Building for Wildfire Resiliency

In Ouray County, CO

To be used in conjunction with:

Section 16: Wildfire Mitigation Regulations -

Ouray County Land Use Code

Ouray County Land Use Department

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Purpose

This document is intended as a reference guide for the **Section 16 – Wildfire Mitigation Regulations** of the Ouray County Land Use Code. It is designed to help homeowners, architects, engineers, general contractors, and others who plan to build or retrofit homes understand the requirements in the Ouray County Wildfire Mitigation Regulations. It is not a definitive, current, or comprehensive summary of all the Ouray County Land use codes. As owner, you are responsible for compliance with the latest land use and building codes, subdivision covenants, applicable laws, and regulations. Other resources include:

- "**Before You Buy or Build in Ouray County**" for information pertaining to other land regulations that may apply to you, available online at: https://ouraycountyco.gov/DocumentCenter/View/142/Before-You-Buy-or-Build?bidId=
- **Current Ouray County Land Use Code**, including all its Sections can be found online at: https://ouraycountyco.gov/214/Land-Use-Code.

The incorporated municipalities of Ridgway and Ouray may have significantly different requirements from the unincorporated County. Be sure to verify the jurisdiction of your property before finalizing any purchases or plans. Not all remodel, replacement, or repair work requires a permit. For more information on which jobs need a permit, see the section entitled "Permits and Procedures" in "Before You Build or Build in Ouray County". You may also contact the Building Official at (970) 626-9775 for further clarification.

Introduction

Ouray County is a small, rural county, and as such, does not have the resources (both financial and staffing) of larger, more urban counties and communities, and cannot provide the same level of services. Protecting residents' lives and property is our top priority, so we are implementing regulations and providing homeowners with the information they need to reduce their risk from wildfire.

The County has identified wildfire as one of the top risks to our residents. The Ouray County Multi-Hazard Mitigation Plan (updated 2019) rated the City of Ouray, Town of Ridgway, Unincorporated Ouray County as well as Log Hill Mesa Fire Protection District (which is part of Unincorporated Ouray County) as "high" for wildfire risk and identified $1,083,030,105 in "total exposure value" that is at risk to wildfire. The Ouray County Community Wildfire Protection Plan (2011) identified 17 communities/geographic areas that were rated "high" to "very high" for wildfire risk. Given the increase in size and intensity of wildfires over the last 2 decades across the country and world, this current level of risk from wildfire is expected to increase. In the 2018 Fourth National Climate Assessment, scientists calculate that by 2060, the area burned by lightning-caused fires could increase 30 percent. Increased acres burned, coupled with impacts of climate change, such as extended droughts and widespread insect outbreaks, and increased numbers of people moving into the wildland urban interface/intermix, will escalate the risk of catastrophic losses to individuals and communities. The Wildfire Mitigation Regulations Section of the Ouray County Land Use Code is intended to ensure that homes and communities are planned, designed and built with current and future wildfire risk in mind so that the county, and its residents, can become better adapted to living with wildfire

Instructions & Considerations

The specific intent of this document is to provide more detailed guidance and assistance to individuals who are currently applying for a building permit for a new single-family dwelling/accessary dwelling unit, additions to dwelling units, new detached accessory structures, additions to detached accessory structures, attached decks, construction in the Colona Zone, or are otherwise seeking information and assistance with building and/or retrofitting a home that is resistant to ignition during a wildfire. In addition to reviewing this document, we recommend the following:

1. Read through **Section 16**: Wildfire Mitigation Regulations of the Ouray County Land Use Code.

3. Read through the 'Exhibit A' to Section 16. As part of the Wildfire Mitigation Regulations, Ouray County has adopted a "Wildfire Vulnerability Rating System Worksheet" which is also referred to as the "Worksheet" as well as "Exhibit A". The Worksheet is a part of the Wildfire Mitigation section of the Ouray County Land Use Code. The Worksheet is intended to encourage ignition resistant design, construction and landscaping practices in Ouray County.

This rating sheet provides categories that apply to construction in Ouray County. The *Rating Assessor* will determine, using his/her best professional judgement, the degree to which a proposed material and/or proposed assembly is legitimately considered *Ignition Resistant* to meet the criteria of the regulations. Note that the Rating Assessor is a position assigned and designated by the County Land Use Director.

3. Please understand that the Wildfire Mitigation Regulations of the Ouray County Land Use Code (currently Section 16) and the Worksheet work *together* to establish the regulations relating to wildfire mitigation in Ouray County.

The following pages contain more detailed information relating to the elements including key wildfire related issues as well as mitigation measures.

A1.1. Roofing- A description of the roof covering material and construction assembly of the roof. Important Note: *Roofing has been shown to have the single most significant impact on the survivability of the home during a wildfire*!

A1.1. PASS- Class A Roof Covering: The construction of the roof utilizes a roof covering material that has been tested to be a Class A material in accordance with UL 790 (ASTM E108). Some materials may rely on additional underlying materials to improve their fire ratings. Both "by assembly" and "stand-alone" materials are considered acceptable so long as the material has been installed in accordance with their listing and the manufacturers' installation instructions and the full assembly has been constructed to ensure the Class A rating status has been achieved.

A1.2. FAIL- Class B, C or Unrated Roof Covering: Any roof covering that does not meet the Class A roof covering standards in accordance with UL 790 (ASTM E108).

NOTE: As part of the permit process, you will be required by the Ouray County Land Use Department to indicate which type of roofing material is selected on your plan set AND you must provide a manufacturer's specification sheet or a letter from the material supplier certifying that the materials (the entire assembly) have been rated as Class A.

Picture of a roof assembly rating test.

KEY ISSUES:

- Roof assemblies are the most vulnerable component of a home in a wildfire because of their horizontal orientation and overall size.
- During a wildfire, embers can ignite the roof covering, other roof components, and/or debris on the roof.
- Once a roof has ignited, it typically propagates into the interior of the home, which will result in substantial damage or total loss of the home.
- The more valleys and roof/wall intersections are incorporated in the design, the greater the likelihood that combustible materials (leaves, needles, etc.) as well as embers can collect and start an ignition.

MITIGATION MEASURES:

- Use fire resistant (Class A) roof coverings to significantly increase the probability a home will survive a wildfire.
  There are many types of Class A roofing materials/assemblies available on the market. Typical Class A roofing products include, but are not limited to the following: Asphalt Shingle, Metal/Stone-Coated Metal, Concrete (Std/lightweight), Clay Tile, Slate or Stone, Hybrid Composites.

- Ensure the overall roof assembly achieves a Class A rating to further increase the probability a home will survive a wildfire. Class A is not just a rating for the roof covering, but is a rating derived from the overall assembly, including interlocking roof components comprised of the roof covering AND the roof deck, vapor retarder (if present), insulation (if present) insulation cover boards (if present).

A2.1. Exterior Cladding & Siding: A description of the materials and construction assembly of the exterior cladding and siding of the building and its resistance to ignition from embers, as well as radiant and convective heat.

A2.1. PASS- Ignition Resistant Siding: The building will feature exterior cladding and siding that are constructed of Ignition Resistant materials. Ignition Resistant materials include, but are not limited to: heavy timber log construction that is 6" in diameter or greater; fiber-cement board, 3 stage stucco, masonry, brick, manufactured stone, etc. Rating Assesor will determine, using best professional judgement, degree to which a proposed material and proposed assembly is justifiably considered "ignition resistant" to meet this standard.

A2.2. PASS- Combustible Siding WITH Ember Mitigation AND Defensible Space: The building will feature combustible (ie. non-ignition resistant) exterior cladding and siding; however, measures have been taken to ensure that the base of exterior walls, (where the walls meet the ground, decks or any other horizontal surfaces), as well as junctures between exterior walls and rooflines (e.g. dormers, complex roof features, etc.) and other structural projections, etc. have no less than 6 inches of a non-combustible material (e.g. metal flashing, skirting, concrete foundation, etc.) to reduce the likelihood of ignition from embers (ie. ember mitigation) AND the property meets the standard stated in B1.1 for defensible space (ie. 100-feet) to mitigate the risk of ignition from radiant and convective heat sources. If the property owner cannot meet the defensible space criteria they may elect to utilize "Ignition Resistant Siding".

A2.3. FAIL- Combustible (Non-Ignition Resistant) Siding: The building has exterior siding or cladding that does not meet standard A2.1 or does not otherwise meet standard A2.2.

As part of the permit process, you will be required by the Ouray County Land Use Department to indicate which type of exterior siding /cladding material and entire assembly is selected on your plan AND you need to provide a manufacturer's specification sheet or a letter from the material supplier demonstrating the ignition resistance.

