Appendix A: Full Risk Assessment

Table of Contents

Terms and Definitions

The following table defines terms used throughout the Full Risk Assessment Appendix.

Term Definitions

Term	Definition
Hazard	A potential source of injury, death, or damage.
Asset	People, structures, facilities, and systems that have value to the community.
Risk	The potential for damages, loss, or other impacts created by the interaction of hazards and assets. Risks include the probability that a hazard will occur and the extent of the impact on community assets.
Vulnerability	Susceptibility to injury, death, or damage due to a specific hazard.
Impact	The consequence or effect of a hazard on the community or assets.
Historical Occurrence	The number of hazard events reported during a defined period.
Extent	The strength or magnitude relative to a specific hazard.
Historical Probability	Likelihood of a hazard occurring based on historical occurrences.
Future Likelihood	The probability of a hazard occurring based on historical occurrences, climate change, and future development.

Methodology

The risk assessment methodology utilized for this appendix follows the same methods outlined in the FEMA Local Mitigation Planning Handbook.[1] This process consists of four primary steps: 1) Describe the hazard; 2) Identify vulnerable community assets; 3) Analyze risk; and 4) Summarize vulnerability.

When describing the hazard, this appendix will examine the following items: previous occurrences of the hazard within Gunnison County; locations where the hazard has occurred in the past or is likely to occur in the future; the extent of past events and the likely extent of future occurrences; and the probability of future occurrences. The county and participant risk analysis will examine historical impacts and losses, and what is possible should the hazard occur. Risk analysis will include qualitative (i.e., descriptions of historical or potential effects) and quantitative data (i.e., assigning values and measurements to potential asset losses).

The best and most current appropriate data available have been considered for each hazard profiled. Further discussion of each hazard is in the hazard profile portion of this appendix. Unless expressly stated otherwise, each hazard's extent scale(s) apply to all jurisdictions within Gunnison County. Mapping vulnerable population locations was not possible during this plan update because the necessary spatial data for these populations was unavailable.

Hazard Identification

Identifying relevant hazards for Gunnison County began with a review of the Colorado Enhanced State Hazard Mitigation Plan 2023-2028. The Gunnison County Planning Team reviewed, discussed, and determined the list of hazards to be profiled in this hazard mitigation plan update. It was decided that the hazards addressed in the 2026 Gunnison County Hazard Mitigation Plan were still applicable and would be used for this plan update. The hazards for which a risk assessment was completed are listed on the page below. Additional hazards were added that were not in the previous hazard mitigation plan.

1 Federal Emergency Management Agency. May 2023. "Local Mitigation Planning Handbook". https://www.fema.gov/sites/default/files/documents/fema_local-mitigation-planning-handbook_052023.pdf.

Hazards Addressed in the Plan

Hazards Addressed in the Plan		
Avalanche	Flooding and Ice Jams	Lightning
Communication Disruption / Failure	Ground Subsidence & Expansive Soils	Mass Casualty Incident
Dam Failure	Hailstorm	Pandemic
Drought	Hazardous Materials Release	Severe Winter Storm
Earthquake	High wind	Terrorism & Cyber-Attack
Extreme Cold	Landslide/Rockfall/Debris Flow	Wildfire

FEMA Risk Assessment Requirements

Requirement §201.6(c)(2): Risk assessment. The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Requirement §201.6(c)(2)(i): The risk assessment shall include a] description of the type … of all natural hazards that can affect the jurisdiction.

Requirement §201.6(c)(2)(i): The risk assessment shall include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii): The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged floods.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Average Annual Damages, Historical Probability, and Future Likelihood

Average Annual damages

FEMA *Requirement §201.6(c)(2)(ii) (B)* suggests that when the appropriate data is available, hazard mitigation plans should also provide an estimate of potential dollar losses for structures in vulnerable areas. This risk assessment methodology includes an overview of assets at risk and offers historical average annual dollar losses for all hazards for which historical event data are available. Additional loss estimates are provided separately for those hazards for which sufficient data are available. These estimates are available in the relevant hazard profiles.

Average annual losses from historical occurrences can be calculated for those hazards for which there is a robust historical record and for which monetary damages are recorded. Two main data points are used in this formula.

- **Total Damages in Dollars:** The total dollar amount of all property and crop damage recorded in federal, state, and local data sources. The limitation of these data sources is that dollar figures are usually estimates and often do not include all damages from every event, but only officially recorded damages from reported events.

- **Total Years of Record:** The number of years for which data is available for recorded events.

An example of the Event Damage Estimate is found below:

$$\textbf{Annual Damages } (\$) = \frac{Total\ Damages\ in\ Dollars\ (\$)}{Total\ Years\ Recorded\ (\#)}$$

FEMA Standard Economic Values

As part of FEMA's Benefit-Cost Analysis Toolkit, standard economic values were developed to help better estimate the avoided loss of services when implementing a hazard mitigation project. These standard economic values can also help assess potential future economic impacts from a hazard event. The table below presents the economic value of traffic delays on roads and bridges, loss of electric services, loss of wastewater services, loss of potable water services, and loss of communications/IT services. The assumed damages do not account for physical damage to utility equipment and infrastructure, but they do account for the impact on economic activity and residential customers. To learn more about how these values were calculated, visit FEMA's Benefit-Cost Analysis Sustainment and Enhancements.[2]

FEMA Standard Economic Values

Service Lost	Economic Value
Traffic Delays on Roads and Bridges	$37.49/Vehicle/Hour
Loss of Electric Services	$199/Person/Day
Loss of Wastewater Services	$66/Person/Day
Loss of Potable Water Services	$138/Person/Day
Loss of Communications/IT Services	$141/Person/Day

Source: FEMA, 2023[3]

FEMA's standard economic values will not be used to determine average annual damages and average damage per event estimates for each hazard profile. Past hazard events do not list the total number of people or vehicles impacted, so it is impossible to calculate the total economic impact using these values retroactively. The values are provided in this plan so that participants can better estimate potential losses and determine the benefits of future mitigation actions.

Historical Probability

Historical probability can be calculated based on the total years of record and the years in which an event occurred. It is important to note that the total number of events is not used in this formula, as multiple events may occur in a single year. This would skew the historical probability higher than it is. An example of the historical probability estimate is found below:

2 Federal Emergency Management Agency. September 2023. "Benefit-Cost Analysis Sustainment and Enhancements". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.
3 FEMA. September 2022. "Benefit-Cost Analysis Sustainment and Enhancement". https://www.fema.gov/sites/default/files/documents/fema_standard-economic-values-methodology-report_092022.pdf.

$$\textbf{Annual Probability}\ (\%) = \frac{Total\ Years\ with\ an\ Event\ Occuring\ (\#)}{Total\ Years\ of\ Record\ (\#)}\ x\ 100$$

Future Likelihood

Future likelihood is the probability that a hazard will occur in the future. While historical probability tells us how often a hazard has happened in the past, it does not provide a complete picture of what could happen in the future. Future conditions are likely to change the probability of hazard events. Climate change and future development will alter the probabilities, risks, and vulnerabilities. For this hazard mitigation plan, historical probability, climate change, and future development will be considered when determining the likelihood of a hazard event occurring. Because future conditions are difficult to quantify in terms of percentages, future likelihood is broken down into the four categories below.

Very Unlikely = Hazard is expected to occur once every 50+ years.

Unlikely = Hazard is expected to occur once every 10-50 years.

Likely = Hazard is expected to occur once every 5-10 years.

Very Likely = Hazard is expected to occur once every 1-5 years.

Community Lifeline Potential Impacts

Within each hazard profile listed below, there will be a *Community Lifeline Potential Impacts* section. This section will contain a figure similar to the example seen below. This figure shows the likely extent of impacts for each community lifeline type from the profiled hazard. The likely extent of impacts is broken down in the four categories below.

Grey – No expected impacts on the lifeline type.
Green – Minimal expected impacts on the lifeline type.
Yellow – Moderate expected impacts on the lifeline type.
Red – High expected impacts on the lifeline type.

Example Community Lifeline Impacts

Hazard Profiles

Information from participating jurisdictions was collected and reviewed alongside hazard occurrence, magnitude, and event narratives from local, state, and federal databases. Based on this information, profiled hazards were determined to have a historical record of occurrence or the potential for occurrence in the future. The following profiles will broadly examine the identified hazards across Gunnison County. Hazards of local concern or events that have deviated from the norm are discussed in greater detail in each respective jurisdictional profile (see *Section Eight: Participant Profiles*).

Avalanche

An avalanche is a mass of snow, ice, and debris flowing and sliding rapidly down a steep slope. Avalanches can be highly destructive due to the tremendous impact forces of the rapidly moving snow and debris, and the burial of areas in the run-out zone. Four factors contribute to an avalanche: a steep slope, a snowpack, a weak layer within the snowpack, and a trigger. Nine different types of avalanches could occur. Definitions and graphics for each type are from the Colorado Avalanche Information Center.[4]

Loose Dry

Release of dry, unconsolidated snow. These avalanches typically occur within layers of soft snow near the snowpack's surface. Loose-dry avalanches start at a point and entrain snow as they move downhill, forming a fan-shaped avalanche. Other names for loose-dry avalanches include point-release avalanches or sluffs. Loose-dry avalanches can trigger slab avalanches that break into deeper snow layers. Loose Dry avalanches are usually relatively harmless to people unless they are above rocks, dense timber, a cliff, or a crevasse.

Storm Slab

Release of a soft cohesive layer (a slab) of new snow that breaks within the storm snow or on the old snow surface. Storm-slab problems typically last between a few hours and a few days. Storm slabs that form over a persistent weak layer (surface hoar, depth hoar, or near-surface facets) may be termed Persistent Slabs or may develop into Persistent Slabs. Storm slabs are most dangerous on slopes with terrain traps, such as timber, gullies, over cliffs, or terrain features that make it difficult for a rider to escape off the side.

Wind Slab

Release of a cohesive layer of snow (a slab) formed by the wind. Wind typically transports snow from the upwind sides of terrain features and deposits snow on the downwind side. Wind slabs are often smooth and rounded, sometimes sound hollow, and can range from soft to hard. Wind slabs that form over a persistent weak layer (surface hoar, depth hoar, or near-surface facets) may be termed Persistent Slabs or may develop into Persistent Slabs.

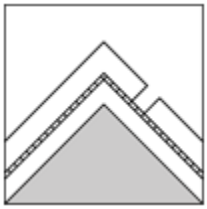
4 Colorado Avalanche Information Center. 2023. “Avalanche Problems”. https://avalanche.state.co.us/forecasts/tutorial/avalanche-problems.

Wind Slabs form in specific areas and are confined to lee and cross-loaded terrain features. They can be avoided by sticking to sheltered or wind-scoured areas.

Persistent Slab

Release of a cohesive layer of soft to hard snow (a slab) in the middle to upper snowpack when the bond to an underlying persistent weak layer breaks. Persistent layers include surface hoars, depth hoars, near-surface facets, or faceted snow. Persistent weak layers can continue to produce avalanches for days, weeks, or even months, making them especially dangerous and tricky. As additional snow and wind events build a thicker slab on top of the persistent weak layer, this avalanche problem may develop into a Deep Persistent Slab.

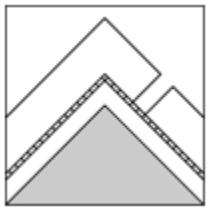
The best way to manage the risk from Persistent Slabs is to make conservative terrain choices. They can be triggered by light loads and weeks after the last storm. The slabs often propagate in surprising and unpredictable ways. This makes the problem difficult to predict and manage, and requires a wide safety buffer to account for the uncertainty.



Deep Persistent Slab

Release of a thick cohesive layer of hard snow (a slab) when the bond breaks between the slab and an underlying persistent weak layer, deep in the snowpack or near the ground. The most common persistent weak layers involved in deep, persistent slabs are depth hoars or facets surrounding a deeply buried crust. Deep, persistent slabs are typically hard to trigger, very destructive, and dangerous due to the large mass of snow involved. They can persist for months once they have developed. They are often triggered in areas with shallow, weak snow and are particularly difficult to forecast and manage. They commonly develop when Persistent Slabs become more deeply buried over time.

