green

Figure 14

Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	1,2,6.
Water supply:	Hydrants.
Hazards:	Steep narrow roads and driveways, powerline, homes close together and ravines.

Description:

Kensington Green is a large community of cluster homes located at the end of the northernmost ridge in the Divide section of Cordillera. There are numerous fairways that provide some discontinuity in the fuels, but they are by no means a continuous fuel break. There are also several small ponds here, but none are large enough to offer an alternative water supply. The main above ground power line for the entire Cordillera area comes from the transformer on Highway 6 into this neighborhood. There are slopes of up to 60% below this area, some with heavy shrub fuels, however the dominant fuel type here is sage and other short shrubs with a grass understory (FM 2). Most homes here have ignition resistant construction, but many of the homes that are not located adjacent to fairways need defensible space. Some roads and driveways are steep and quite narrow. Homes are close together and maneuvering large apparatus would be very difficult.

Comments & Mitigation Notes:

Fuels mitigation along the power line corridor should be a high priority as it affects the power for all of Cordillera. All homes need conforming defensible space. Discourage the planting of ornamental conifers within 30 feet of homes. Since there is only one-way in and out, Kensington Drive and Eagle's Glen Road should be maintained to prevent fuel buildup within 100 feet of the centerline. Lighted or other night-visible addressing would be a good idea for all homes. A parcel level analysis is recommended.

12. Bearden Meadows

Figure 15

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,4,8,10.
Water supply:	Hydrants
Hazards:	Ravines, and shake roofs.

Description:

This area faces a significant fuels threat from steep slopes of heavy shrub fuels mixed with aspen stands with heavy shrub understory (FM 4 and 8) on the north and east sides and also a significant loading of decadent stands of lodgepole pine (FM 10) to the south and on adjacent USFS lands. Many homes in this area have none or inadequate defensible spaces particularly on the south side where many homes are located in dense stands of decadent lodgepole pine with no clearings. Almost all of the homes in this community have shake roofs and wooden siding which further compounds the problem. There are some homes located on the eastern and southern ends of this community that are significantly more hazardous than the overall rating would indicate.

Comments & Mitigation Notes:

Investigate the possibility of constructing a shaded fuel break in lodgepole stands along the Zinn/Yordi equestrian trail through the USFS lands on the Cordillera border to the end of Bearden Road. Defensible space is recommended for all homes and extended defensible space is recommended for homes located above or adjacent to heavy fuel loads. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. A parcel level analysis of this neighborhood is recommended.

13. Andorra/Central Divide

Figure 16

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	2,8,10
Water supply:	Hydrants.
Hazards:	Steep slopes and ravines.

Description:

Most homes in this area have none or inadequate defensible space. In Andorra there are many structures located in heavy fuel loads of mixed conifer (FM10) and aspen with a heavy shrub understory (FM 8). Fuels are lighter on the top or the ridge and on some of the upper slopes of the Little Andorra area. Homes here are widely spaced and most have ignition resistant roofs and siding materials. Like many Cordillera communities, the addressing is generally good, but not illuminated or reflective.

Comments & Mitigation Notes:

Defensible space is critical to reducing the hazard in this area. Extended defensible space is recommended for homes located above or adjacent to heavy fuel loads. Since there is only one-way in and out, access roads should be thinned to 100' from the centerline. Illuminating the address signage would be helpful for night operations. Discourage the planting of ornamental conifers within 30 feet of homes. A parcel level analysis is recommended.

14. Red Draw Meadows

Figure 17

Hazard Rating:	High
Does the neighborhood have dual access roads?	No
Are there road grades >10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,8,10.
Water supply:	Hydrants.
Hazards:	Steep slopes and shake roofs.