KEY ISSUES:

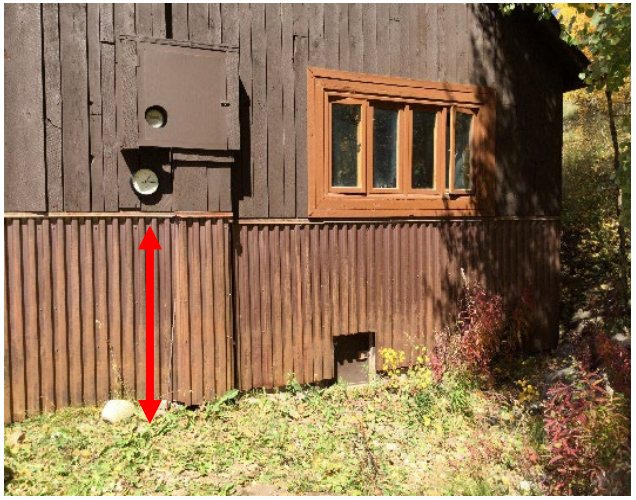
- Exterior walls are susceptible to wildfire flames, conductive heat, and radiant heat. Combustible walls can ignite when exposed to direct flames and heat.
- Exterior walls can also ignite from windborne embers that become trapped along the base of the wall (*where it meets grade or other horizontal features*) along roof lines or in cracks in walls.
- Once an exterior wall ignites, fire can spread to other parts of the home and result in substantial damage or total loss of the home.

MITIGATION MEASURES:

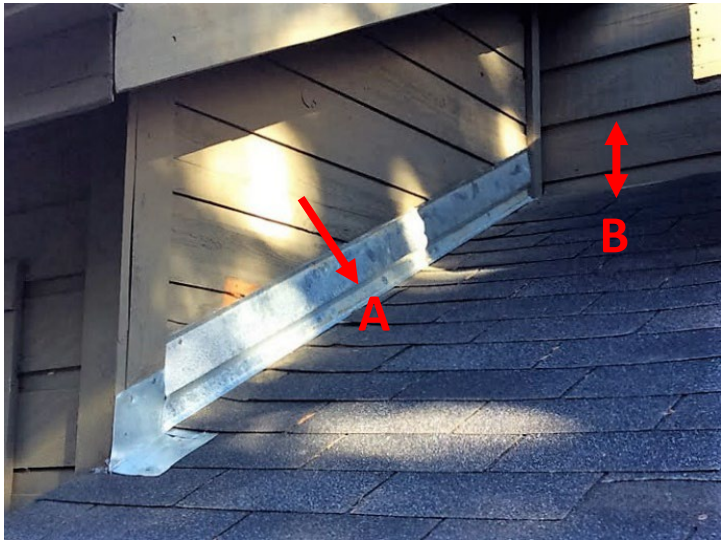
- For best protection, use ignition resistant exterior wall coverings that are not susceptible to igniting or melting.
- Ensure the overall siding assembly (*not just the surface siding*) is ignition resistant.
- Comply with the requirements of the fire-rated assembly, including using the exact type of materials, configuration, and attachment used during the testing that established the rating.

- If combustible siding is used, <u>it must have</u> **1)** ember mitigation and **2)** adequate defensible space.
  (1) Ember mitigation includes: At least 6" of ignition-resistant material (such as metal flashing, etc.) at the base of walls (where they meet grade, decks or other horizontal surfaces), and along roof lines or other structural projections.
  (2) Adequate defensible space includes: <u>No less than 100' of defensible space</u> **(see B1.1)** to mitigate the potential for combustible siding to ignite from radiant and convective heat sources.

If ignition-resistant siding is not used, at a minimum, at least 6 inches of ignition-resistant material needs to be installed at the base of walls (left). Picture on the right shows more than 6 inches of ignitiion-resistant mateiral.



Picture on left shows combustible siding on dormer ignitigin from firebrands or embers that were trapped between the roof seams. If ifnition-resistant siding is not use, the mitigation measure is to install a at least 6 inches of ignition-resistant material along roof seams. Note arrwo A shows where mitigation measures were taken. To be in compliance with the Ouray Code, the same mitigaiton measture would ned to be installed along the horizonal roof seam where arrow B is located.



A3.1. Vents: A description of all vents, including but not limited to attic, soffit, and gable vents. Any vent that connects the outside of the building with the inside of the building is covered under this element unless the vent emanates from a combustion chamber or an ignition-resistant chamber. (ex. clothes dryer or range hood with solid metal duct to the exterior vent)

A3.1. PASS- Ember Resistant Screening: Vents are screened with 1/8" screening, an acceptable louvered venting system (as is common for dryer vents) and/or a similar screening system that has been specifically designed to prevent the intrusion of embers. A3.2. FAIL- Non-Ember Resistant Screening/No Screening: One or more location(s) on the building that connects the outside of the building with the inside of the building either (a) does not have any screening or (b) insufficient screening such that it does not meet Standard A3.1.

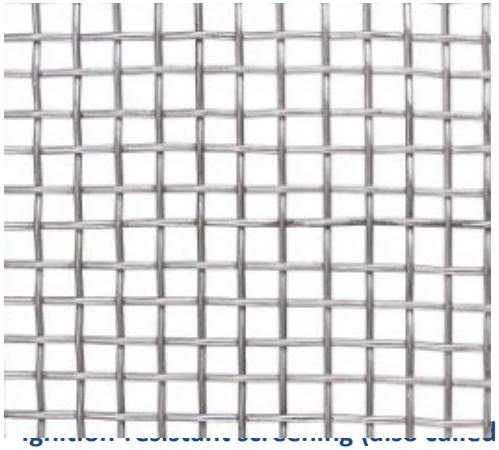
KEY ISSUES:

- Vents can be critical for temperature and moisture control in a home however, vents are openings into the home that can leave homes vulnerable to ember intrusion during a wildfire.
- Large embers carry enough heat to potentially cause an ignition. Small embers may be able to pass through screening but generally they burn out quickly and do not have enough heat to continue to burn and/or ignite combustible material inside the home.

MITIGATION MEASURES:

- Use screening material with openings no larger than 1/8” on all vent openings to restrict the size and quantity of embers entering the home. Screening material should be non-combustible material (e.g. 1/8” ignition resistant hardware cloth).
- There are several different types of vents on a home, including soffit, roof, ridge and gable vents. Each of these vents types are required to include 1/8” screening.

There are several different types of vents on a home: gamble (left), soffit (middle) and roof (right). All of these vents are required to have 1/8th inch screening.



hardware cloth) where openings are no larger than 1/8th inch in size.

NOTE: not actual size.

A4.1. Chimneys and Other Heating Appliances: Approved spark arresters installed on all wood burning appliances.

A4.1. PASS- Approved Spark Arrester Installed. Approved spark arrester or cap is properly installed on the chimney.

A4.2. FAIL- Lack of Approved Spark Arrester: Missing, not properly installed or not meeting Standard A4.1.

KEY ISSUES:

- Spark arresters are designed to catch embers that are produced during normal operation of a fireplace or wood burning appliance.
- Preventing embers from exiting a chimney reduces the risk of ignition outside of the home and potentially causing a wildfire.

MITIGATION MEASURES:

- Install spark arresters on all new wood burning appliances to reduce the risk of ignitions starting outside the home. A typical standard for code compliance is that the spark arrester shall be constructed of woven or welded wire screening of **12 USA standard wire gauge** having openings not exceeding ½ inch.

- Where a spark arrestor is installed on a masonry chimney, the spark arrestor shall meet all the following requirements:
    1. The net free area of the arrestor shall not be less than four times the net free area of the outlet of the chimney flue it serves.
    2. The arrestor screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
    3. Openings shall not permit the passage of spheres having a diameter greater than $^{1}/_{2}$ inch (13 mm) nor block the passage of spheres having a diameter less than $^{3}/_{8}$ inch (10 mm).
    4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

Example of a spark arrester installed on a wood burning chimney to prevent embers from exiting the chimney and to reduce the potential to start an ignition outside of the home.

A5.1. Building Perimeter Hardened Zone: This standard is applicable to the ground level area directly adjacent the building perimeter extending out to 5 feet. The building perimeter includes any attachments, such as combustible decks, combustible fences, attached outbuildings, etc.

A5.1. PASS- 5 Foot Hardened Zone: Hardened zone extends out 5 feet from the building perimeter. A hardened zone is void of all combustible fuels including grasses, vegetation, landscape mulch, combustible building materials, etc. The hardened zone must be covered so as to prevent eventual growth of grasses/weeds. Minimum standard - Weed barrier fabric and rock/gravel.