Deep Persistent Slabs are destructive and deadly events that can take months to stabilize. The Colorado Avalanche Information Center no longer uses this avalanche problem in avalanche forecasts.



Loose Wet

Release of wet, unconsolidated snow or slush. These avalanches typically occur within layers of wet snow near the snowpack's surface, but they may quickly penetrate deeper layers of the snowpack. Like Loose Dry Avalanches, they start at a point and entrain snow as they move downhill, forming a fan-shaped avalanche. They generally move slowly but can contain enough mass to cause significant damage to trees, cars, or buildings. Other names for loose-wet avalanches include point-release avalanches or sluffs. Loose Wet avalanches can trigger slab avalanches that break into deeper snow layers.

Wet Slab

Release of a cohesive layer of snow (a slab) that is generally moist or wet when the flow of liquid water weakens the bond between the slab and the surface below (snow or ground). They often occur during prolonged warming events and/or rain-on-snow events. Wet Slabs can be very destructive.

Cornice Fall

Cornice Fall is the release of an overhanging mass of snow that forms as the wind moves snow over a sharp terrain feature, such as a ridge, and deposits snow on the downwind (leeward) side. Cornices range in size from small wind lips of soft snow to large overhangs of hard snow that are 30 feet (10 meters) or taller. They can suddenly break off the terrain, pull back onto the ridge top, and catch people by surprise, even on the flat ground above the slope. Even small cornices can have enough mass to be destructive and deadly. Cornice Fall can entrain loose surface snow or trigger slab avalanches.

Cornices can never be trusted; avoiding them is necessary for safe backcountry travel. Stay well back from ridge line areas with cornices. They often overhang the ridge edge and can be triggered remotely. Avoid areas underneath cornices. Even a tiny Cornice Fall can trigger a larger avalanche, and a large Cornice Fall can easily crush a human. Periods of significant temperature warm-up are times to be particularly aware.

Glide
Release of the entire snow cover due to gliding over the ground. Glide avalanches can be composed of wet, moist, or almost entirely dry snow. They typically occur on particular paths where the slope is steep enough, and the ground surface is relatively smooth. They are often preceded by full-depth cracks (glide cracks), though the time between the appearance of a crack and an avalanche can vary between seconds and months. Glide avalanches are unlikely to be triggered by a person, are nearly impossible to forecast, and thus pose a hazard that is extremely difficult to manage.

Predicting the release of Glide Avalanches is very challenging. Because Glide Avalanches occur only on specific slopes, safe travel relies on identifying and avoiding them. Glide cracks are a significant indicator, as are recent Glide Avalanches. The Colorado Avalanche Information Center no longer uses this avalanche problem in avalanche forecasts.

Roof Avalanche
Release of snow or ice from a structure, such as a roof. This avalanche occurs when snow accumulates and then rapidly loosens due to warming temperatures, rainfall, sun exposure, or building heat that melts the bottom layer of snow. Melting allows snow to suddenly slide off a roof, possibly causing injury, death, property damage, and blocked emergency exits. Roof avalanches most often occur on sloped metal roofs, but can occur on any sloped roof.

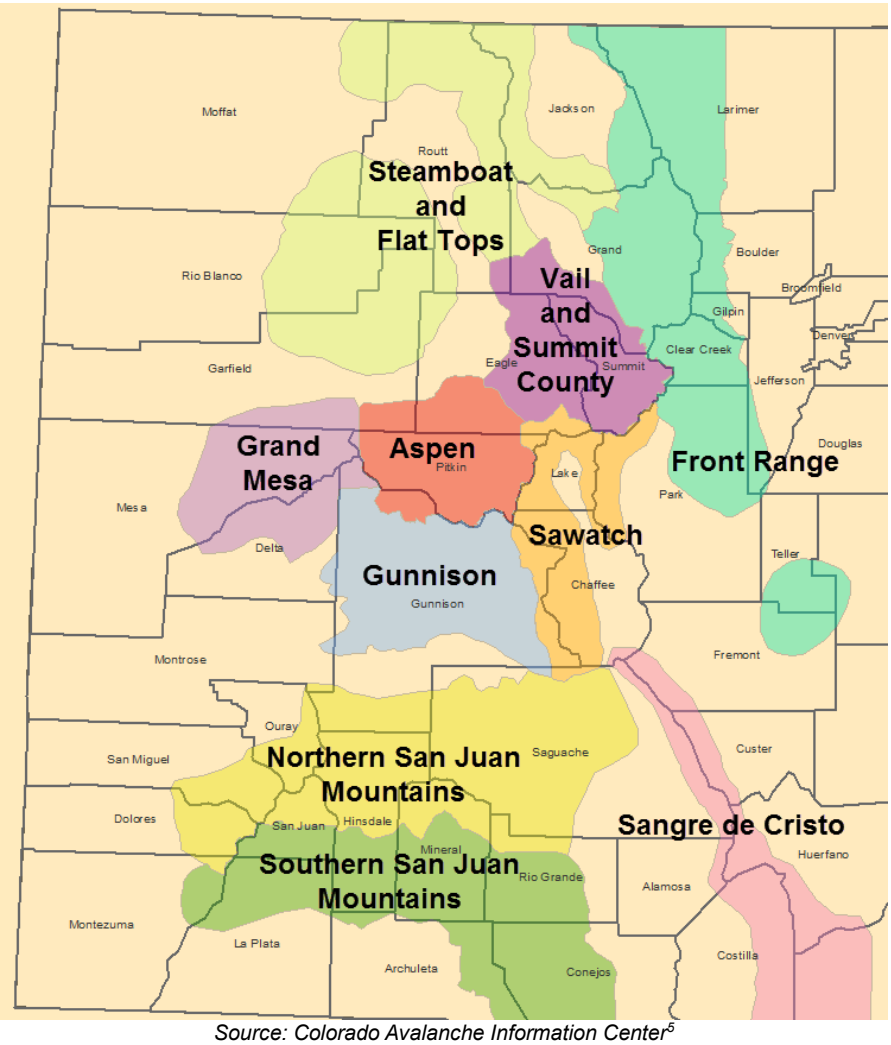
Location

The greatest avalanche threats are in areas of Gunnison County with significant elevation changes. Steeply sloped areas (30 to 45 degrees) are highly susceptible to avalanches, particularly on south-facing slopes where unstable snow conditions are most likely. Most avalanches in the state occur on slopes of 25-50 degrees. The Colorado Avalanche Information Center forecasts backcountry avalanche and mountain weather conditions for ten zones in the mountains of Colorado (Avalanche Forecast Zones). The Avalanche Forecast Zones on the next page show the 10 ten zones. The northern and central portions of Gunnison County are in the Gunnison Mountains zone. Portions of the county include the Grand Mesa, Aspen, and Sawatch zones.

Additionally, the Crested Butte Avalanche Center (CBAC) provides daily avalanche forecasts for the Crested Butte and Mt. Crested Butte areas. The map on the next page shows those avalanche areas. CBAC also tracks historical avalanches and provides avalanche education on their website: https://cbavalanchecenter.org/.

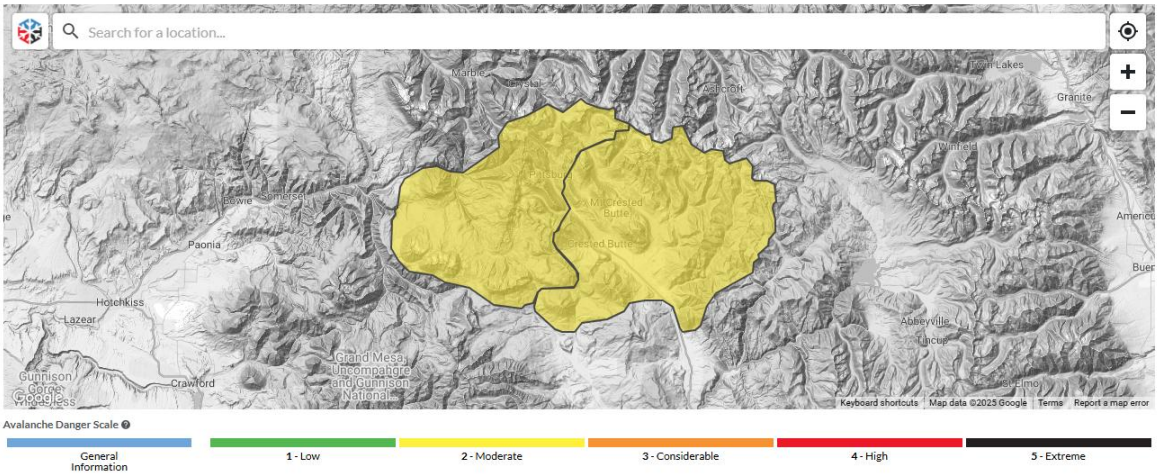
Some of the most significant areas of concern are the towns of Crested Butte and Mt Crested Butte. As seen on the map on the pages below, west and south of Crested Butte and Mt Crested Butte are areas where avalanches regularly occur.

Colorado Avalanche Information Center Avalanche Forecast Zones



Source: Colorado Avalanche Information Center[5]

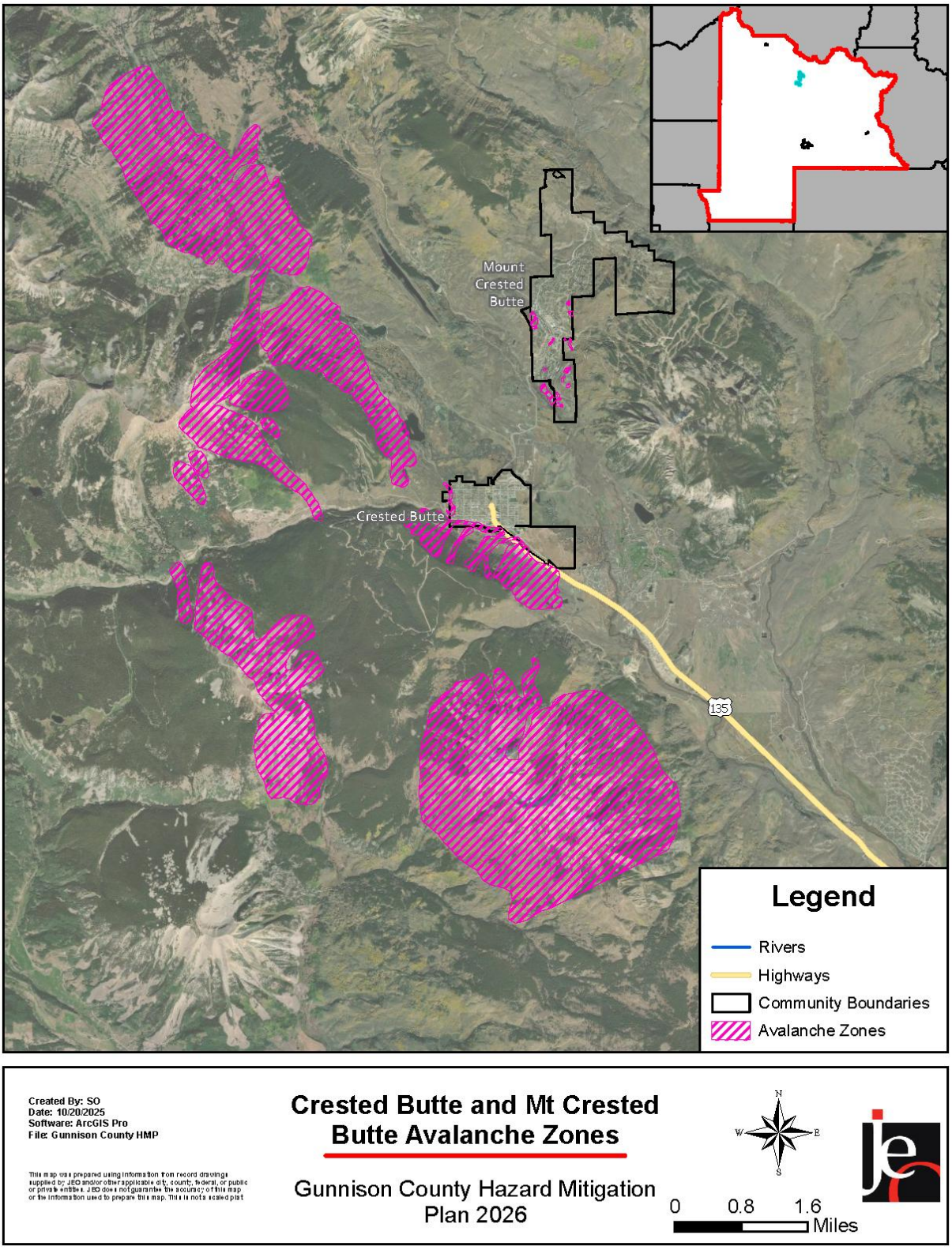
Crested Butte Avalanche Center Avalanche Forecast Zones



Source: Crested Butte Avalanche Center[6]

5 Colorado Avalanche Information Center. 2024. "Forecast Zones". https://lb.avalanche.state.co.us/forecasts/help/forecast-zones/.
6 Crested Butte Avalanche Center. 2025. "Forecast Zones". https://cbavalanchecenter.org/.