Description:

Most of Red Draw Meadows is built along the nose of a ridge that slopes into Red Draw about 1/2 mile from its intersection with the West Squaw Creek drainage. The road between Red Draw Meadows and the Red Draw and Peregrine community has heavy fuels on both sides. West facing slopes have heavy loads of spruce/fir (FM 10). Vegetation on the east facing slopes consists of mostly sage and scattered pinyon/juniper with a grass understory (FM 2). The northwest facing slopes above the homes in the northernmost portion of this community are approximately 40% and have continuous fuels. Homes in The Timbers and Fairways are located on the upper 1/3 of this slope. Most homes here have shake roofs and wooden siding. Few have conforming defensible spaces. There is a good escape route (unimproved dirt, but open with light vegetation) that runs through the Petty property and joins West Squaw Creek Road to the northeast.

Comments & Mitigation Notes:

Creating a shaded fuel break along the existing roads and proper defensible spaces would go a long way toward reducing the threat to homes. Extended defensible space for homes in Red Draw Meadows would also have the added benefit of reducing the fuel loads below The Timbers and Fairways community. Discourage the planting of ornamental conifers within 30 feet of homes. If possible, work with the property owners to the northeast to improve the escape route that crosses the Petty property. Future homes should avoid shake roofs and wood siding materials. A parcel level analysis is recommended.

15. Settler's Woods

Figure 18

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	Yes (see description)
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,8,10.
Water supply:	Hydrants.
Hazards:	Ravines and shake roofs.

Description:

There is very little development here. Only a few scattered homes on Graham Road and Sunquist Road exist currently and nothing is built on Emma's Way and Norgaard Way. Fuels here vary from moderate loads of sage with grass understory (FM 2) to heavy timber on steep slopes (FM 10). Most existing homes have shake roofs and wooden siding and some have trees touching roofs and decks. There is an excellent escape route (visible in Figure 18) from the end of Emma's Way along a good dirt two track that connects with Ute Forest Road, which becomes West Squaw Creek Road, There is a locked gate at the intersection, but the road is short, in good condition and fuels are light.

Comments & Mitigation Notes:

Since development is light, this would be a good opportunity to encourage future homeowners to avoid shake roofs, wooden siding and ornamental plantings of flammable vegetation within 30 feet of structures. Some of the existing homes critically need defensible space and extended defensible space is recommended for homes located in and above heavy fuel loads. The maintenance of the escape route to Ute Forest Road should be considered high priority and its use for evacuation of citizens should be preplanned. Pockets of heavy fuels along the primary access roads should be thinned to 100 feet from the centerline. A parcel level analysis is recommended.

16. Elk Woods and Springs

Figure 19

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

Description:

There are fairways bordering the north side of this community large enough to make a good safety zone. There are some jackpots of fuel inside the fairways in the form of shrub clusters and historic ranch buildings, but this area would still be very safe especially with the sprinklers operating. The biggest fuels threat is on the south and west sides where position of the structures and the fuel types are very similar to the description of Bearden Meadows. This is another community where there are many ornamental conifers planted near foundations. Although there is some rock wainscoting on foundation walls and some heavy timber construction, the dominant construction materials are still shake roofs and wooden siding. Flammable construction and heavy fuel loads are the primary reasons for the high rating, but access and turnarounds for large equipment in the southern end of this community are also concerns.

Comments & Mitigation Notes:

There are hiking trails in this area the could be used to make a shaded fuel break between homes and the heavy timber to the south, but there is a serious volume of dead and down materials along these trails that would make doing so a difficult project. All homes should have defensible space and homes in the timber should have extended defensible space. Discourage the planting of ornamental conifers within 30 feet of homes. Pockets of heavy fuels along the primary access roads should be thinned to 100 feet from the centerline. A parcel level analysis is recommended.

17. Summit Club

Figure 20

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

Description:

This area is located along the upper 1/3 of the slope that is the upper (southern) end of the major drainage to the west of the Red Draw and Peregrine community. There are few homes built, but most of these have shake roofs and wooden siding. A few have rock wainscoting on the foundation walls. There is a continuous coverage of aspen with heavy shrub understory (FM 8) and mixed conifer (FM 10) around and on the slopes below these homes. Slopes in this area are not as steep as in the Divide and above Red Draw averaging 18% to 24% depending on aspect and position. Most existing homes have some defensible space, but in general it is non-conforming due to flammable ornamental plantings close to homes.