A5.2. FAIL: Lack of 5 Foot Hardened Zone: Area within 5 feet of the building perimeter (including attachments) does not meet the standard as defined in A5.1

KEY ISSUES:

- The first 5 feet adjacent to the home (including attached decks) is referred to as Zone 1A. This area is often referred to as the "home ignition zone".
- A creeping ground fire moving towards the home and/or embers falling within this zone are the typical risks associated with ignition in this zone.
- Combustible materials in this zone pose a significant ignition risk to the home.

MITIGATION MEASURES:

- Remove all combustible materials from Zone 1A to avoid a home ignition.
- A weed barrier combined with rock/gravel or paver stones can make for an attractive and functional exterior aesthetic.

Examples of hardened Zone 1A. The hardened area extends at least 5 feet beyond the edge of a combustible deck attachment (left) and at least 5 feet beyond the perimeter of the base of the home (right). Note the hardened Zone 1A is free of grasses, vegetation, landscape mulch, and other comubsitble materials .

A6.1. Exterior Doors: A description of all exterior doors. Doors represent a vulnerable point for fire intrusion.

A6.1. PASS- Ignition Resistant Doors: Exterior doors are ignition resistant or solid core not less than 1 3/4-inches thick, or constructed with aluminum or fiberglass cladding. Windows within doors, and glazed doors, are tempered safety glass or multi-layered glazed panels. County Staff or Rating Assessor will determine, using best professional judgement, the degree to which a proposed material and proposed assembly is justifiably considered 'ignition resistant to meet this standard.

A4.2. FAIL- Non-Ignition Resistant Doors: One or more exterior doors do not meet Standard A6.1.

KEY ISSUES:

- Exterior doors can leave the house vulnerable to fire intrusion during a wildfire. Doors are typically much thinner and less ignition-resistant than exterior walls and can therefore represent an ignition vulnerability.
- Doors and door frames constructed with combustible materials can ignite from flames or hot gasses.
- Embers can become lodged in openings between the door and door frame and ignite a door or door frame constructed with combustible materials,
- During a wildfire, radiant and convective heat can cause certain windows to crack and allow for ember intrusion into the home.

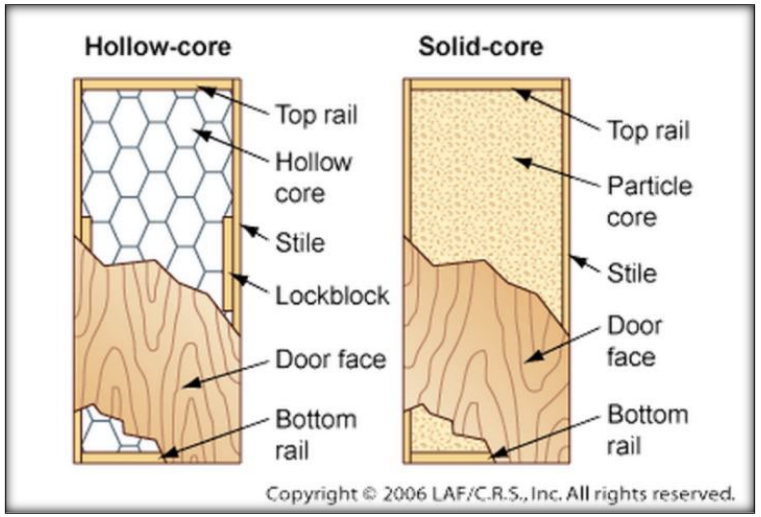


Diagram showing the differences between a hollow-core (not approved) and solid-core (required) door construction.

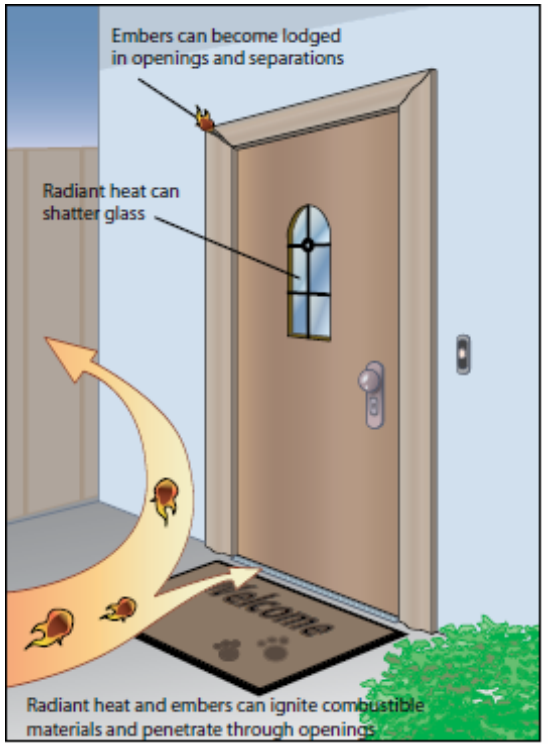


Diagram showing how exterior doors are vulnerable to fire intrustion during a wildfire.

MITIGATION MEASURES:

- Use ignition resistant exterior doors, such as metal or fiberglass, to reduce the risk of fire and/or embers entering the home and igniting a fire.
- Wooden doors are acceptable when they are solid core construction. A solid core door provides protection against radiant heat during a wildfire.
- Use windows or glass panels made of tempered safety glass or multi-layered glazed panels in doors. They are designed to withstand extreme heat, reducing the risk of fire and/or embers entering the home and igniting a fire.

A7.1. Private Road & Driveway Emergency Vehicle Access: Private roads and driveways should conform to Ouray County Road Standards as set forth in this Code. EXCEPTION: Homes, driveways, or portions of driveways, located on mining claims above 9480-feet in elevation may be exempt from these standards. Note: Driveway design may require a 'plan and profile' to be prepared by a Colorado State Registered Professional Engineer. Please refer to the Ouray County Land Use Code for more information and applicability.

A7.1. PASS- Driving surface as least twelve feet (12') wide, and; Otherwise FAIL.

A7.1. PASS- Interior radii shall be at least thirty-two feet (32'), and; Otherwise FAIL.

A7.1. PASS- Driveway opening at least sixteen feet (16') wide, and; Otherwise FAIL.

A7.1. PASS- Grades do not exceed 12 percent (12%). Otherwise FAIL.

A7.1. PASS- Adequate sight distance, angle of approach, crowning/cross-sloping, adequate drainage meets County standards. Otherwise FAIL.

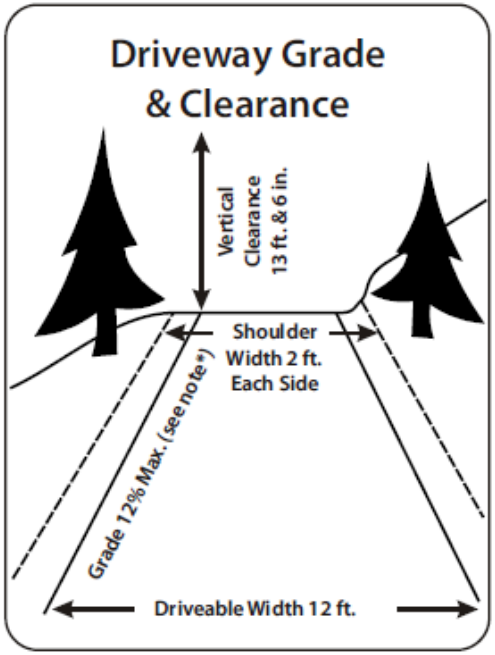
For more information about driveway design and construction, contact the Ouray County Road and Bridge Department.

KEY ISSUES:

- Adequate clearance along roads and driveways is critical in any emergency, but especially during a wildfire.
- Firefighters and emergency vehicles cannot attempt to defend your home during a wildfire if it is not accessible by firetrucks and multiple response vehicle. In addition, inadequate egress can be a risk to you and your family if you are attempting to evacuate your home during a wildfire.
- Vegetation along your driveway can inhibit visibility for firefighters/first responders and make it unsafe for them to defend your home.

MITIGATION MEASURES:

- When building a road or driveway, make sure the driving surface is at is at least 12 ft. wide.
- Consider turnaround options for emergency vehicles when designing the driveway. The best option is to connect the driveway to the public road using a "horseshoe" design. Alternatively, you can install a turnaround along the driveway with a large circular 'cul-de-sac' design (radius of at least 32' feet) or you *may* be able to install a "Y" style turnaround or "Hammerhead" style turnaround.
- The driveway opening is where the driveway or private road joins the county road. The opening should be at least 16' wide. Refrain from restricting the driveway opening with columns, gates, archways or ranch style entrances (e.g. timber frame construction) that limits access for emergency vehicles.
- If you need to install a driveway on a steep slope, include any necessary switchbacks or other features to reduce the grade of the driveway. Water bars and ditches will likely be an additional important consideration for these steep driveways.