Crested Butte and Mt. Crested Butte Forecast Zones



Extent

Since local avalanche extent data is limited, the following information is from the state plan. The destructive potential of avalanches is a function of the mass, speed, and density of avalanche debris paired with the length and cross-section of the avalanche path. Observers rate the size of an avalanche based on its destructive potential.[7] The table below gives the destructive potential scale for avalanche events.

Avalanche Destructive Potential Scale

Size	Destructive Potential	Typical Length	Typical Size and Depth
D1	Relatively harmless to people.	Bus	Average apartment size, 3 feet deep
D2	Injure, bury, or kill a person	Football field	Flood size of a large home, ~6 feet deep
D3	Bury/destroy a car or structure	½ mile	Hockey rink, 6-10 feet deep
D4	Destroy a large truck or 10-acre forest	1+ miles	1 full football field, 13 feet deep
D5	Destroy a village or 100-acre forest	2+ miles	5+ full football fields, 13 feet deep

Source: Avalanche.org[8]

Historical Occurrences

CBAC has tracked avalanche activity since 2014, along with injuries and deaths. According to CBAC records, there were 3,826 reported avalanche events in Gunnison County from 2014 to 2023. These events resulted in two injuries and two deaths. Property and crop damage were unavailable for these events, but two structures were noted as destroyed.[9] Select events with damage and deaths are discussed below.

- **March 4, 2019:** An avalanche in the Poverty Gulch area destroyed hundreds of trees, a workshop, and a cabin, and altered ski lines. No injuries or deaths were reported from the event.
- **April 28, 2020:** An avalanche on Climax Chutes resulted in one death.
- **January 21, 2021:** An avalanche on Ruby Peak was unintentionally triggered by a snowmobile. One of the riders was buried and died. No other damages were reported.

Average Annual Losses

Damage information was not available from the CBAC records, so average annual losses could not be calculated.

Historical Probability & Future Likelihood

Given the historical record of multiple avalanches occurring each year in Gunnison County, the historical probability of an avalanche is 100 percent. Due to the anticipated impacts of climate change and future development, the future likelihood of an avalanche event in the county is very likely.

7 Colorado Division of Homeland Security and Emergency Management. 2023. "Colorado Enhanced State Hazard Mitigation Plan 2023-2028." https://drive.google.com/file/d/1MPL0Oiy-yZYDIMziTvYkR12s35FzG-G8/view.
8 Avalanche.org. 2017. "Destructive Force (D Scale)". https://avalanche.org/avalanche-encyclopedia/avalanche/avalanche-problems/avalanche-size/destructive-force-d-scale/.
9 Crested Butte Avalanche Center. 2025. "View Avalanches". https://cbavalanchecenter.org/view-observations/#/view/avalanches.

Historical Probability & Future Likelihood – Avalanche

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Increase in Frequency	Increase in Frequency and Impacts	**Very Likely**

Climate Change

The Colorado Enhanced State Hazard Mitigation Plan 2023-2028 indicated that avalanche risk will likely increase due to a more variable, thinner snowpack that does not bond well to new layers and to warming temperatures. There will be more rain-on-snow events, leading to earlier wet avalanche activity.[10] With avalanches a possibility every winter in Gunnison County and winter backcountry recreation remaining popular, it will be imperative for avalanche forecasters to monitor these changes and incorporate them into future avalanche predictions and education.

Future Development

Any future development in Gunnison County, especially in high-elevation areas, increases the likelihood that avalanche events will impact people and property. Before construction, developers and Gunnison County should evaluate surrounding grades, annual average snowpack loads, and potential run-out zones in high-risk areas. Emergency access should also be reviewed, as terrain limits access to these areas. An increase in backcountry recreation during winter could lead to more avalanches.

Vulnerabilities

Public safety is most at risk from this hazard. Those most vulnerable include individuals recreating in, traveling through, or under avalanche hazard areas. Motorists traveling along steep mountain highways are also at risk of injury and death due to avalanches. US Highway 50 (Monarch Pass and Little Blue Canyon), CO Highway 133 McClure Pass, and County Road 730 Taylor Canyon are regularly impacted by avalanches. Road and highway closures, damaged structures, and forest destruction are direct results of avalanches. Road closures can last several days until crews can safely clear debris. Recognizing areas prone to avalanches is critical for determining the type and nature of development allowed in a given area.

Homes and cabins located near steep slopes, particularly in Crested Butte, Mt Crested Butte, and the Crested Butte Mountain Resort, are at higher risk during avalanche season. Power lines, communication towers, and water infrastructure in remote areas can become damaged during an avalanche.

Backcountry avalanche incidents involve search-and-rescue teams and resources, which can expose these personnel to risk. The keys to limiting impacts to individuals recreating (hiking, skiing, climbing, snowboarding, snowmobiling) in avalanche areas are knowledge and awareness of the hazard and being adequately equipped for self-rescue, if necessary, with tools such as locater beacons, shovels, and probes. Additionally, people living in rural, mountainous areas may face challenges in evacuation or access to emergency services. Tourists and seasonal workers may lack knowledge of avalanche risks and property safety measures.

An analysis was conducted to determine whether any of the identified participant community lifelines were located within mapped avalanche zones in the county. This does not mean that all identified community lifelines will be affected by an avalanche; it merely shows that they are more

10 Colorado Division of Homeland Security and Emergency Management. December 2023. “Colorado Enhanced State Hazard Mitigation Plan 2023-2028.” https://drive.google.com/file/d/1MPL0Oiy-yZYDIMziTvYkR12s35FzG-G8/view.

vulnerable to avalanches due to their locations. In total, 1 out of 112 community lifelines are within a mapped avalanche zone. These lifelines can be found in the *Participant Profiles Appendix*.

Avalanche Vulnerabilities

Sector	Vulnerability
People	-Backcountry skiers, snowboarders, snowmobilers, backpackers, ice climbers, and hikers in mountainous areas. -Residents in isolated areas. -Tourists and seasonal workers. -First responders to avalanche areas where snow is still unstable. -Motorists driving in the county.
Economic	-Road closures could prevent residents and tourists from traveling and accessing local businesses.
Built Environment	-Localized impacts to homes in the county.
Community Lifelines	-Road closures. -Damage to power lines, communication towers, and water infrastructure in remote areas.
Recreation	-Backcountry skiers, snowboarders, snowmobilers, backpackers, ice climbers, and hikers in mountainous areas -Multiple events may cause a lower number of recreational tourists.

Community Lifeline Potential Impacts

Avalanche Impacts

Level of Concern for Avalanche

The table below lists the avalanche concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Avalanche

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Low
Town of Crested Butte	Low
Town of Mt. Crested Butte	Low
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Communications Disruption / Failure

A communications disruption or failure refers to the partial or complete loss of systems that enable the transmission of information critical to public safety, emergency response, and daily operations. This includes major telephone outages, failures of government radio systems, prolonged interruptions of electronic broadcast services, and impairments of cellular, internet, and satellite communications. Essential services such as emergency 911 dispatch, law enforcement, fire and EMS operations, public works coordination, and emergency warning systems all rely on functioning communication networks. While periodic outages occur, typically due to storm activity or other hazards, these are usually isolated events, and communication is restored within hours.

This profile will specifically examine communication disruptions or failures not caused by the other hazards discussed in this plan. Communication failures will also be discussed in those specific profiles.

Location

A communications failure can occur anywhere within the county, as the systems affected are often interdependent and span across local, regional, and national networks. Rural and remote areas may be at greater risk due to fewer redundancies in network infrastructure.

Extent

A communication disruption or failure may be localized, such as damage to a single cell tower. It may also be widespread, resulting from regional infrastructure failures, cyberattacks, or satellite disruptions.

Historical Occurrences

Communications disruptions and failures have occurred in the past, but documentation about the events is limited. Simple mistakes or undocumented fiber lines have temporarily caused Gunnison County to lose access to fiber internet and the ability to call emergency services using 911. In the summer of 2016, two cable cuts impacted the county and the surrounding counties. As recently as 2020, a fiber line was accidentally cut by a contractor putting in a water line. The outage lasted approximately 36 hours, during which landline, cell service, internet, and 911 were not working. 911 calls were routed to Montrose County, and Gunnison Dispatch used the radio to communicate with emergency personnel for reporting and responding to emergency calls. Since the event, other companies have added connections to Gunnison County, strengthening the internet's redundancy in the county.[11]

Average Annual Losses

Losses from communications disruptions and failures are hard to quantify. Remote workers, emergency services, schools, and other economic drivers can be disrupted by these failures, but are often not measured.

11 Crested Butte News CenturyLink Finishing Fiber Optic Project in County this Fall, March 2020, https://crestedbuttenews.com/2020/03/centurylink-finishing-fiber-optic-project-in-county-this-fall/.

Historical Probability & Future Likelihood

Based on historical occurrences, the historical probability of a communication disruption/failure event is 20%. However, historical occurrences may not be a useful measure of future probability. Due to anticipated impacts of climate change and future development, the likelihood of a communication disruption or failure is low. As redundant internet connections come online, this will reduce the risk of disruptions and failures in the county.

Historical Probability & Future Likelihood – Communication Disruption / Failure

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
20%	No Direct Impacts	Increase in Frequency and Exposure	**Unlikely**

Climate Change

Climate change is unlikely to have a direct impact on communication failures. However, the effects of climate change will likely increase the likelihood of many hazards (such as severe winter storms and high winds) that disrupt communication. In turn, this could lead to more communication disruption events in the future.

Future Development

Population growth and new developments will place increased demands on the existing communications infrastructure. Without adequate planning, this growth can strain network capacity, leading to degraded service during peak usage, especially in emergencies. Expanding development into rural or hazard-prone areas, such as the wildland-urban interface, can expose critical communications equipment to greater physical risks. Additionally, as more residents, visitors, and businesses rely on high-speed data, cell coverage, and interconnected systems, the consequences of service disruptions will escalate, amplifying economic, public safety, and health impacts. The growing integration of technologies and connected devices into governmental services will also mean that communication failures could disrupt a wider range of essential services than in the past.

Vulnerabilities

Communication failures can have significant impacts, as nearly every aspect of modern life depends on communication networks. Disruption of these networks can lead to technological and financial losses, or even loss of life. Potential impacts can include delayed emergency response and dispatch capabilities, reduced situational awareness during crises, public inability to receive timely alerts and warnings, disruption of coordination between government agencies and departments, and economic loss from business downtime. These would likely also have cascading effects on nearly every sector of the county.

Gunnison County has a limited communications infrastructure with very few redundancies. If one tower goes down, it could impact a significant geographic area. There are two fiber lines in the county, offering some redundancy. Additionally, the county and many first response agencies have Starlink systems to deploy if internet is needed in a small area.