Comments & Mitigation Notes:

Since development is light, this would be a good opportunity to encourage future homeowners to avoid shake roofs, wooden siding and ornamental plantings of flammable vegetation within 30 feet of structures. All homes should have conforming defensible space and homes in the timber should have extended defensible space. Pockets of heavy fuels along the primary access roads should be thinned to 100 feet from the centerline. Turnarounds in this area should be wider. Most are 55 to 65 feet. The usual recommendation for fire apparatus is 80 feet. A parcel level analysis is recommended.

18. Granada Glen

Figure 21

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,10.
Water supply:	Hydrants and one large draft pond.
Hazards:	Ravines.

Description:

Most of the Divide is built along a broad ridge top and the upper 1/3 of spur ridges off of the main ridge. This community is built along the first drainage to the east and up the south-facing slope of the east side of this main ridge. Homes here are large and of generally ignition resistant construction. Although fuels are light on the south facing slopes, homes are threatened by heavy fuel loads of spruce/fir (FM 10) on the north facing slopes and steep ravines on the south and east sides. Some homes are built in the trees with none or inadequate defensible space and most are located mid-slope. Some homes have defensible space and most have visible addressing, but like much of Cordillera the addressing is not illuminated or reflective for nighttime visibility.

Comments & Mitigation Notes:

All homes need defensible space and homes located above or adjacent to heavy timber loads need extended defensible space. Discourage the planting of ornamental conifers within 30 feet of homes. There are a few long driveways here and these should be thinned to the same standards as access roads, 100 feet from the centerline. Long driveways should have an additional address marker at their intersection with the access road especially if the house is not visible. A parcel level analysis is recommended.

19. Settler's Loop

Figure 22

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	Yes
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	< 1 Acre.
Fuel models found in the neighborhood:	2,8,10.
Water supply:	Hydrants.
Hazards:	Ravines, shake roofs.

Description:

This community is arranged in an oval, the central area of which is composed primarily of sage with a grass understory (FM 2). This central area is the location of the Summit Athletic Club and very little else. Homes arranged around the periphery of the oval are located in aspen stands with heavy shrub understory (FM 8) and mixed conifer stands (FM 10). Lots here are mostly smaller, less than or equal to 1 acre. In spite of that, spacing between homes seems good, except on Hawley Court. Perhaps this is because this area is not fully built out. The heavy fuels are mostly arranged in stringers and patches broken by sage and short grasses, unfortunately many of these are below and close to homes. Although there is some heavy timber construction here, shake roofs and wood siding are still the dominant materials. The area rates as high hazard because of heavy flammable fuels and homes built mid-slope and above ravines.

Comments & Mitigation Notes:

Defensible space is recommended for all homes and extended defensible space is recommended for homes located above or adjacent to heavy fuel loads. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. A parcel level analysis of this neighborhood is recommended.

20. Territories

Figure 23

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	Yes (see description)
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	2,4,8.
Water supply:	Hydrants.
Hazards:	Ravines, poor water supply and shake roofs.

Description:

These are very large lots (35+ acres) with few homes constructed at this time. The general topography of this area slopes moderately, 16% to 22%, to the west from the western slope of Webb Peak. There are several ravines in this area, but most are shallow. The dominant fuel model is sage with grass understory (FM 2). Aspen with shrub understory and tall oak brush occur in stringers and patches throughout the area, but on the west slope of Webb Peak there is a more continuous fuel load of aspens with shrub understory (FM 8). Oak brush stands of up to 15 feet in height (FM 4) are common in the western portion of this area where they are a threat to the access road. There is a good potential escape route out of this area through the BLM property to the west.