- Consider the design of sight distance, angle of approach, crowing/cross-sloping and drainage (refer to the Ouray County Road Standards)

A8.1. Address Sign Visible & Meets Standard: All new address signs installed in the unincorporated portions of Ouray County shall conform to the current standard for address signs as set forth by the Board of County Commissioners.

A8.1. PASS- Address Sign Visible & Meets Standard: All new address signs installed in the unincorporated portions of Ouray County shall conform to the current standard for address signs as set forth by the Board of County Commissioners.

A8.2. FAIL- Address Sign Not Visible OR Does Not Meet Standard: The address sign does not meet the standard for address signs as set forth by the Board of County Commissioners.

KEY ISSUES:

- Adequate addressing at the entrance of your driveway or private road is critical in any emergency, but especially during a wildfire.
- Firefighters and emergency responders cannot respond to an emergency or defend your home if they cannot locate your house quickly and easily.
- Consider that during a wildfire visibility could be very poor due to smoke, embers, flames or because firefighters are responding during the night when it is dark outside.

MITIGATION MEASURES:

- **Follow Ouray County Standards (Resolution No. 2017-048) for installing address signs in unincorporated parts of Ouray County:**
  - Address signs must be of metal construction, retro-reflective, green background, white characters
  - Address signs must be 4-inches tall, horizontal or vertical orientation
  - Width of address sign may be determined by the required number of characters
  - Numbers or letters shall be 3-inches tall and retro-reflective
  - Address signs may be mounted vertical or horizontal
  - Address signs shall be securely mounted and visible from the County Road or driveway

A9.1. Gutter System: A description of any proposed gutter system, including gutters, downspouts and gutter caps, including their materials and construction assembly. Regardless of the installed gutter system, regular maintenance of gutters, to clear them of any accumulated combustible materials, is highly recommended. To reduce maintenance, installation of a non-combustible (ie. ignition-resistant) gutter cap is recommended.

A9.1. PASS- Ignition-Resistant Gutter System: Gutters are made out of ignition-resistant material AND gutters are installed such that the leading edge of the roof is finished with a metal drip edge so that no wood sheathing is exposed. The drip edge extends in to the gutter. If no gutter system is installed, then PASS.

A8.2. FAIL- Wildfire Vulnerable Gutter System: Gutters do not meet the standard as described in A9.1.

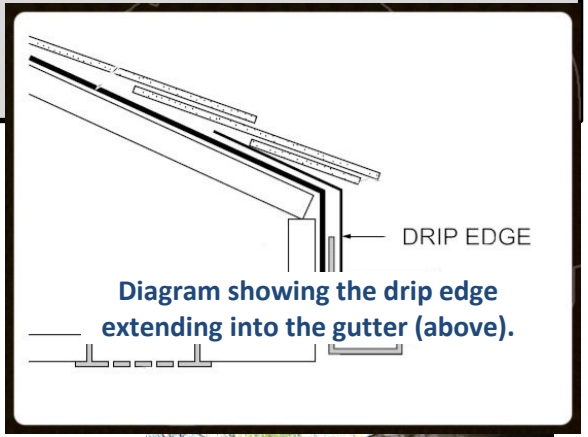


Diagram showing the drip edge extending into the gutter (above).

KEY ISSUES:

- Gutters and downspouts that are constructed of plastic or vinyl melt when exposed to high temperatures during a wildfire.
- Debris (leaves, needles, branches, etc.) that accumulates in the gutter can ignite during a fire (most likely from embers) and expose any combustible roofing materials or fascia boards to heat and/or direct flame contact.
- Vinyl gutters have been shown to degrade when exposed to heat and can eventually fall off the roof and cause an ignition near the exterior base of the home.

MITIGATION MEASURES:

- Install gutters that are constructed out of non-combustible materials (such as metal).
- Also install a piece of metal flashing, otherwise known as a drip edge, along the exposed face of the roof decking/fascia. This will prevent flame exposure to wooden components on the leading edge of the roof and ember intrusion under the shingles of roofing material.
- This drip edge shall cover the edge of the roof deck, extend into the gutter, and shall be installed tightly against the gutter material. In cases of a very long roof line, additional flashing may need to be installed behind the gutter and drip edge to prevent exposure of the fascia.
- Gutter caps can be used to prevent gutters from accumulating debris. If gutter caps are not used to prevent accumulation of combustible debris, gutters should be cleaned out on a regular basis.

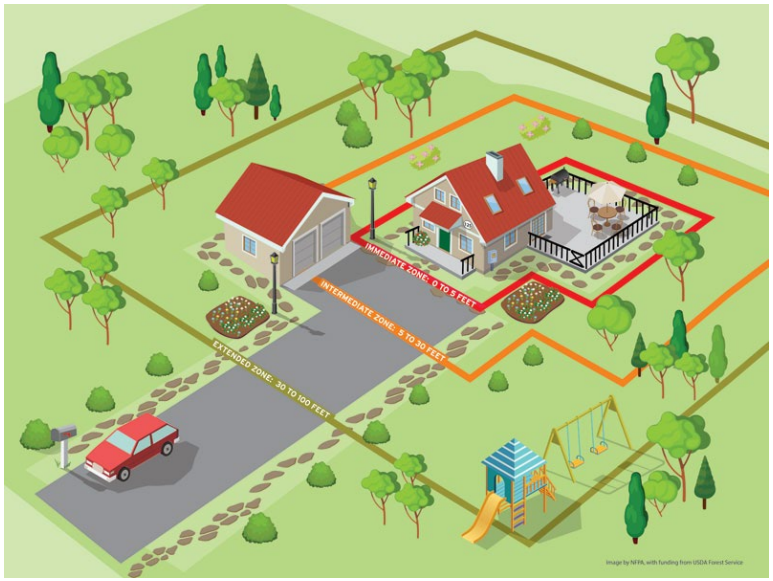
DEFENSIBLE SPACE ELEMENTS

B1.0. Defensible Space (If Applicable): A description of the current and/or planned extent and quality of defensible space around the proposed building. Please refer to "Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones" (CSFS 2012-1) - OR current and relevant replacement of this document - for additional information and standards related to the creation of Defensible Space. Note: Defensible space does not mean clearcutting or complete removal of all vegetation!

B1.1. – If using combustible siding, you must have at least 100' of D-Space to pass

KEY ISSUES:

- Creating and maintaining adequate defensible space through a variety of thinning and other management techniques has been shown to effectively reduce the likelihood of a home ignition, especially from exposure to radiant and convective heat.
- Homes have been shown to be resistant to radiant heat exposure associated with a crown fire at distances of 10 meters or approximately 30 feet.
- Homes have been shown to be resistant to convective heat exposures associated with a crown fire at distances of 30 meters or approximately 100 feet.



MITIGATION MEASURES:

- Adequate Defensible Space entails the following:
- Zone 1A (0-5 feet from home)- hardened area and no vegetation within this zone.
- Zone 1B (5-30 feet from home)- manage vegetation so that trees, shrubs, etc. are very limited. Maintain grasses to be green and less than 4" in height.
- Zone 2 (30-100 feet from home)- manage vegetation so that trees and shrubs have adequate spacing between their crowns (horizontal spacing) to help prevent a running crown fire and are pruned/limed to remove ladder fuels that can carry a ground fire into the crowns of trees (vertical spacing).
- The Colorado State Forest Service has developed a set of guidelines for defensible space creation and in Colorado. The document, called "Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones" was first published in 2012. A link to that resource is available in the additional resources section of this document.

B5.0. Decks and Fencing: A description of the construction materials, design and assembly of the fencing and decks that are attached to the building.

B2.1. - Hardened Decking & Fencing Design/Construction:

a) decking composed of composite material; and
b) wood joists are covered with a metal cap or similar covering (foil-faced tape bitumen is also recommended) to reduce ember ignitions on exposed joists between deck boards; and
c) gaps between decking boards are ¼" or more (narrower gaps have been shown to increase fire spread); and
d) the decking is not elevated above ground level or, if elevated less than 30-inches from the underside of the framing to the ground level, it is completely enclosed such that neither convective nor radiant heat can penetrate the deck from the bottom up OR if full enclosure is not feasible the property meets the requirements of 100 feet of defensible space as defined in B1.1; and
e) bottom of desk enclosure (if applicable), where it meets grade, meets ignition resistant standards as described in A2.1; and
f) entire area under deck must be covered with a weed barrier and covered with an ignition-resistant material such as crushed rock or gravel; and

B2.2 – Hardened Decking & Fencing Design/ Construction (continued)

a) fences, (if present, attached to the home are composed of an ignition-resistant material), will feature at least 5 feet of ignition-resistant fencing where the fence attaches to the structure to reduce the likelihood of the fence carrying fire to structure.
b) hardened zone extends out 5 feet from the deck perimeter, void of all combustible fuels including grasses, vegetation, landscape mulch, combustible building materials, etc. Hardened zone must be covered so as to prevent eventual growth of grasses/weeds. A weed barrier fabric and rock/gravel are recommended.