County Communication Disruption / Failure Vulnerabilities

Sector	Vulnerability
People	-Geographically isolated residents -Medically dependent individuals -Elderly Residents -Non-English Speakers -Low-Income Households
Economic	-Business downtime -Disruption of the supply chain and logistics -Revenue loss of businesses
Built Environment	-Minimal physical damage to buildings or infrastructure
Community Lifelines	-Delayed emergency dispatch -Loss of interoperability between first responders during incidents -Loss of alerts, warnings, and updates -Delayed coordination between departments and agencies -Disruption of water, wastewater, and power systems
Recreation	-Minimal impacts

Community Lifeline Potential Impacts

Communication Disruption / Failure Impacts

Level of Concern for Communication Disruption / Failure

The table below lists the communication disruption or failure level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Communication Disruption / Failure

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	High
Town of Mt. Crested Butte	Low
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	High
Mt. Crested Butte Water & Sanitation District	Moderate

Dam Failure

Dam failures are primarily due to hydrologic or structural deficiencies. The operation of an artificial reservoir can also affect the structure's safety. Dam failure due to hydrologic deficiency results from inadequate spillway capacity, which can cause the reservoir level to exceed the dam's capacity or height (overtopping) during large flows. Dam failure due to hydrologic deficiency typically occurs following unusually heavy precipitation in the basin. Large waves generated from landslides into a reservoir, or the sudden inflow from upstream dam failures, are other causes of dam failure by overtopping. Overtopping is especially dangerous for an earth dam because the downrush of water over the crest erodes the dam's face. If it continues long enough, the downrush of water breaches the dam embankment and suddenly releases all the stored water into the downstream floodplain.

The mechanics of a structural failure depend on the type of dam and the mode of failure. While they can occur at any time, earthen dams are most susceptible to structural failure during the fall and spring freezing and thawing cycles.

Examples of structural deficiencies include seepage through the embankment, piping in internal conduits, erosion, cracking, sliding, overturning, rodent tunneling, and other structural weaknesses. Old age is often at the root of structural deficiencies. Seismic activity in Colorado has also been recognized as a potential source of structural problems, as liquefaction of sand layers in a dam's embankment has been observed.

The Colorado Division of Water Resources has classified dams into two main categories based on the size of their reservoirs: jurisdictional and non-jurisdictional.

- **Non-Jurisdictional Dam** is a dam creating a reservoir with a capacity of 100 acre-feet or less and a surface area of 20 acres or less and with a height measured as defined in Rules 4.2.5.1 and 4.2.19 of 10 feet or less.

- **Jurisdictional Dam** is a dam creating a reservoir with a capacity of more than 100 acre-feet or creates a reservoir with a surface area of more than 20 acres at the high-water line or exceeds 10 feet in height measured vertically from the elevation of the lowest point of the natural surface of the ground where that point occurs along the longitudinal centerline of the dam up to the crest of the emergency spillway of the dam.

Jurisdictional dams are further classified by the potential hazard each poses to human life and economic loss. The following are classifications and descriptions for each hazard class of jurisdictional dams:

- **No Public Hazard** – Dams assigned the No Public Hazard potential classification are those for which no loss of human life is expected and for which damage only to the dam owner's property will result from failure.

- **Low Hazard Potential** – Dams assigned the low hazard potential classification are those in which failure or misoperation results in no probable loss of human life and significant damage to structures and public facilities, as defined for a significant hazard dam, is not expected.

- **Significant Hazard Potential** – Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, infrastructure disruption critical to community lifelines, or other concerns.

- **High Hazard** – Dams assigned the high hazard potential classification are those where the loss of human life is expected in the event of a failure.[12]

Dams that are classified with high hazard potential require the creation of an Emergency Action Plan. The Emergency Action Plan defines responsibilities and provides procedures for identifying unusual and unlikely conditions that may endanger the dam's structural integrity in sufficient time to take mitigating actions and notify the appropriate emergency management officials of possible, impending, or actual dam failure. The Emergency Action Plan may also notify when flood releases will create significant flooding. An emergency can occur at any time; however, it is more likely to happen during extreme conditions. The Emergency Action Plan includes information on notifying emergency response entities so that appropriate action can be taken to prevent loss of life and property. Local emergency response entities generally included in an Emergency Action Plan include, but are not limited to, 911 Dispatch, County Sheriff, Local Fire Departments, Emergency Management Agency Director, County Highway Department, and the National Weather Service.

Location

Communities or areas downstream of a dam, especially those downstream of high-hazard dams, are at the greatest risk of property or infrastructure damage and loss of life from dam failure. A total of 42 dams are located in Gunnison County. The dam location map shows all the dams in the county. Non-jurisdictional dams were not mapped because location data were unavailable for all of them.

Dams in Gunnison County

Non-Jurisdictional	No Public Hazard	Low Hazard	Significant Hazard	High Hazard	Total
13	0	16	4	9	**42**

Source: Colorado Division of Water Resources [13]

The following table lists dams classified as “High Hazard” in Gunnison County.

High Hazard Dams in Gunnison County

Dam Name (National ID)	Owner	Condition Assessment	Downstream Town	Dam Height	Normal Storage (Acre-Ft)
Beaver (CO00397)	Beaver Reservoir Company	Fair	Paonia	100’	1,600
Blue Mesa Dam (CO01675)	Bureau of Reclamation	Not Available	Delta	390’	748,430
Coal Creek (CO590117)	Town of Crested Butte	Conditionally Satisfactory	Crested Butte	20’	506

12 Colorado Department of Natural Resources Division of Water Resources. November 2010. “Guidelines for Hazard Classification”. https://damfailures.org/wp-content/uploads/2019/08/Colorado-Guidelines-for-Hazard-Classification.pdf.
13 Colorado Department of Natural Resources Division of Water Resources. August 2025. "Dam Safety". https://dwr.colorado.gov/services/dam-safety.

Dam Name (National ID)	Owner	Condition Assessment	Downstream Town	Dam Height	Normal Storage (Acre-Ft)
Lake Grant (CO02785)	Skyland Metropolitan District	Satisfactory	Gunnison	17’	282
Monument (CO00598)	Minnesota Ditch & Reservoir Co	Fair	Paonia	51’	430
Paonia Dam (CO01691)	Bureau of Reclamation	Not Available	Paonia	199’	17,461
Silver Jack Dam (CO01693)	Bureau of Reclamation	Not Available	Paonia	173’	13,520
Spring Creek (CO00148)	Colorado Parks and Wildlife	Unsatisfactory	Gunnison	53’	1,631
Taylor Park Dam (CO00151)	Bureau of Reclamation	Not Available	Gunnison	161’	106,225

Source: Colorado Division of Water Resources, 2025

Lastly, the county has 503 livestock water tanks and erosion control dams. These structures include all reservoirs built after April 17, 1941, on watercourses that the state engineer has determined to be "normally dry" and having a capacity of not more than ten-acre feet and a vertical height not exceeding fifteen feet from the bottom of the channel to the bottom of the spillway.[14]

Upstream Dams Outside Gunnison County

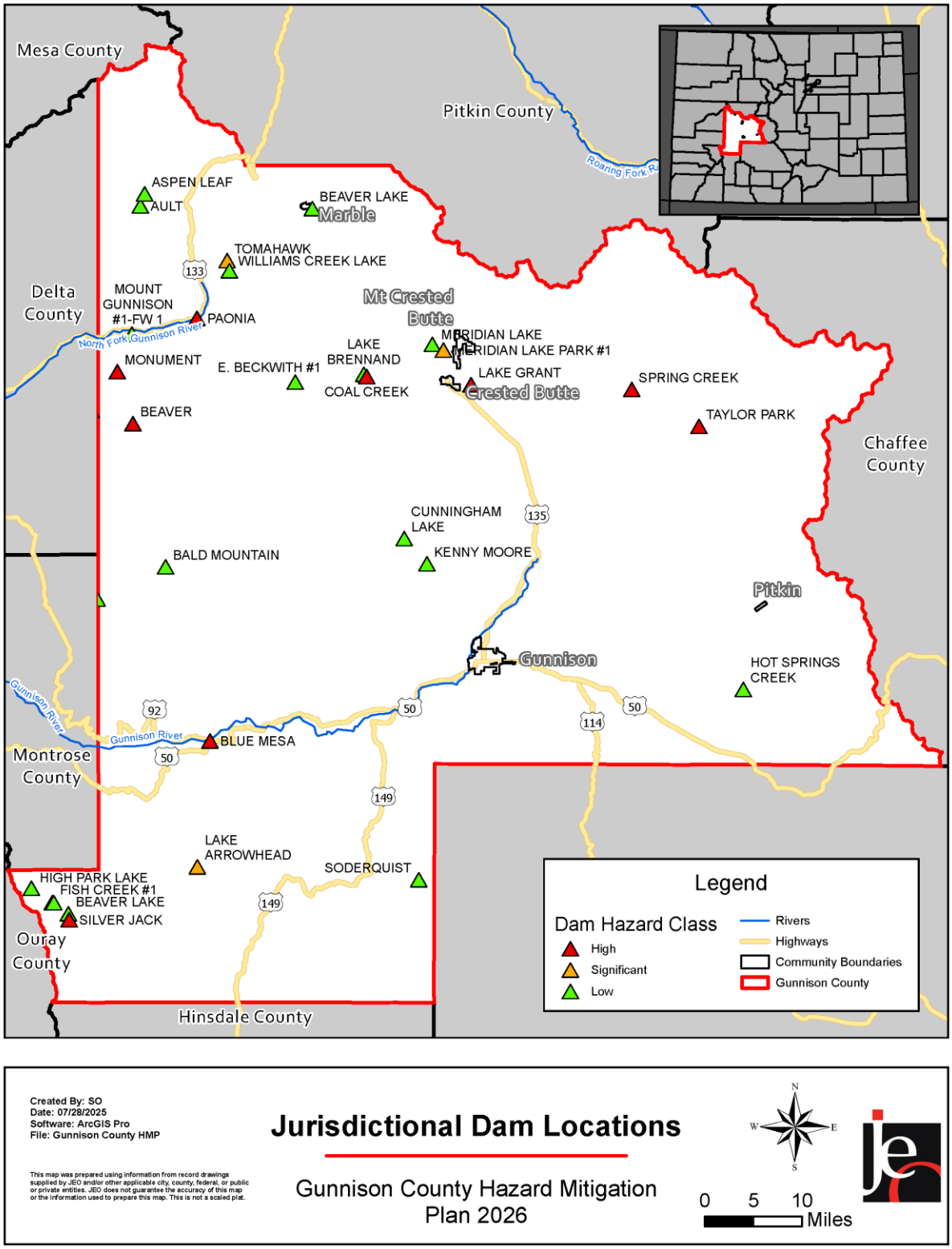
According to the Colorado Department of Natural Resources Dam Safety team, the high-hazard Vouga Dam lies within the Saguache County portion of the response area, but would have consequences in Gunnison County in the event of failure. Gunnison County Emergency Management is provided with Emergency Action Plans for all of the High and Significant Hazard Dams, many of which include inundation maps.

Extent

The extent of dam failure is indicated by its hazard classification and dam inundation maps. Hazard classification does not indicate the likelihood of a dam failure, but rather the extent of potential damage that may occur in the event of a failure. Thus, the high-hazard dams in Gunnison County would have the most significant impact if they were to fail. Additionally, the extent can be measured by factors such as speed of onset and warning time. The speed of onset depends on the type of failure. Small leaks allow for adequate warning time if a dam is inspected regularly. Once a dam is breached, however, failure and resulting flooding occur rapidly. Dams can fail at any time of year, but the consequences are catastrophic when they fill or overtop during winter or spring rain/snowmelt events. Dam inundation maps are maintained by dam owners, included in each dam’s Emergency Action Plan, and shared with Gunnison County Emergency Management.

14 Colorado Department of Natural Resources Division of Water Resources. September 2024. "DWR Livestock Water Tank and Erosion Control Dams". https://data.colorado.gov/Water/DWR-Livestock-Water-Tank-and-Erosion-Control-Dams/r2rp-ecjb/about_data.

Gunnison County Jurisdictional Dam Locations



Created By: SO
Date: 07/28/2025
Software: ArcGIS Pro
File: Gunnison County HMP

This map was prepared using information from record drawings supplied by JEO and/or other applicable city, county, federal, or public or private entities. JEO does not guarantee the accuracy of this map or the information used to prepare this map. This is not a scaled plat.