Comments & Mitigation Notes:

Since development is light, this would be a good opportunity to encourage future homeowners to avoid shake roofs, wooden siding and ornamental plantings of flammable vegetation within 30 feet of structures. All homes should have defensible space. Oak brush within 200 feet of proposed building footprints should be removed before construction is approved (see "Special Considerations for Treatments in Oak Brush" in the main report). Pockets of heavy oak brush fuels along the primary access roads should be thinned to 100 feet from the centerline. This area is in the Greater Eagle FPD so response times could be improved dramatically by negotiating emergency access through the BLM property. Mutual aid from Eagle River FD would be improved by permanent staffing at Station 2. Even though all homes here are required to have sprinklers, many lots are too far from a hydrant. A parcel level analysis is recommended.

21. Gold Dust/Murphy's Creek

Figure 24

Hazard Rating:	**Moderate**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	2,8
Water supply:	Hydrants.
Hazards:	Steep slopes, ravines and shake roofs.

Description:

There are very few homes constructed in this area, but many of the lots are marked as sold. The homes that are built here and homes in adjacent areas have predominately shake roofs. Most of the lots in this area are large (3 to 8 acres), and are located along the top of Bellyache Ridge. Terrain within this community slopes generally west about 10% to 15%, however the entire area is located above steep ravines running into the Salt Creek Drainage to the southwest. This area has lighter fuel loads than the north side of Gore Trail and the Granite Springs community. Sage with grass understory (FM 2) and bunch grasses (FM 1) are common in this area, but there are also several stands of aspen with heavy shrub understory (FM 8) especially in the ravines.

Comments & Mitigation Notes:

Defensible space planning will be key to keeping the hazards moderate in this area. Since development is light, this would be a good opportunity to encourage future homeowners to avoid shake roofs, wooden siding and ornamental plantings of flammable vegetation within 30 feet of structures. All future structures should have conforming defensible space and homes located in the aspen stands should have extended defensible space including removal of snags, dead and down materials and mosaic thinning of the shrub understory.

22. Cimarron

Figure 25

Hazard Rating:	**Moderate**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	< 1 Acre
Fuel models found in the neighborhood:	1,8
Water supply:	Hydrants.
Hazards:	Steep slopes below this community and shake roofs.

Description:

This small group of cluster homes is located on the south side of Fenno Road between The Timbers and Fairways and The Aspens/Black Bear/Whitaker Ponds communities. Although this area is above the heavy fuel loads in Red Draw, the hazards are lower than in The Timbers and Fairways because the community is surrounded by fairways. These homes are predominately heavy timber construction, however, they still have shake roofs, which would be very susceptible to ignitions from embers cast by a fire in Red Draw. Homes are close together, but most have some defensible space. In general the defensible space is not conforming due to flammable ornamental plantings too close to structures. Some of the aspen stands on the fairways have a significant shrub understory.

Comments & Mitigation Notes:

The shrubs should be thinned from the aspen stands on and adjacent to the fairways to maintain the integrity of the fairways as a fuel break. Ornamental conifers should be removed from within 15 feet of homes and plantings of flammable ornamentals within 30 feet of structures should be discouraged. Fuels reduction in Red Draw will reduce the threat to this area, however it will always be at risk from fires in Red Draw because of the flammable roofing materials employed. Replacing shake roofs with ignition resistant roofing would be the most productive way to reduce the risk to this community.

23. Bearcat

Figure 26

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

Description:

This group of cluster homes is located on the same ridge as The Ridge community. Although construction styles are similar, wood siding and shake roofs, this area earns a much lower hazard rating due to two factors. The topography is much less steep and the community is surrounded by fairways that serve as a good fuel break. There are aspen stands with shrub understory (FM 8) in this community, however, they occur mostly in patches broken by fairways and grass (FM 1). Homes are close together, but most have some defensible space. In general the defensible space is not conforming due to flammable ornamental plantings too close to structures. This area would still be at risk for ignitions to the shake roofs from a wind driven fire in Red Draw during peak burning conditions.