All decks and fencing must meet the above standards in order to pass.

See next page for more info

KEY ISSUES:

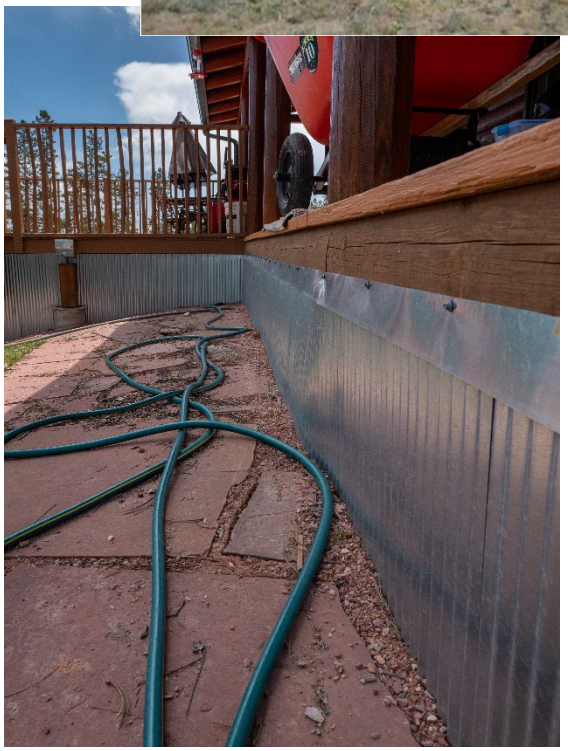
- With regards to ignition vulnerability, decks are typically one of, if not the most vulnerable points on a home.
- Wooden decks are composed of a series of horizontally and vertically arranged dry, combustible fuel, with lots of gaps and spacing for air exchange. In other words: the perfect fire kindling to start a fire. Decks are vulnerable to ignition from both direct flames and embers.
- Conductive heat (direct flames) and embers can cause an ignition on top of the deck. The most vulnerable points are where embers are most likely to collect, such as where the deck attaches to the house, in the gaps between the decking boards, and at the railings edge.
- Conductive heat (direct flames) and embers can also cause an ignition under the deck when they ignite accumulated combustible materials such as weeds or leaves.
- Wooden fences can also become fuel in a wildfire. Fences can collect embers and can also act as a ladder fuel by allowing the fire to travel along the fence towards the main building. Once ignited, combustible fences that are attached to or near a building can ignite the building through radiant or convective heat or by direct flame contact.

MITIGATION MEASURES:

- Decks: For best protection, use a composite decking boards (e.g. TimberTech, AZEK, and Trex) to reduce the risk of an ignition on the deck. In addition to being ignition-resistant, these materials are relatively maintenance free and do not rot or split.
- Decks: Similar to roofing materials, building products for decks are tested for the surface burning characteristics and given a rating classification depending upon how well they resist ignition and spread of flame across the surface. The classification has three levels; Class A, Class B and Class C, with Class A having the best performance at resisting flame spread. Many natural wood products inherently have a Class C rating, except for some exotic hardwoods or other products not typically selected for decking materials. Many of the composite or PVC decking materials are available with a Class B rating – some even have a Class A rating.
- Decks: Space deck boards more than ¼" apart and keep them clear of debris to reduce the risk of an ignition in the gap between the boards.
- Decks: Cover wood joists with metal caps or with a foil-faced self-adhering adhesive flashing tape (foil-faced bitumen tape) to reduce the risk of ember ignitions on exposed joists.
- Decks: If the decking is elevated less than 30 inches from the ground to the framing, fully enclose it with ignition resistant materials (e.g. composite boards or metal) so no heat/embers can penetrate the deck from underneath.
- Decks: Cover the area under the deck with a weed barrier and then cover that with an ignition-resistant material such as crushed rock or gravel to eliminate potential ignitions.
- Fences: For best protection, use ignition resistant materials such as composite boards or iron for fences attached to the homes.
- Fences: At minimum, ensure at least the 5 feet of fence that attaches to the house is composed of an ignition-resistant material to reduce the risk of the fence carrying fire to structure.

Examples of ways to enclose decks using ignition-resistant material.

Area under deck is covered with a wed barrier and covered with an ignition resistant material (below).



Gaps underneath decks (top left) or decks that overhang (bottom left) are vulnerable to ignition from embers that get trapped below.

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use.

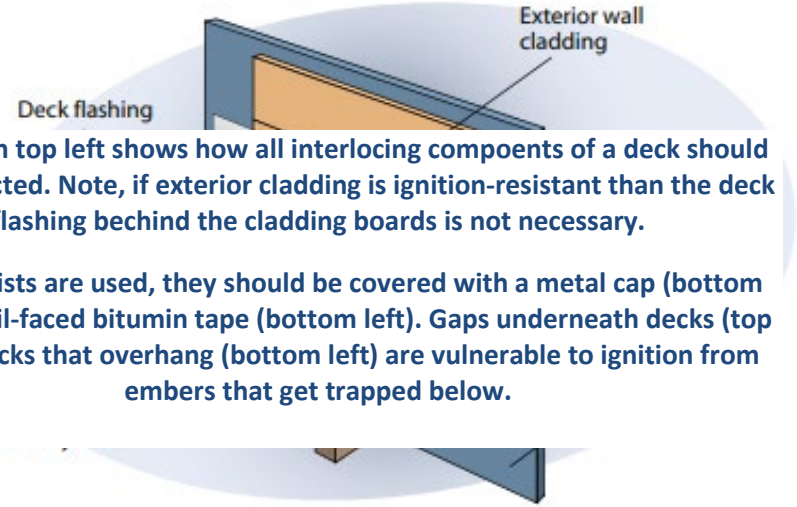
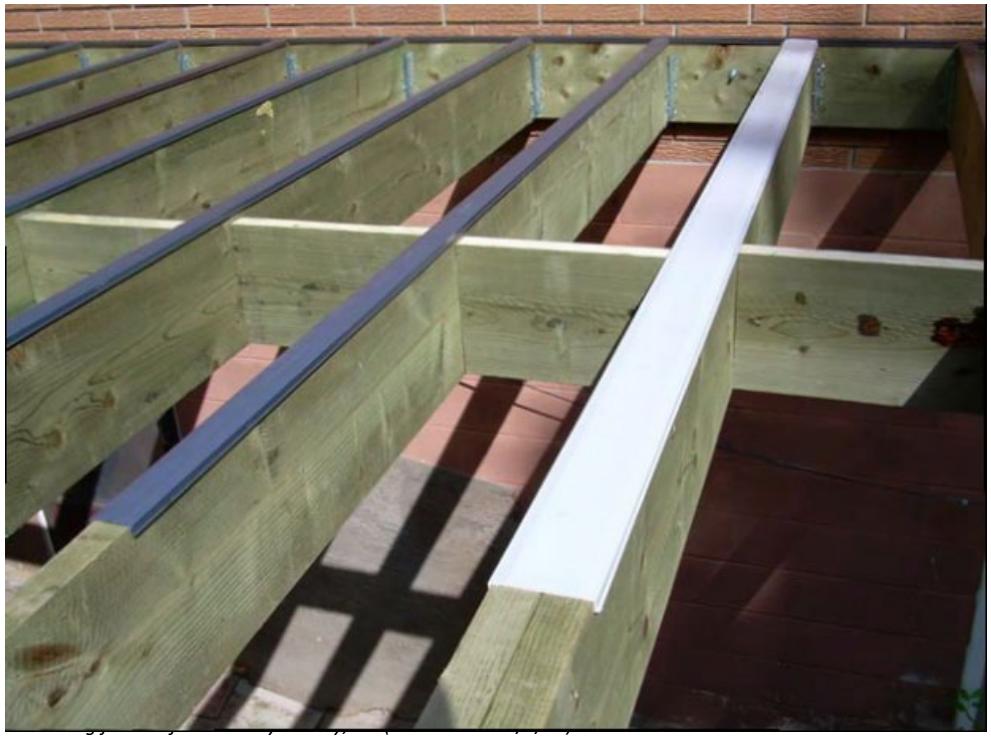


Diagram on top left shows how all interlocing compoents of a deck should be constructed. Note, if exterior cladding is ignition-resistant than the deck flashing bechind the cladding boards is not necessary.