Jurisdictional Dam Locations

Gunnison County Hazard Mitigation Plan 2026

N
W
E
S

0 5 10 Miles

Historical Occurrences

According to the Stanford University National Performance of Dams Program, there have been no reported dam failures in the county.[15]

The dam owner should inspect all dams regularly and after heavy rainfall or snowmelt events. If problems are found during an inspection, the dam should be repaired to preserve its structural integrity. The Colorado Department of Natural Resources, Division of Water Resources, conducts periodic inspections of dams and provides recommendations for repairs to dam owners.

Average Annual Losses

With no reported dam failure events in the county, the average annual loss from dam failure is $0.

Historical Probability & Future Likelihood

Stanford University's National Performance of Dams Program reports zero dam failure events from 1890 to September 2025. Based on historical records, the probability of a dam failure in Gunnison County is less than 1% per year. Given the anticipated impacts of climate change and future development, the future likelihood of a dam failure in the county remains very unlikely.

Historical Probability & Future Likelihood – Dam Failure

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Less than 1%	Increase in Frequency	Neither Increase nor Decrease in Frequency Increase in Impacts	**Very Unlikely**

Climate Change

While climate change does not directly cause dam failures, changes in precipitation and temperature can influence them. Increased rainfall events, either in frequency or magnitude, will exacerbate stress on infrastructure systems, including dams. Additionally, historical streamflow records are typically used to design or determine dam construction and maintenance requirements. Climate change may impact these systems in the following ways.

- Drought: land subsidence, erosion, embankment settling, or foundation cracking.
- Flooding: increased embankment erosion, sloughing, overtopping risk, or damage from ice jams.

Future Development

Any future growth in dam inundation areas increases the impacts of dam failure. Additionally, any increase in development downstream of existing dams may elevate these dams to a higher hazard rating. Closer to the dam, the breach inundation zone is frequently more extensive than the identified floodplain, so caution should be used when developing areas just downstream of a dam. Communities could implement requirements for any new development or substantial improvements in dam-inundation areas, such as floodplain ordinances, to minimize the number of people and properties impacted during a dam failure.

15 Stanford University. September 2025. "National Performance of Dams Program". http://npdp.stanford.edu/.

Vulnerabilities

Dam failures can result in downstream flooding. Water released from a failed dam can generate tremendous energy and cause a catastrophic flood. Three factors that influence the potential severity of a full or partial dam failure are the amount of water impounded, the density, type, and value of downstream development and infrastructure, and the nature of the terrain between the dam and the downstream development. A dam failure event can dislodge trees and boulders, carrying them downstream into developed areas.

A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts on life safety would depend on the warning time and the resources available to notify and evacuate the public. They could include significant loss of life and potentially catastrophic damage to roads, bridges, and homes. Associated water quality and health concerns could also be an issue.

Individual High Hazard Dam Failure Impacts

The Beaver Dam is located on the northwest edge of the county. The dam owner did not provide data on the dam's inundation area. However, areas downstream of the dam would see flooding. Delta County would see the largest flooding impacts.

The Blue Mesa Dam is located on the western end of the Blue Mesa Reservoir, approximately 27 miles west of the City of Gunnison. The dam owner did not provide data on the dam’s inundation area. However, the Gunnison River downstream of the dam would see flooding. Montrose and Delta counties would likely also see flooding impacts.

The Coal Creek Dam is located approximately six miles west of the Town of Crested Butte. If this dam were to fail, Coal Creek and the Slate River downstream of Lake Irwin would be inundated. The inundation area would exceed the 100-year floodplain and affect the Town of Crested Butte and Highway 135 at several locations.

The Lake Grant Dam is located approximately one mile south of the Town of Crested Butte. If this dam were to fail, the Slate River downstream of Lake Grant up to the East River junction would be inundated. The inundation area would be slightly smaller than the 100-year floodplain and impact Highway 135 in two locations.

The Monument Dam is located on the county's northwest edge. The dam owner did not provide data on the dam's inundation area. However, areas downstream of the dam would see flooding. Delta County would see the largest flooding impacts.

The Paonia Dam is located approximately six miles east of Somerset. If this dam were to fail, the North Fork Gunnison River downstream of the Paonia Reservoir up to the Grand Junction would be inundated. The inundation area would be slightly larger than the 100-year floodplain and impact parts of Somerset, Delta County, and Mesa County. Highways 50, 92, and 133 would also be impacted.

The Silver Jack Dam is on the north side of the Silver Jack Reservoir. The dam owner did not provide data on the dam's inundation area. However, the Cimarron River downstream of the dam would see flooding. Montrose County would likely also see flooding impacts.

The Spring Creek Dam is located approximately 15 miles east of the Town of Crested Butte. If this dam were to fail, Spring Creek and the Gunnison River downstream of the Spring Creek

Reservoir up to the Blue Mesa Reservoir would be inundated. The inundation area would be somewhat larger than the 100-year floodplain and impact parts of the City of Gunnison and Almont. Highways 50 and 135 would also be impacted. The dam currently has an unsatisfactory condition assessment and is under a storage restriction due to the poor spillway condition and seepage issues. The water level must be kept 10 feet below the spillway to minimize further damage and potential failure. Colorado Parks and Wildlife is currently in the preliminary planning phase of the Spring Creek Dam Rehabilitation Project. An alternatives analysis for the Spring Creek Dam will be conducted from October 2025 to June 2026. After the conclusion of the alternatives analysis and selection of the preferred alternative, the project will move into the design phase, which will be completed in 2027. Depending on the scope of the rehabilitation, construction will begin in spring 2027 or 2028.

The Taylor Park Dam is located approximately 35 miles Northeast of the City of Gunnison. If this dam were to fail, the Gunnison River downstream of the Taylor Park Reservoir up to the Blue Mesa Reservoir would be inundated. The inundation area would be much larger than the 100-year floodplain and impact parts of the City of Gunnison and Almont. Highways 50 and 135 would also be impacted.

Inundation areas for high-hazard dams are available from the individual dam owners. These areas are not shown in this plan due to security concerns. However, an analysis of the total number of structures and their values in the inundation area was completed and is presented in the table below. All dam owners were contacted for inundation areas. Dams with data marked “Not Available” either did not respond or chose not to provide inundation-area information. In total, 15 out of 112 community lifelines are within a dam inundation area. These lifelines can be found in the *Participant Profiles Appendix*.

Dam Inundation Area Building Impacts

Dam Name	Number of Buildings in the Inundation Area	Value of Buildings in the Inundation Area
Beaver	Not Available	Not Available
Blue Mesa	Not Available	Not Available
Coal Creek	692	$695,912,000
Lake Grant	2	$5,321,440
Monument	Not Available	Not Available
Paonia Dam*	15	$6,929,940
Silver Jack	Not Available	Not Available
Spring Creek	756	$341,860,000
Taylor Park	2,550	$1,078,285,900

**The number of buildings is just for Gunnison County. Actual number of buildings, including other counties would be higher.*

County Dam Failure Vulnerabilities

Sector	Vulnerability
People	-Evacuation needs are likely with high-hazard dam failures -Elderly or residents with decreased mobility may have trouble evacuating -Residents living in the dam inundation areas -Those without adequate notification (text alerts, sirens, internet, or cable access) may be at greater risk -Those at recreational sites situated near high-hazard dams
Economic	-Business closures or damages may have significant impacts -Closed roads would impact the commercial transportation of goods -Employees of closed businesses may be out of work for an extended period
Built Environment	-Buildings may be damaged
Community Lifelines	-Damages to roadways and bridges -Wastewater and water treatment facilities are at risk, particularly those in dam inundation areas -Infrastructure, especially those in dam inundation areas, is at risk of damage
Recreation	-Potential unsafe fishing and hiking conditions -Loss of recreation tourism

Community Lifeline Potential Impacts

Dam Failure Impacts

Level of Concern for Dam Failure

The table below lists the dam failure level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Dam Failure

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	None
Crested Butte Fire Protection District (Stakeholder)	Low
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Drought

Drought is generally defined as a natural hazard resulting from a prolonged period of below-normal precipitation. Drought is typically a slow-onset, creeping phenomenon. However, "flash droughts" can occur quickly and last only briefly. Drought and its impacts vary from region to region. In Colorado's Rocky Mountain Region, winter snowpack sustains towns, agriculture, and recreation. The amount of winter precipitation usually sets the tone for drought conditions from year to year.[16]

> **Drought** can develop in diverse ways, which makes predicting drought challenging. 'Average' snowpack does not necessarily translate to average streamflows or mean that we won't experience drought conditions.
>
> – Colorado State University Extension

The impacts of drought spread across a larger area and typically affect more people than those of other natural hazards. Detection and early warning of drought conditions have improved recently, but remain more challenging to identify than those of quick-onset natural hazards (e.g., floods, winter storms, tornadoes). According to the National Drought Mitigation Center, droughts are classified into four major types: [17]

- **Meteorological Drought** is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates, frequencies (norms), and winds vary.

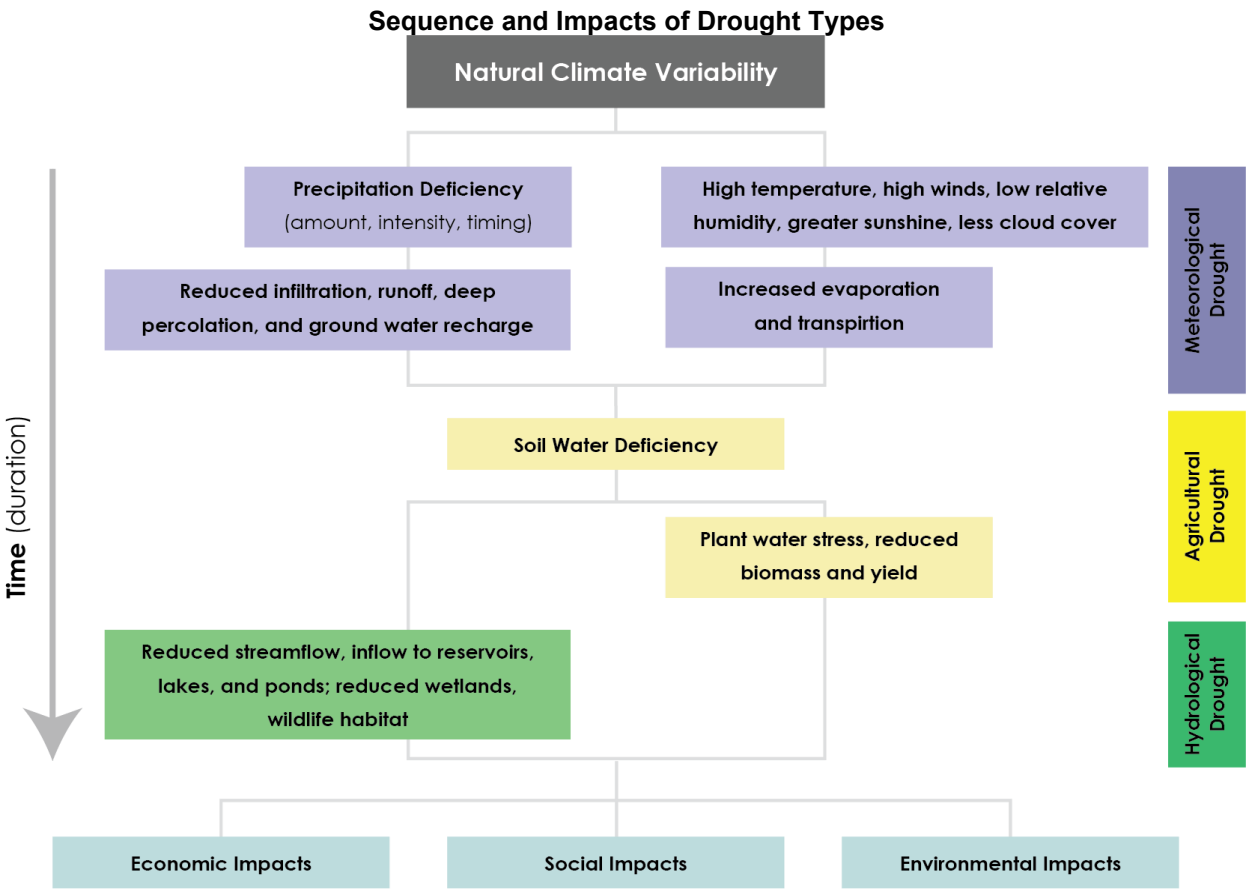
- **Agricultural Drought** occurs when insufficient moisture hinders germination, resulting in a lower plant population per hectare and reduced final yield. Agricultural drought is closely linked to meteorological and hydrological drought, as agricultural water supplies depend on both.