Comments & Mitigation Notes:

The shrubs should be thinned from the aspen stands on and adjacent to the fairways to maintain the integrity of the fairways as a fuel break. Ornamental conifers should be removed from within 15 feet of homes and plantings of flammable ornamentals within 30 feet of structures should be discouraged. Replacing shake roofs with ignition resistant roofing would be the most productive way to reduce the risk to this community. More visible addressing would also be a benefit here.

24. Summit Fairways

Figure 27

Hazard Rating:	**Moderate**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	2,8
Water supply:	Hydrants.
Hazards:	Ravines and shake roofs.

Description:

This community includes streets on the north and south sides of Summit Trail, but only the south side has existing homes. Most of this area is located on the upper 1/2 of the western slope of Bellyache Ridge. The homes that are built here have shake roofs and primarily wood siding. There are several ravines, but most of the terrain is moderate at 10% to 20% slopes. Fuel loads are light to moderate. The primary fuel near homes is sage with a grass understory (FM 2), but there are also substantial patches of aspen with shrub understory (FM 8), particularly in the ravines on the south side. Fuels in this area are discontinuous due to the presence of fairways that provide a good fuel break in most of this community.

Comments & Mitigation Notes:

This is another community that really needs planning more than mitigation. Since development is light, this would be a good opportunity to encourage future homeowners to avoid shake roofs, wooden siding and ornamental plantings of flammable vegetation within 30 feet of structures. All future structures should have conforming defensible space. The shrubs should be thinned from the aspen stands on and adjacent to the fairways to maintain the integrity of the fairways as a fuel break.

25. Founder's Preserve

Figure 28

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

Description:

Homes in this community have better spacing that the adjacent areas of Club Cottages and Bentgrass, but construction materials are the same, shake roofs and wood siding. Slopes here are moderate (15% to 22%) and this community is surrounded by large fairways. Fairways to the north and south may be large enough to be good safety zones. Unlike many of the fairways in Cordillera these are largely free of pockets of aspen with flammable shrub understory. Most homes have defensible space, however, many are non-conforming due to the planting of ornamental conifers close to structures.

Comments & Mitigation Notes:

Conforming defensible space is recommended for all homes. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes.

26. Club Cottages

Figure 29

Hazard Rating:	**Low**
Does the neighborhood have dual access roads?	Yes
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	< 1 Acre
Fuel models found in the neighborhood:	1
Water supply:	Hydrants.
Hazards:	Shake Roofs.

Description:

This group of cluster homes has primarily shake roofs and wood siding and very close spacing. This area is completely surrounded by fairways. Fuels near homes are light loads of irrigated short grass (FM 1) and ornamental plantings. The area is mostly flat and there is little to burn. Homes in this area are probably more at risk from house to house radiation of a structure fire than wildland fires. Extreme fire behavior to the north or east may bring embers into this area that could ignite the flammable roofing materials, but this would still be a fairly safe place to be.

Comments & Mitigation Notes:

Maintain defensible space around homes. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes.

27. Bentgrass

Figure 30

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

Description:

This area is very similar to Club Cottages. Smaller homes on smaller lots with shake roofs and wooden siding. There is more rock wainscoting around foundation walls in this area, which would help resist surface fires. Most homes have non-conforming defensible space due to ornamental plantings of flammable vegetation. The Fairways section of this community may be a little more hazardous due to an increase in slope to the west and the presence of flammable shrubs between some of the homes and the fairways, but overall this area is still well buffered.

Comments & Mitigation Notes:

Maintain defensible space around homes. Future homes should avoid shake roofs and wood siding materials. Discourage the planting of ornamental conifers within 30 feet of homes. In the Fairways area, shrubs should be thinned from the aspen stands on and adjacent to the fairways to maintain their integrity as a fuel break.