If wood joists are used, they should be covered with a metal cap (bottom right) or foil-faced bitumin tape (bottom left). Gaps underneath decks (top left) or decks that overhang (bottom left) are vulnerable to ignition from embers that get trapped below.



B3.0. Eaves, Overhangs and Structural Projections: A description of any portion of the attached building where projections or overhangs are part of the design element. These areas are vulnerable to heat and ember collection.

B3.1. - Ignition Resistant Projections: All eaves are soffited and all eaves, overhangs and structural projections are composed of or enclosed by ignition resistant materials (as described in "Exterior Cladding and Siding"- Section A.2).

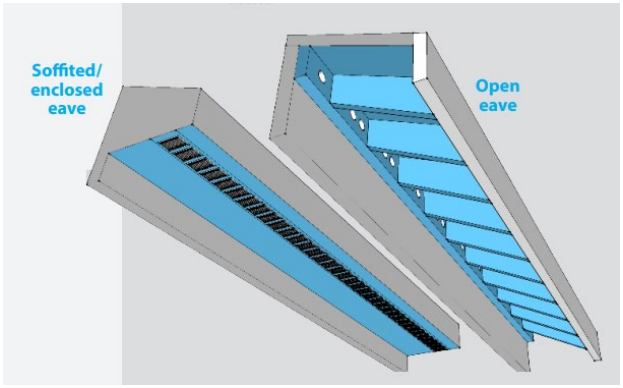
Must meet the above standards in order to pass

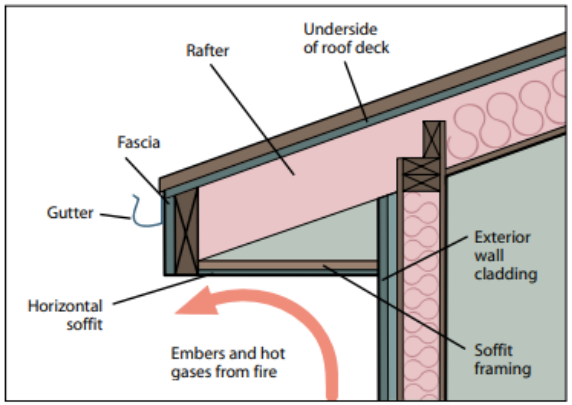
KEY ISSUES:

- Embers, convective heat, and radiant heat can be trapped under overhangs and eaves and in the upper portion of exterior walls and can ignite.
- Once an eave, overhang, or soffit has ignited, fire can spread onto the roof, into the attic, or onto and through the exterior walls.
- If eaves, overhands, and soffits are not fire-resistant, they are susceptible to ignition by embers as well as hot gasses.

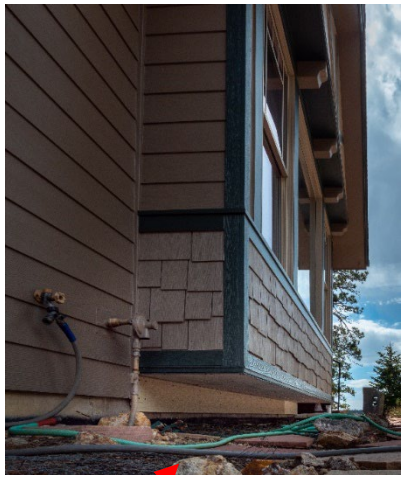
MITIGATION MEASURES:

- Enclose overhangs with ignition resistant soffits to prevent embers and hot gases from contacting the joists, rafter or tresses, or the underside of the roof decking.
- Enclose the underside of projections with ignition resistant products to reduce the likelihood of an ignition in those areas.





Eaves and overhangs are also vulnerable to ignition from embers and hot gasses and should be enclosed with ignition resistant soffits.



Similar to decks, projections on the home are vulnerable to ignition from embers that get trapped below and should be enclosed with ignition resistant products.

B4.0. Windows: A description of all exterior windows. Windows are vulnerable to fire intrusion through window frame failure (primarily due to heat exposure) and glazing (glass surface) failure.

B4.1	**Preferred Exterior Windows: (a)** all exterior windows have an 'Insulated Glazing Unit' (IGU) consisting of 2 or 3 panes, and; **(b)** tempered or laminated glass for one or all panes, and; **(C)** low-e coating on the inner surface of the exterior pane; and **(d)** all exterior window frames are composed of Ignition Resistant materials. (Note: If Defensible Space is 30-feet or greater then requirements 'c and d' above are eliminated.)	**Stick-built homes must meet the standard in Section B4.1.**
B4.2	**Less Preferred Exterior Windows: (a)** All exterior windows have an 'Insulated Glazing Unit' (IGU) consisting of 2 or 3 panes; and **(b)** all exterior window frames are composed of Ignition Resistant materials.	**Manufactured / modular homes must meet the standard in Section B4.2.**
B4.3	**Fire Vulnerable Exterior Windows:** Windows do not conform with B4.1 or B4.2.	**Mobile homes are exempt from the requirement for ignition-resistant windows.**

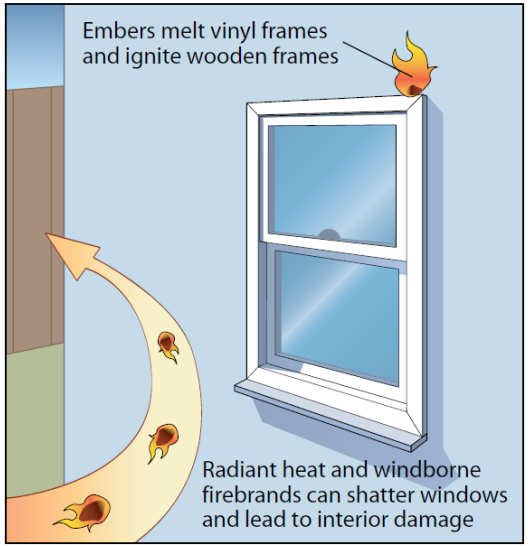


Diagram showing how exterior windows are vulnerable to fire intrustion during a wildfire.

KEY ISSUES:

- There are two main components of windows that are vulnerable to wildfire: the first is the glazing (or glass surface) and the second is the frame construction.
- Just like placing a hot glass in cold water, the extreme temperature fluctuation in a wildfire will cause the glazing in a window to crack and/or the window frame to melt (if plastic) or ignite (if wooden) and allow for the glazing to fall out.
- If windows are compromised or fail during a wildfire they can be a source of ember intrusion into the home.

MITIGATION MEASURES:

- Use dual pane windows to insulate the panes and help protect them again temperature differences. Two or 3 pane windows can withstand a flame front by reflecting the radiant heat energy. Single pane windows do not perform well and are vulnerable to cracking and breaking due to the intense heat of a wildfire.
- For better protection, use laminated glass to reduce the chances of the window pane cracking from the impact of large flying embers that can strike with enough force to break the glass. The plastic film in the core of the glass will keep the glazing in the frame, allowing the broken glass to continue to resist embers and hot gases.
- For the best protection, use tempered glass, which is more resistant to heat and flames than laminated glass. It can be further enhanced with a low-e coating or proprietary reflective coating. Impacts from large flying embers can break tempered glass, which can be counteracted by installing with an interior laminated inner pane.
- Use ignition resistant window frames (metal or metal-clad wood) to help window frames retain their shape when exposed to increased heat. Melting or distortion of the frame can cause the glass panes to shift or fall out and allow embers or flames to enter the home.

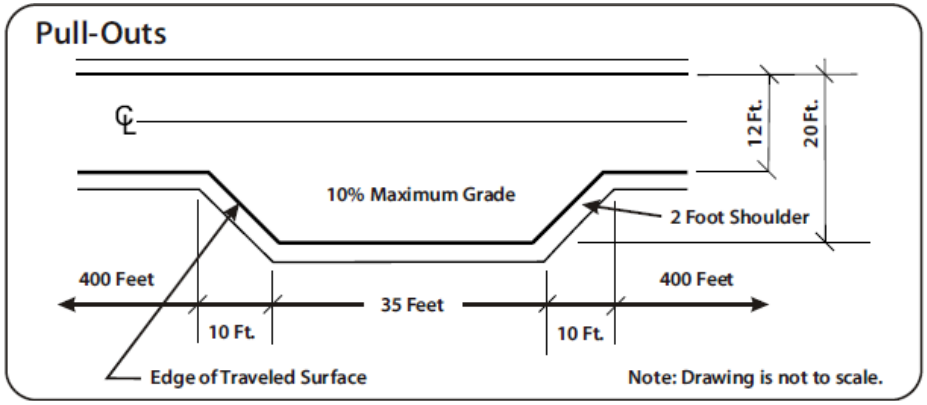
EMERGENCY ACCESS ELEMENTS

B5.0. Driveway Clearances: In addition to Require Element A7.0 "Driveways", this is a description of the driveway's horizontal and vertical clearances which allow for unimpeded emergency response vehicular access. Typical impediments to safe horizontal and vertical access include trees, branches, shrubs, gateways, archways, etc. The horizontal clearance does not require that additional road base material be laid down, instead this is solely looking at the ability for emergency vehicles to access the site.