- **Hydrologic Drought** occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives average precipitation. This is due to reserves diminishing from increased water use, usually from agricultural activities or high evapotranspiration resulting from prolonged high temperatures. Hydrological drought is often identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest as decreased hydropower production and the loss of water-based recreation.

- **Socioeconomic Drought** occurs when demand for an economic good exceeds supply due to a weather-related water shortfall. The supply of many economic goods includes, but is not limited to, water, forage, food grains, fish, and hydroelectric power.

The figure on the next page presents the different types of droughts, their temporal sequence, and the various types of effects they can have.

16 National Integrated Drought Information System (National Oceanic and Atmospheric Administration). 2024. "Drought in the Intermountain West". https://www.drought.gov/states/colorado.
17 National Drought Mitigation Center. 2017. "Drought Basics". https://drought.unl.edu/.



Location

The entire county is at risk of drought conditions, including the populated areas of local water supplies for the City of Gunnison, Town of Marble, Town of Pitkin, Town of Crested Butte, and Town of Mt. Crested Butte (domestic needs) and rural areas of the county (agricultural, environmental, and recreational needs). Areas that rely on snowmelt and seasonal precipitation, particularly in lower elevations, experience drought more frequently.

Extent

Climatologists use the Palmer Drought Severity Index to standardize long-term global drought analysis. The table below shows the details of Palmer Drought Severity Index classifications.

Palmer Drought Severity Index Classification

Numerical Value	Description		Numerical Value	Description
4.0 or more	Extremely wet		**-0.5 to -0.99**	Incipient dry spell
3.0 to 3.99	Very wet		**-1.0 to -1.99**	Mild drought
2.0 to 2.99	Moderately wet		**-2.0 to -2.99**	Moderate drought
1.0 to 1.99	Slightly wet		**-3.0 to -3.99**	Severe drought
0.5 to 0.99	Incipient wet spell		**-4.0 or beyond**	Extreme drought
0.49 to -0.49	Near normal		--	--

Source: Climate Prediction Center[18]

18 National Weather Service. 2025. "Climate Prediction Center". https://www.cpc.ncep.noaa.gov/.

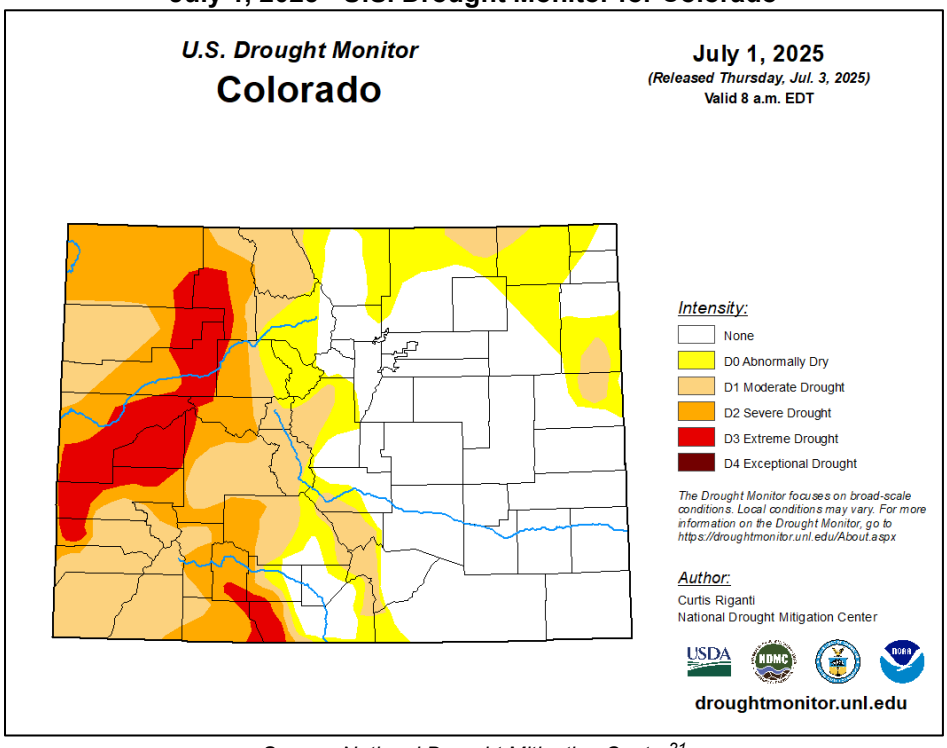
The U.S. Drought Monitor shows where drought is and its extent across the United States. The map uses six classifications, as shown in the table below. The U.S. Drought Monitor is produced jointly by the National Drought Mitigation Center, the National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture. It uses physical data at multiple scales, drought impacts, and feedback from local experts.[19] Communities and jurisdictions across Gunnison County are likely to experience similar extents and impacts from drought.

United States Drought Monitor Classification

Category	Description	PDSI Ranges	Possible Impacts
D0	Abnormally Dry	-1.0 to -1.9	Going into drought: short-term dryness slows crop or pasture growth. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
D1	Moderate Drought	-2.0 to -2.9	Some damage to crops, pastures, streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	-3.0 to -3.9	Crop or pasture losses likely, water shortages common; water restrictions imposed
D3	Extreme Drought	-4.0 to -4.9	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	-5.0 or less	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells create water emergencies.

Source: National Drought Mitigation Center, 2025[20]

July 1, 2025 - U.S. Drought Monitor for Colorado



Source: National Drought Mitigation Center[21]

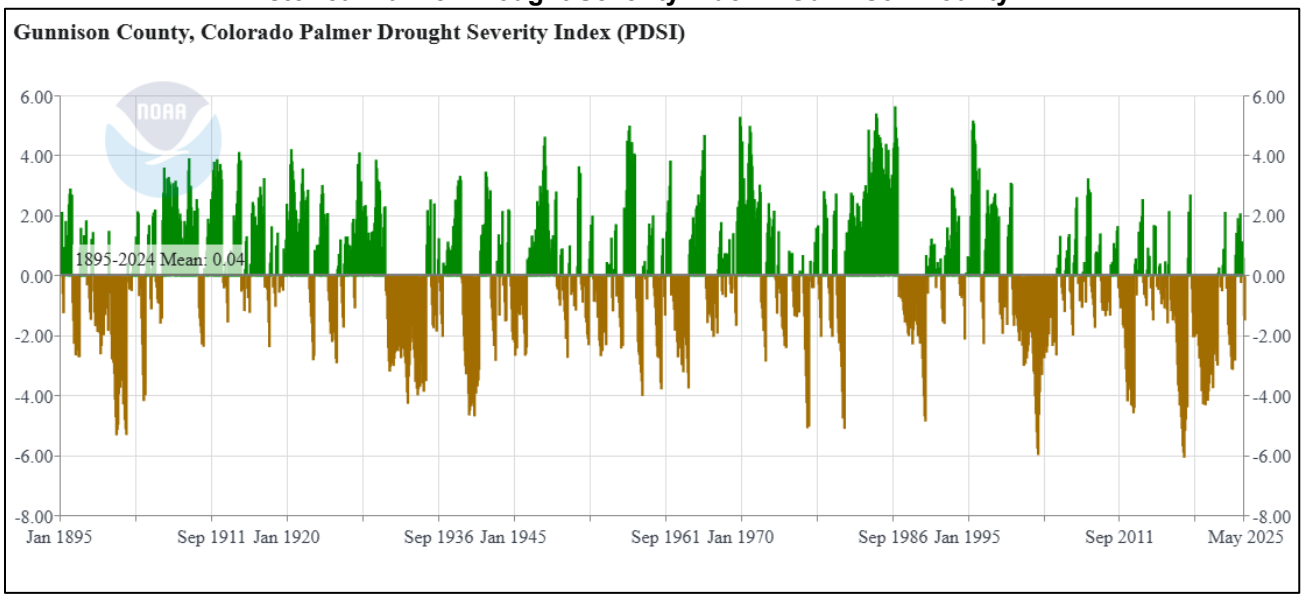
19 National Drought Mitigation Center. 2023. "What is the USDM?". https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx.
20 National Drought Mitigation Center. 2017. "Types of Drought." http://drought.unl.edu/DroughtBasics/TypesofDrought.aspx.
21 National Drought Mitigation Center. July 2025. "U.S. Drought Monitor Colorado". https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?fips_08037.

The onset of drought in the western Colorado mountainous counties is usually signaled by a lack of significant winter snowfall. Gunnison County receives most precipitation as snow in the higher elevations between November and April. Hot, dry conditions that persist into spring, summer, and fall can exacerbate drought, making its effects more pronounced as water demand increases during the growing season and summer months.

Historical Occurrences

Between 1895 and 2025, portions of Gunnison County experienced drought during 38% of the months on record.[22] The figure below shows that the drought conditions in Gunnison County are highly variable. The table shows the number of months at each drought magnitude.

Historical Palmer Drought Severity Index – Gunnison County



Source: NCEI, Jan. 1895-May 2025[23]

Historical Drought in Gunnison County

Drought Magnitude	Total Months
-1 Magnitude (Mild)	240
-2 Magnitude (Moderate)	450
-3 Magnitude (Severe)	344
-4 Magnitude or Greater (Extreme)	158
Total Months in Drought	**1,192**
Total Months Not in Drought	**1,944**

Source: NCEI, Jan 1895-Sept 2025

According to the *2018 Colorado Drought Mitigation and Response Plan*, Gunnison County has experienced multiple drought periods and was included in USDA Disaster Declarations in 2006, 2011, 2012, 2013, 2015, and 2018. While drought conditions can vary across Colorado, these events have undoubtedly affected Gunnison County, impacting local agriculture, water supplies,

22 National Centers for Environmental Information. 1895-Sept 2025. "County Time Series". https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series/CO-037/pdsi/all/9/1895-2023?base_prd=true&begbaseyear=1901&endbaseyear=2000.
23 National Centers for Environmental Information. 1895-2025. "County Time Series". https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series/CO-051/pdsi/1/0/1895-2025?base_prd=true&begbaseyear=1895&endbaseyear=2024

and ecosystems. The county's history of recurring droughts underscores its ongoing vulnerability to fluctuating moisture levels and prolonged dry conditions.

The Drought Impact Reporter has recorded 44 drought-related impacts throughout Gunnison County. This is not a comprehensive list of droughts that may have impacted the county, but only those with reported impacts. The following are the categories and the total number of reported impacts for all drought events. Note that some impacts have been assigned to more than one category. Some of these impacts are summarized in the following table.

- Agriculture: 13
- Business & Industry: 5
- Energy: 3
- Fire: 10
- Plants & Wildlife: 15
- Relief, Response & Restrictions: 22
- Society & Public Health: 5
- Tourism & Recreation: 14
- Water Supply & Quality: 20

Drought Impacts in Gunnison County

Category	Date	Title
Fire; Plants & Wildlife; Relief, Response, & Restrictions; Society & Public Health; Tourism & Recreation	6/26/2025	Stage 1 fire restrictions for much of northwest Colorado.
Agriculture; Plants & Wildlife	8/31/2022	Short feed supplies in northwest Colorado
Business & Industry; Tourism & Recreation; Water Supply & Quality	5/1/2022	Marinas at Blue Mesa Reservoir in Colorado to remain closed this boating season.
Business & Industry; Tourism & Recreation; Water Supply & Quality	11/30/2021	Western Colorado ski resorts open with just a few runs available due to a lack of snow.
Agriculture; Plants & Wildlife	7/26/2021	Drought cut hay growth in western Colorado and livestock sales.
Plants & Wildlife	1/1/2020	Black beetle infestation expanded in Colorado in 2020

Source: National Drought Mitigation Center, 2000-July 2025[24]

Average Annual Losses

The direct and indirect effects of drought are difficult to quantify. Still, drought can lead to complex and widespread impacts on people, wildlife, the environment, and the economy of Gunnison County. The annual property loss estimates for Gunnison County were determined using the NCEI Storm Events Database from 1996 onward. Annual crop loss for Gunnison County was determined based on the SHELDUS data from 1960 to 2023.