28. Martingale

Figure 31

Hazard Rating:	**Low**
Does the neighborhood have dual access roads?	No
Are there road grades > 10%?	No
Are all access roads of adequate width?	Yes
Average lot size:	< 1 Acre
Fuel models found in the neighborhood:	1
Water supply:	Hydrants and a large draft pond within 1/4 mile.
Hazards:	Shake roofs.

Description:

This community is mostly flat, has light fuel loads and is surrounded by fairways. Lots here vary from 3/4 acre to 1 1/4 acres. Fuels here are light loads of short grass (FM 1) with a few patches of aspen that are broken by fairways and irrigated lawns. Homes have shake roofs and primarily wood siding. Most homes have defensible space, however, many are non-conforming due to the planting of ornamental conifers close to structures.

Comments & Mitigation Notes:

This area is not fully built out so this would be a good time to discourage the use of shake roofs and the planting of ornamental conifers within 30 feet of homes. Maintain defensible space around existing homes. Addressing could be improved, as the black numbers on wooden poles would be hard to read at night. Brass numbers, like the ones used on Bermuda Court in Bentgrass, would be a better choice and should be mounted on the house as well as the address pole.

Appendix C

Cordillera POA Hazard Assessment
Structural Triage and Preparation

Size-up Considerations

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

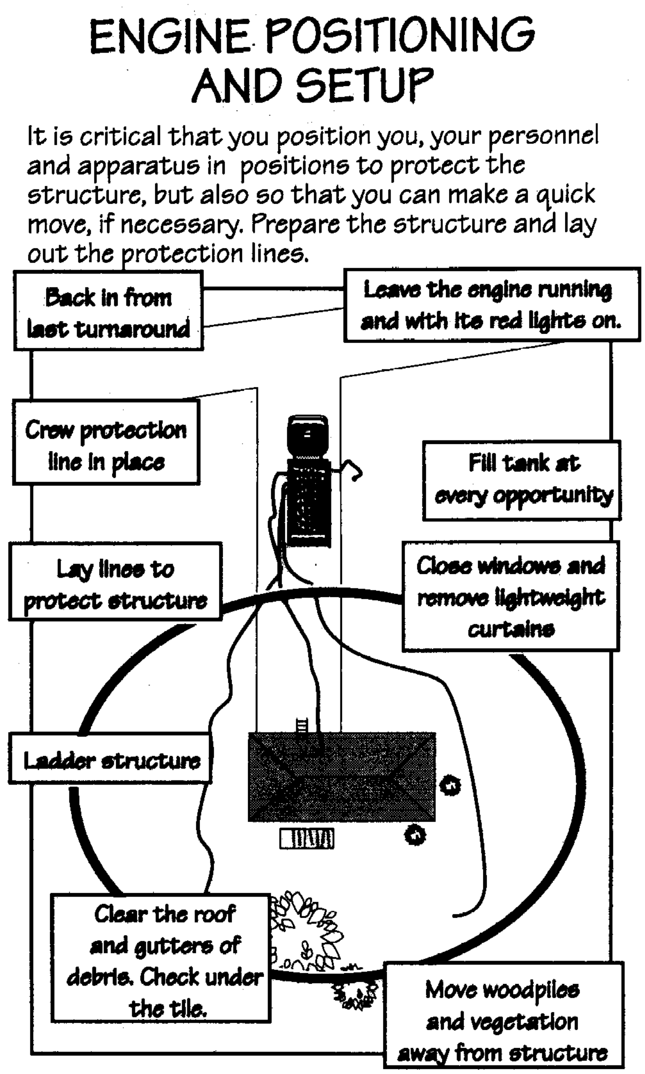
Fire Fighter Safety

- What are the routes of egress and ingress?
  - What is the largest engine that can access the structure safely?
  - Are the roads two way or one way?
  - Are there road grades steeper than 10%?
  - Are the road surfaces all weather?
  - Are there load-limited bridges?
- Are there anchor points for line construction?
- Are there adequate safety zones?
- What are the escape routes?
- Are there special hazards such as hazardous materials, explosives, high-voltage lines, or above ground fuel tanks?
- Are communications adequate?