In order to pass the driveway is 24 feet wide, or, if driveway is less than 24 feet wide and at least 200 feet in length, an area along the driveway provides a "pullout" for emergency vehicles. The "pullout" is at least 24 feet wide (as measured with the driveway and the pullout combined) and is at least 35 feet in length if possible so that two emergency vehicles can pass one another along the driveway. The pullout should be approximately midway between the structure and the access point off of the County Road system.

KEY ISSUES:

- Adequate clearance along roads and driveways is critical in any emergency, but especially during a wildfire.
- Firefighters and emergency vehicles cannot attempt to defend your home during a wildfire if it is not accessible by firetrucks and multiple response vehicle. In addition, inadequate egress can be a risk to you and your family if you are attempting to evacuate your home during a wildfire.
- Vegetation along your driveway can inhibit visibility for firefighters/first responders and make it unsafe for them to defend your home.



MITIGATION MEASURES:

- When clearing/managing vegetation along a road or driveway, ensure the horizontal clearance measures at least 24 feet on each side of the road or driveway. OR
- Ensure there are pullouts along the road or driveway that are at least 24 feet in horizontal clearance and at least 35 feet long.

OTHER CONSIDERATIONS- EDUCATIONAL PURPOSES ONLY

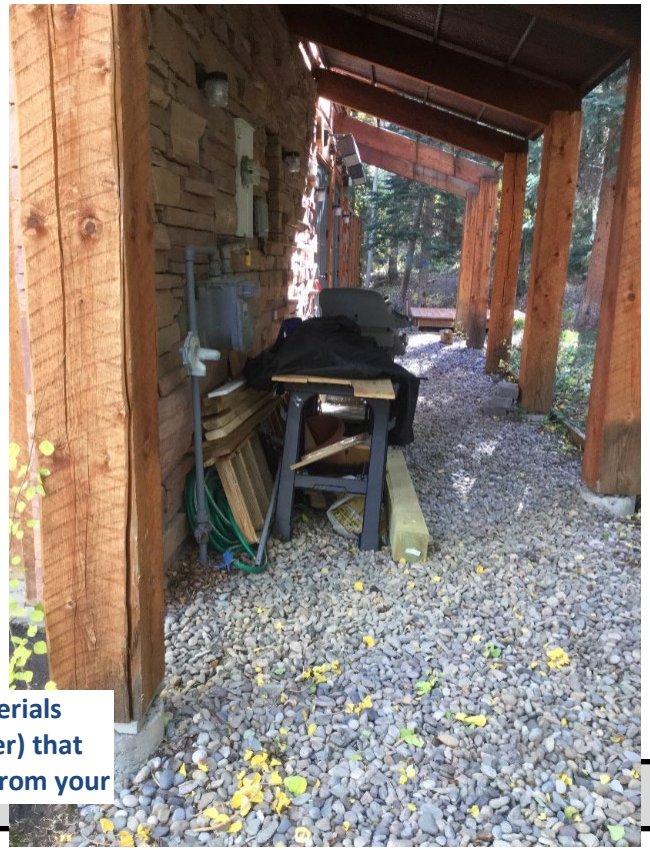
Near Building Combustibles:

KEY ISSUES:

- Combustible material that is stored within 30 feet of your home (Zone 1) can ignite and provide enough heat to ignite components of your home.

MITIGATION MEASURES:

- Store, keep, and install all combustible materials at least 30 feet away from your home.
- Over time, it is common for residents to continually add and store additional items outside and near the home. While this cannot be regulated in any way, it is highly recommended that if residents are put on pre-evacuation notice or know of potential/impending wildfire but have not evacuated, that these materials (lawn furniture, ornamental items, etc.) be either brought inside or moved away from the home (30 feet or more).



Examples of combustible materials (firewood, propane tank, lumber) that should be stored at least 30 feet from your

Slope:

KEY ISSUES:

- Fuel, topography, and weather are the three principal environmental elements that affect wildfire behavior.
- Slope plays a critical role in wildfire behavior. Steep slopes are associated with increased wildfire behavior severity and make your home more vulnerable to ignition.
- Wildfires spread more quickly on upslope terrain than on level terrain because heat rises, which pre-heats and ignites fuels.
- Wind-driven wildfires follow wind direction and are minimally influenced by topography. In the absence of a strong wind, wildfire follows topography, burning primarily upslope.

MITIGATION MEASURES:

- When deciding where to place you home on your property, to whatever extent possible, situate your home so that it is
- Exposed to the least amount of slope possible.

Proximity to High Wildfire Risk Topographic Feature:

KEY ISSUES:

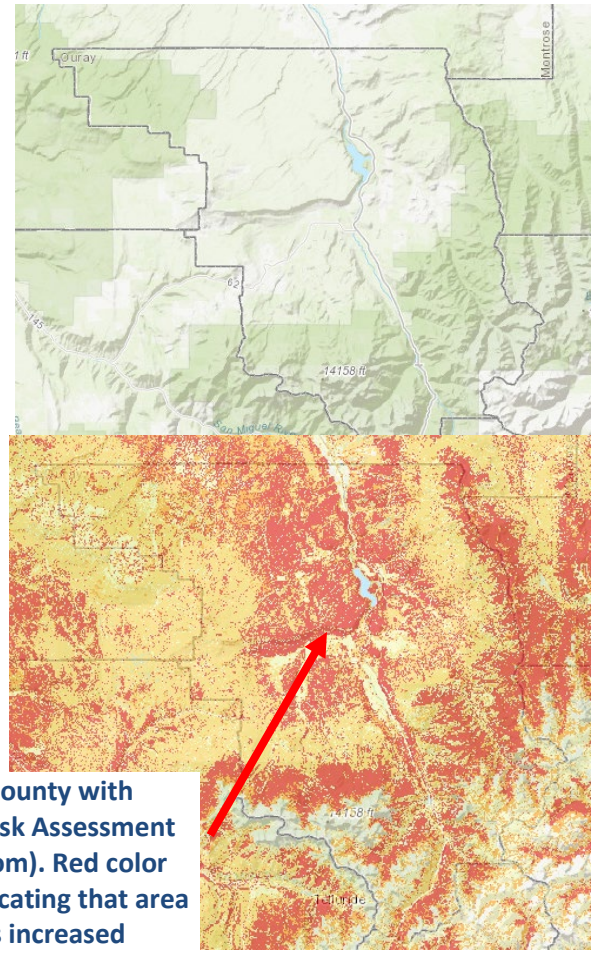
- Fuel, topography, and weather are the three principal environmental elements that affect wildfire behavior.
- In addition to steep slopes, other topographic features are associated with substantial increased and elevated wildfire behavior.
- Section 2: Definitions, of the Ouray County Land Use Code, provides the following definition:

  HIGH WILDFIRE RISK TOPOGRAPHIC FEATURES (HWRTF). *HWRTF contribute to increased wildfire behavior severity. Examples of HWRTF include: gullies, canyons, ravines, and ridge tops.*

- All of the listed HWRTF influence wind direction and speed, which influences wildfire behavior. Even homes that are built with modern structural hardening techniques, as described in this manual, when exposed to the severe convective heat associated with wildfire behavior in HWRTF's are liable to ignite.

MITIGATION MEASURES:

- Siting the home location is a critical factor in reducing wildfire risk from the start. It is recommended that you keep your site (locate) your home as far away from any topographic features that are associated with increases in wildfire behavior intensity. At a minimum, locating your home 150 feet away is recommended, though more than 150 is encouraged. As stated previously, fuels reduction and home hardening techniques alone will likely not be sufficient to mitigate the risk associated with the wildfire behavior that these features can present.



Map showing Ouray County (above) and Ouray County with Wildfire Risk Layer from the Colorado Wildfire Risk Assessment Portal (available at: www.coloradowildfirerisk.com). Red color indicates higher wildfire risk rating. Arrow is indicating that area along the escarpment south of Loghill Village has increased wildfire risk.