Loss Estimate for Drought

Hazard Type	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Drought	$0	$0	$943,396	$14,741

Source: 1 Indicates data is from NCEI (Jan 1996 to May 2025)[25]*; 2 Indicates data is from SHELDUS (1960 to 2023)*[26]

24 National Drought Mitigation Center. July 2025. "Drought Impact Reporter". https://unldroughtcenter.maps.arcgis.com/apps/dashboards/46afe627bb60422f85944d70069c09cf
25 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
26 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Historical Probability & Future Likelihood

Given the historical record of drought occurrence, as shown in the table below, the historical probability of a drought for this plan is 38 percent. Due to the anticipated impacts of climate change and future development, the future likelihood of a drought event in the county is very likely.

Historical Drought Probability in Gunnison County

Drought Magnitude	Total Months	Percent Chance
-1 Magnitude (Mild)	240	8%
-2 Magnitude (Moderate)	450	14%
-3 Magnitude (Severe)	344	11%
-4 Magnitude or Greater (Extreme)	158	5%
Total Months in Drought	**1,192**	**38%**
Total Months Not in Drought	**1,944**	**62%**

Source: NCEI, Jan 1895-Sept 2025[27]

Historical Probability & Future Likelihood – Drought

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
38%	Increase in Frequency and Intensity	Increase in Frequency and Impact	**Very Likely**

The U.S. Seasonal Drought Outlook provides a short-term drought forecast that local officials and residents can use to assess the likelihood of drought developing or continuing over the next three months based on current conditions. The drought outlook is updated throughout the year and should be reviewed continuously. The figure on the next page provides the drought outlook from August 1, 2025, to October 31, 2025, as an example.

Climate Change

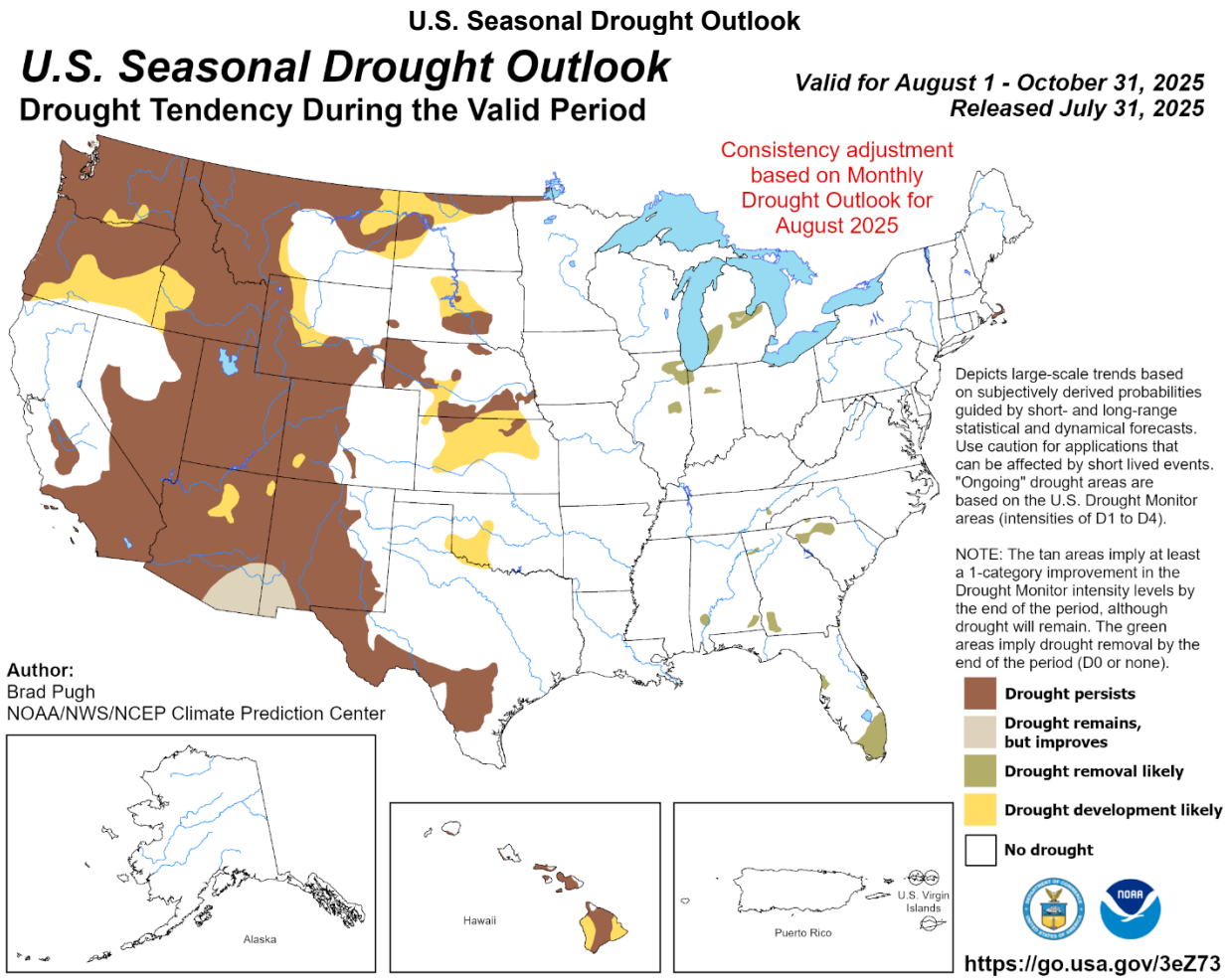
Projected warming will accelerate soil moisture loss during dry spells, intensifying naturally occurring droughts in the future.[28] The increase in drought intensity will also increase the frequency and severity of wildfires as vegetation dries. The table below shows the likelihood of a year-plus drought and a year-plus extreme drought in the county with different warming scenarios.

Projected Climate Change Impacts on Drought

	Warming Scenarios			
Likelihood of	**0.5° C**	**1° C**	**2° C**	**3° C**
Year-Plus Drought	11-33%	11-33%	11-33%	34-50%
Year-Plus Extreme Drought	0-10%	0-10%	0-10%	0-20%

Source: Probable Futures[29]

27 National Centers for Environmental Information. 1895-Sept 2025. "County Time Series". https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/county/time-series/CO-037/pdsi/all/9/1895-2023?base_prd=true&begbaseyear=1901&endbaseyear=2000.
28 NCEI. 2022. "State Climate Summaries – Colorado". https://statesummaries.ncics.org/chapter/co/.
29 Probable Futures. "Maps of Dryness". Sept 2025. https://probablefutures.org/.



Source: National Oceanic and Atmospheric Administration[30]

A specific tool developed and utilized in the State of Colorado includes the Future Avoided Cost Explorer[31] to assess drought-associated costs. This tool provides an in-depth look at the potential economic impacts of future drought on specific sectors of the Colorado economy. The following table and figures show the expected impacts of drought on the current climate and the projected future 'Moderate' and 'More Severe Climate' impacts with various growth rates for Gunnison County.

Based on the Future Avoided Cost Explorer assessments, it is likely that Gunnison County will experience worsening drought impacts from climate change. At the current growth rate and only moderate climate impacts, Gunnison County may experience up to $12 million in total damage annually. Damages may vary across sectors and regions, such as bridges, buildings, livestock, crops, rafting, skiing, and fire suppression activities.

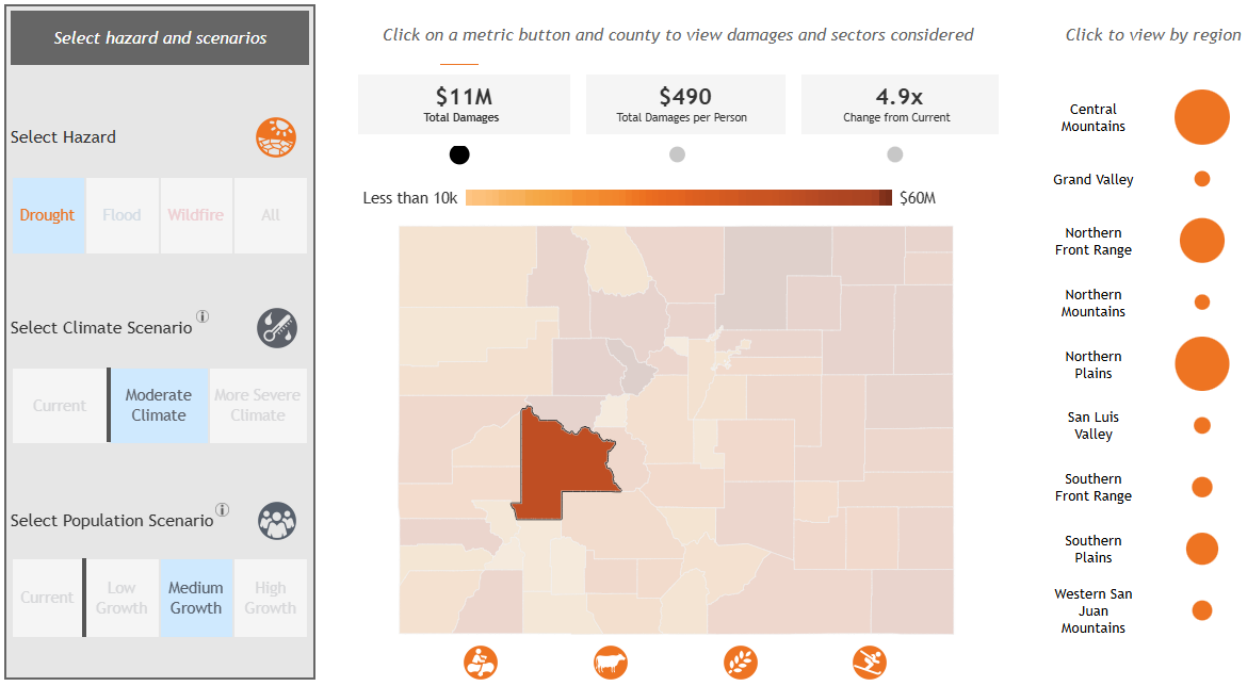
30 National Oceanic and Atmospheric Administration. July 2025. "U.S. Seasonal Drought Outlook". https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php.
31 Colorado Water Conservation Board. 2020. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.

Future Avoided Cost Explorer Anticipated Gunnison County Damages for Drought Matrix

Population Scenario	Climate Scenario		
	Current Climate	Moderate Climate	More Severe Climate
Current Growth Rate	$2.3 million Total Damages $140 per person	$9.7 million Total Damages $600 per person	$11 million Total Damages $690 per person
Low Growth Rate	$2.6 million Total Damages $150 per person	$11 million Total Damages $640 per person	$12 million Total Damages $670 per person
Medium Growth Rate	$3.6 million Total Damages $160 per person	$11 million Total Damages $490 per person	$12 million Total Damages $510 per person
High Growth Rate	$3.6 million Total Damages $120 per person	$11 million Total Damages $390 per person	$12 million Total Damages $410 per person

Source: CWCB Future Avoided Cost Explorer[32]

Future Avoided Cost Explorer Drought Analysis Example



Source: CWCB Future Avoided Cost Explorer[33]

32 Colorado Water Conservation Board. Accessed July 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.
33 Colorado Water Conservation Board. Accessed July 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.

Exploring Resilience Actions for Drought

Source: CWCB Future Avoided Cost Explorer[34]

Future Development

Any future developments are likely to increase water demand, increase travel on local transportation routes, and influence the continued growth of economic sectors at risk from drought. Growing communities will need to adapt and account for increased water demands for residential, commercial, and industrial development.

Vulnerabilities

According to the 2018 Colorado Drought Mitigation and Response Plan, Gunnison County was in the second-highest group of vulnerability to drought compared to other counties in the state.[35] Drought in Gunnison County can have wide-ranging impacts on people, vegetation, livestock, recreational areas, and industries. Impacts of drought in Gunnison County include water shortages for people and livestock, drier forests and vegetation resulting in longer fire seasons and more extreme wildfire behavior, changes to wildlife habitat, accelerated beetle and pest damage to forests, and threats to many of Gunnison County's economic drivers (recreation, agriculture, fishing, etc.).