Structure Triage Categories

Sort structures into one of three categories: **1. Stand Alone or Not Threatened, 2. Defendable, 3. Not Defendable.**

- Factors that may make an attempt to save a structure too dangerous or hopeless.
  - The fire is making sustained runs in live fuels and there is little or no defensible space.
  - Spot fires are too numerous to control with existing resources.
  - Water supply will be exhausted before the threat has passed.
  - The roof is more than 1/3 involved in flames.
  - There is fire inside the structure.
  - Rapid egress from the area is dangerous or may be delayed.



[1]

Common Ignition Points

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

[1] William Teie, "Firefighter's Guide, Urban/Wildland Situations" (Deer Valley Press, 1995).

Appendix D
Cordillera WUI Assessment
Emergency Access and Water Supply

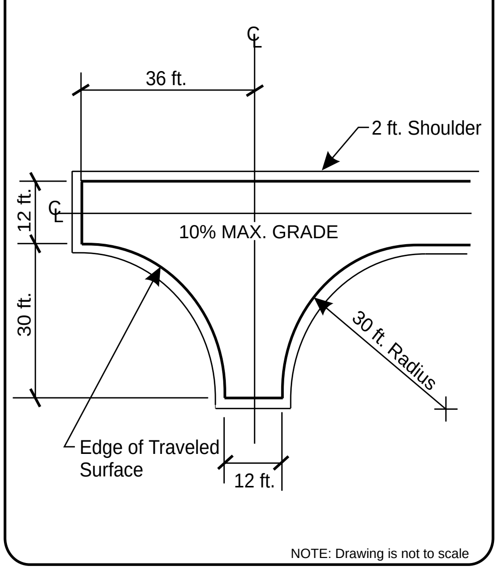
Emergency personnel try their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for homeowners and their families, as well as the firefighters and emergency medical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

ACCESS GUIDELINES

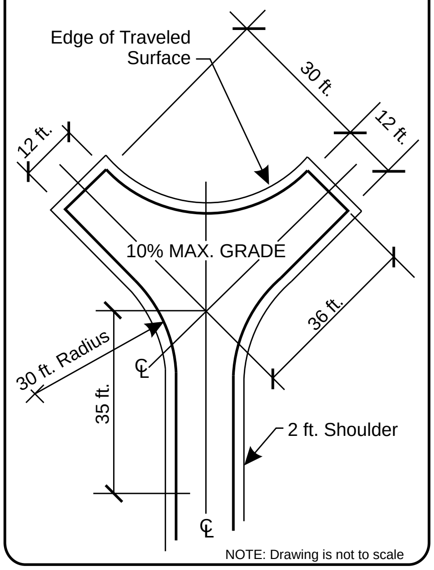
Driveway Turn-Arounds

Turn-arounds, unobstructed by parking, are designed and constructed to allow for safe reversal of direction by emergency equipment. The "Y" and "Hammerhead" turn-arounds shown below are preferred because they provide the necessary access while minimizing disturbance to the site.

HAMMERHEAD TURNAROUND



Y CONFIGURATION



BRIDGE LOAD LIMITS

The load limits for a bridge should be posted at both entrances of the bridge.

DRIVEWAY WIDTH & HEIGHT

Your driveways should have an unobstructed vertical clearance of 13 feet, 6 inches. You may need to limb trees or move utility lines to provide necessary clearance.

Design your driveway with a 12 foot wide driveable surface and a 14 foot horizontal clearance.