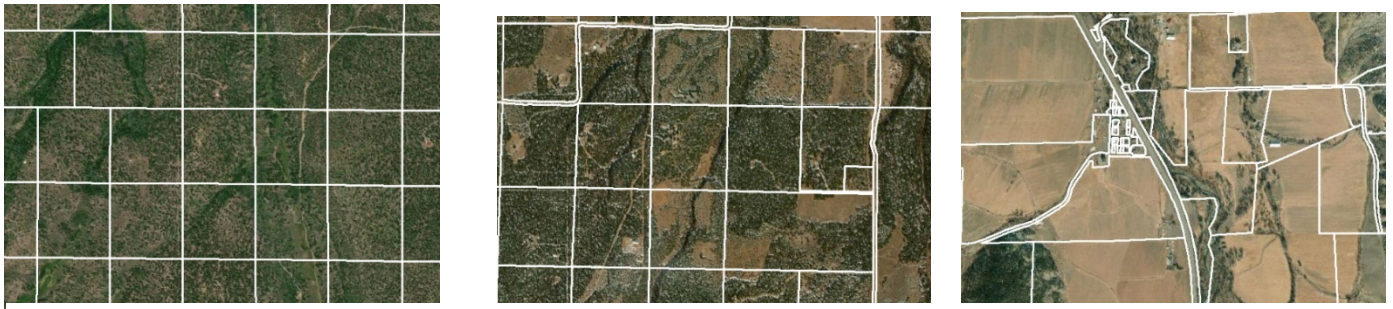
Forest & Fuel Density (aka "Background Fuels"):

KEY ISSUES:

- Fuel, topography, and weather are the three principal environmental elements that affect wildfire behavior.
- The fuels in the general vicinity of your home will have significant influence on how a wildfire will behave as it approaches and moves past your home.
- Background fuels are described as the fuels extending from the edge of your home's Zone 2 (100 feet) to 350 feet from your home. This rating is a relative description of the fuels in the general vicinity of your home.
- Depending on your lot size, you may not have the ability to manage these fuels (if they are on your neighbors' properties, for example). However, wildfires do not respect property boundaries, so these fuels will still contribute to the actual wildfire risk to your home.

MITIGATION MEASURES:

- When deciding where to site (locate) you home on your property, to whatever extent possible, allow room to manage the fuels as far from your home as possible.
- If you are not able to provide management over this zone, understand that your home has innate wildfire risk based on the fuel type.



Aerial imagery of property parcels (shown in white lines) in Ouray County. The background fuel densities range from high (left) to moderate (middle) to low (right) as shown by green coloring (tree cover) in the photographs.

Glossary of Terms

Brands: A burning piece of wood or other burning material generally distributed by wind currents. A brand is differentiated from an ember by its larger size and higher heat energy.

Conflagration: A large, out of control and destructive fire, generally categorized by the loss of many continuous structures within a defined fire area.

Crown Fire: A rapidly moving fire burning in the tops or crowns of trees, which is able to cover a significant area in a short amount of time.

Defensible Space: An area either natural or man-made, where material capable of allowing a fire to spread unchecked has been treated, cleared, or modified to slow the rate and intensity of an advancing wildfire and to create an area for fire suppression operations to occur.

Embers: A small piece of wood or other burning material generally distributed by wind currents. An ember is differentiated from a brand by its smaller size and lower heat energy.

Exposure Fire: A direct flame contact or radiant heat energy substantial enough to ignite vegetation and/or the adjacent structures.

Ignition Resistant Construction: The use of materials and systems in the design and construction of a building or structure to safeguard or provide reasonable protection against the ignition and/or spread of fire to or from buildings or structures.

Ladder Fuels: Natural vegetation or other combustible materials that provide a conduit through direct contact or close proximity to allow for a fire in smaller plants to progress vertically into taller plants and trees.

Wildfire: An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Wildland/Urban Interface: A geographical area where structures and other human development meets or intermingles with wildland or vegetative fuels. For the sake of this manual the wildland/urban interface includes, but is not limited to, the Hillside Overlay Zone.

Literature Cited & Additional Resources

This document was developed using a considerable number of resources such as publications, fact sheets, and other guides. We appreciate the effort other individuals and organizations have spent creating these resources and would like to acknowledge them for the use of their language and photographs.

The format of this document was based heavily on a similar document called “Ignition Resistant Construction Design Manual” published by the City of Colorado Springs Fire Department in 2014.

Other photos and language were derived from the documents listed in the table on the following page.

Name (CODE ID)	Link
Roofing (A1.0)	https://www.fema.gov/media-library-data/20130726-1651-20490-4552/fema_p_737_fs_5.pdf
Roofing (A1.0)	https://www.youtube.com/watch?v=Lgzo6icnX5s
Roofing (A1.0)	https://www.nfpa.org/-/media/Files/Firewise/Fact-sheets/FirewiseFactSheetsRoofingMaterials.ashx?la=en&hash=4203AC72952C6295E302A6571981D9F1286E2793
Exterior Cladding & Siding (A2.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-4620/fema_p_737_fs_7.pdf
Exterior Cladding & Siding (A2.0)	https://disastersafety.org/ibhs/research-center-demo-wildfire-2011/
Vents (A3.0)	http://disastersafety.org/wp-content/uploads/2017/08/Vulnerability-of-Vents-to-Wind-Blown-Embers_Executive-Summary.pdf
Spark Arrestors (A4.0)	https://codes.iccsafe.org/public/document/code/362/6125042
Hardened Zone (A5.0)	https://disastersafety.org/wildfire/defensible-space/
Hardened Zone (A5.0)	https://www.nfpa.org/Public-Education/By-topic/Wildfire/Preparing-homes-for-wildfire
Exterior Doors (A6.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-8249/fema_p_737_fs_11.pdf
Gutters (B8.0)	https://coloradosprings.gov/sites/default/files/final_hillside_wildfire_mitigation_design_manual_final_document_third_printing.pdf

Name (CODE ID)	Link
Gutters (B8.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-7674/fema_p_737_fs_9.pdf
Defensible Space (B1.0)	https://www.fs.fed.us/rm/pubs_other/rmrs_1998_cohen_j001.pdf
Defensible Space (B1.0)	https://www.fs.fed.us/rmrs/science-spotlights/protecting-your-home-wildland-fire
Defensible Space (B1.0)	https://disastersafety.org/wildfire/defensible-space/
Defensible Space (B1.0)	https://static.nationwide.com/static/IBHS-Wildfire-Defensible-Space-Infographic-Update.pdf?r=50
Slope (B2.0)	https://www.fema.gov/media-library-data/20130726-1651-20490-7160/fema_p_737_fs_3.pdf
Proximity to High Wildfire Risk Topographic Feature (B3.0)	https://www.fema.gov/media-library-data/20130726-1651-20490-7160/fema_p_737_fs_3.pdf
Background Fuels (B4.0)	https://www.nwcg.gov/publications/pms437/fuels/surface-fuel-model-descriptions
Background Fuels (B4.0)	https://gacc.nifc.gov/rmcc/predictive/Fire%20Behavior%20Fuel%20Model%20Descriptions.pdf
Background Fuels (B4.0)	https://gacc.nifc.gov/oncc/docs/FBFRG_2014.pdf
Decks and Fencing (B5.0)	http://disastersafety.org/wp-content/uploads/2017/10/Deck-Ember-Testing-Report-2017_IBHS.pdf
Decks and Fencing (B5.0)	https://www.nfpa.org/-/media/Files/Firewise/Fact-sheets/FirewiseFactSheetsDecks.ashx?la=en&hash=8E124A21ACABDAEF66377242D783611D4D9AD7A5

Name (CODE ID)	Link
Decks and Fencing (B5.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-2634/fema_p_737_fs_14.pdf
Decks and Fencing (B5.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-4409/fema_p_737_fs_13.pdf
Eaves, Overhangs and Structural Projections (B6.0)	https://www.nfpa.org/-/media/Files/Firewise/Fact-sheets/FirewiseFactSheetsUnderEaves.pdf
Eaves, Overhangs and Structural Projections (B6.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-2869/fema_p_737_fs_6.pdf
Windows (B7.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-8008/fema_p_737_fs_10.pdf
Driveway Clearances (B9.0)	https://assets.bouldercounty.org/wp-content/uploads/2017/03/w04-emergency-vehicles-access.pdf
Driveway Clearances (B9.0)	https://www.fema.gov/media-library-data/20130726-1652-20490-9581/fema_p_737_fs_17.pdf
Driveway Clearances (B9.0)	http://www.unidocs.org/fire/un-096.pdf