ADDRESS SIGNS

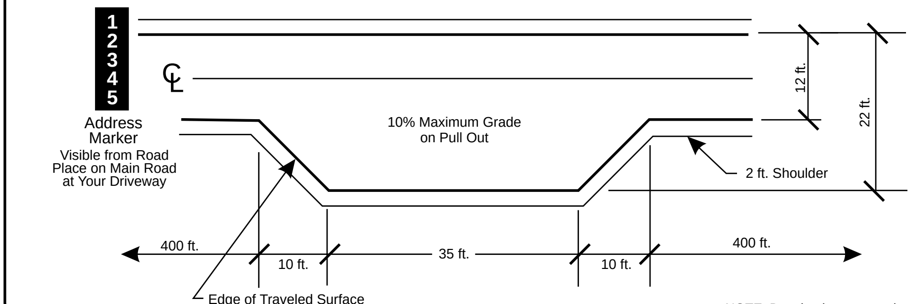
All buildings should have a permanently posted, reflective address sign. This sign should be placed and permanently maintained at each driveway entrance.The address sign must be visible from both directions of travel.

For more information please contact the Anchor Point Group at 303-665-3473.

Driveway Pull-Outs

Driveway pull-outs are designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400 foot intervals along the driveway. The location of the pull-out(s) can be modified to accommodate physical barriers such as rock outcrops, wetlands, and other features.

PULL OUT



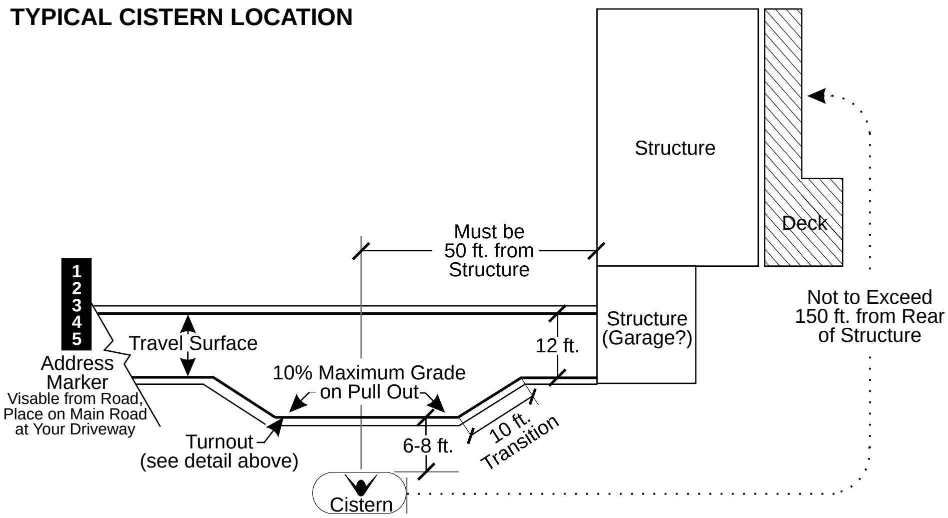
FIRE PROTECTION DISTRICTS

It's always helpful to discuss construction projects with your local fire department. This will help determine what kind of access and water supply will work best for your site. The purpose of this handout is to provide some basic guidelines which, from our experience, are the preferred options.

CISTERNS

Once the emergency vehicles arrive at your site, they will need a dependable supply of water to help control a fire. A residential well is not enough water for fire control. A cistern may be required.

TYPICAL CISTERN LOCATION



NOTE: Drawing is not to scale

WATER SUPPLY OPTIONS

If your property is a significant distance from a reliable water supply or fire department station, it may be advisable to install one of the following water supply options, approved by most fire departments:

An on-site 1,800 to 2,500 gallon cistern.

A monetary contribution to a community cistern fund.

A "dry hydrant" installation in a nearby pond, lake or stream.

For more information about these standards or about fire management efforts, please contact:

The Anchor Point Group
303-665-3473
Fax: 303-386-3954
info@AnchorPointGroup.com

Or
your local fire department

Visit the Anchor Point Group
Web Site:
http://www.AnchorPointGroup.com