Drought conditions can also cause soil to compact, increasing an area's susceptibility to flooding and reducing vegetation cover, which exposes soil to wind and erosion. Reducing electric power

34 Colorado Water Conservation Board. Accessed December 2024. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.
35 Colorado Water Conservation Board Department of Natural Resources. August 2018. "Colorado Drought Mitigation and Response Plan". https://drive.google.com/drive/folders/1ixpT9RH5yoVNhx_NjFThe1c-eLeQI7TF.

generation and deteriorating water quality are also potential problems. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline.

Blue Mesa Reservoir is a state and local asset vulnerable to drought for water supply, water quality, power generation, and recreation. capacity. The reservoir does not provide a water supply to Gunnison residents. However, the reservoir and park are popular attractions for camping, biking, boating, winter sports, and birding, boosting the local economy.

The water supply to much of the county comes from groundwater in the alluvial aquifer, but irrigation ditches also supply water for farming and ranching. A severe drought may reduce irrigation water availability and increase the likelihood of wildfires.

The Upper Gunnison River Water Conservancy District (UGRWCD) was established in 1959 and serves as a leader on all issues affecting the water resources of the Upper Gunnison River Basin. The UGRWCD supports a variety of district interests, including financial, legal, political, and engineering support for water rights litigation, legislation, and other political activities, as well as support for a wide range of local water users' interests, including agriculture, recreation, environmental, and municipal uses.[36]

A drought event would damage none of Gunnison County's owned and identified community lifelines. The following table provides information related to countywide vulnerabilities. Participant-specific vulnerabilities are listed after the table.

County Drought Vulnerabilities

Sector	Vulnerability
People	-Insufficient water supply -Loss of jobs in the agricultural sector -Residents in poverty if food prices increase -Residents in rural areas on private wells or small water systems
Economic	-Loss of tourism dollars -Challenges for livestock and agriculture -Closure of water-intensive businesses (carwashes, pools, etc.) -Reduced power from hydroelectric power plants
Built Environment	-Cracking foundations (residential and commercial structures) -Damages to landscapes
Community Lifelines	-Damages to waterlines below ground -Damage to water resources
Recreation	-Reduced stream/river flows for fishing -Reduced water level in reservoirs for recreation -Less snow for skiing, snowboarding, and snowmobiling -Damage to forest health

36 Upper Gunnison Water Conservancy District. October 2025, https://ugrwcd.org/

Community Lifeline Potential Impacts

Drought Impacts

Level of Concern for Drought

The table below lists the drought-level-of-concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Drought

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	High
City of Gunnison	Moderate
Town of Crested Butte	High
Town of Mt. Crested Butte	High
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	High
Mt. Crested Butte Water & Sanitation District	Moderate

Earthquake

An earthquake results from a sudden release of energy in the Earth's tectonic plates that creates seismic waves. Seismic activity in an area refers to the frequency, type, and size of earthquakes experienced over a period of time. Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to a fault, earthquake magnitude, and earthquake type.

- **Ground shaking** is the motion felt on the Earth's surface caused by seismic waves generated by an earthquake. Ground shaking is the primary cause of earthquake damage. The strength of ground shaking depends on the earthquake's magnitude, the type of fault, and the distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated, thick soils will typically sustain more damage than those on consolidated soils or bedrock.

- **Earthquake-induced landslides** are secondary earthquake hazards that occur from ground shaking. They can destroy roads, buildings, utilities, and other critical facilities necessary to respond to and recover from an earthquake.

- **Liquefaction** occurs when ground shaking causes wet granular soils to change from a solid to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support them.

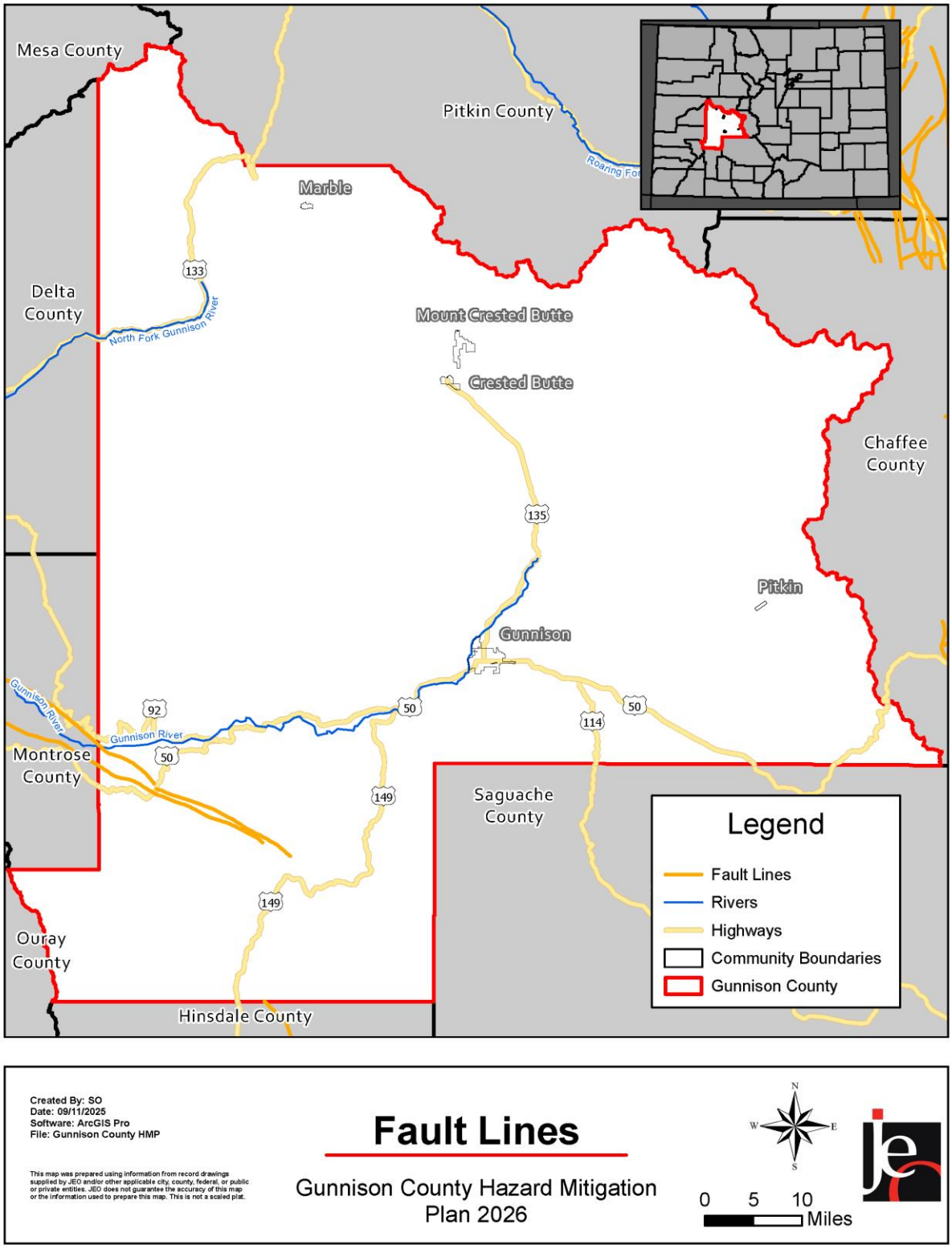
- **Amplification** is the phenomenon in which soils and soft sedimentary rocks near the earth's surface increase the magnitude of the seismic waves generated by the earthquake. Amplification is determined by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils face a greater risk.

Location

Although earthquakes have not been frequent or significant in Gunnison County, the entire county could be affected by them. The most likely locations to experience an earthquake are near a fault line. According to the Colorado Geological Survey, there are two faults in Gunnison County, primarily located in the southwestern part of the county's panhandle. Just east of the county boundary, several fault lines run. There are no named fault lines within Gunnison County.[37] The figure below shows the location of the faults. Additionally, several faults in Chaffee, Lake, Montrose, Ouray, and Hinsdale Counties could affect Gunnison County.

37 Colorado Geological Survey. September 2025. "Colorado Earthquake and Fault Map Server". https://cgsarcimage.mines.edu/ON-001/.

Fault Lines in Gunnison County



Extent

Earthquakes are measured by magnitude and intensity. Magnitude is measured on the Richter Scale, a base-10 logarithmic scale that uses seismographs worldwide to estimate the amount of energy released by an earthquake. Intensity is measured by the Modified Mercalli Intensity Scale, which determines earthquake intensity by comparing actual damage with damage patterns of earthquakes with known intensities. The following tables summarize the Richter Scale and Modified Mercalli Scale. Based on historical records, earthquakes in the county are likely to measure five or less on the Richter Scale.

Richter Scale

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5 – 5.4	Often felt, but rarely causes damage.
5.4 – 6.0	At most, slight damage to well-designed buildings. It can cause major damage to poorly constructed buildings over small regions.
6.1 – 6.9	It can be destructive in areas up to about 100 kilometers from where people live.
7.0 – 7.9	Major earthquake. It can cause serious damage over larger areas.
8 or Greater	Great earthquake. It can cause serious damage in areas several hundred kilometers across.

Source: USGS, 2025[38]

Modified Mercalli Intensity Scale

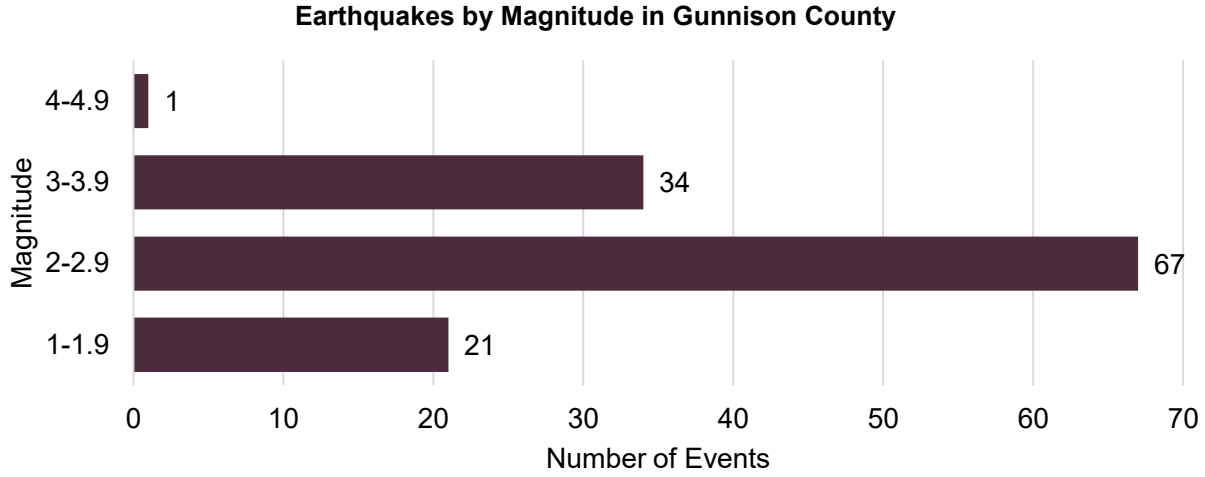
Scale	Shaking	Description of Effects
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on the upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on the upper floors of buildings. Many people do not recognize it as an earthquake. Standing cars may rock slightly. Vibrations are similar to the passing of a truck. Duration Estimated.
IV	Light	Felt indoors by many and outdoors by few during the day. At night, some awakened. Dishes, windows, and doors are disturbed; walls make cracking sounds. A sensation like a heavy truck striking a building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes and windows are broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage is negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable damage in poorly built or badly designed structures, and some broken chimneys.
VII	Severe	Damage is slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.
IX	Violent	Damage is considerable in specially designed structures; well-designed frame structures are thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off their foundations.
X	Extreme	Some well-built wooden structures are destroyed; most masonry and frame structures are destroyed, including their foundations. Rails bent.

Source: USGS

38 U.S. Geological Survey. July 2025. "Earthquake Magnitude, Energy Release, and Shaking Intensity". https://www.usgs.gov/programs/earthquake-hazards/earthquake-magnitude-energy-release-and-shaking-intensity.

Historical Occurrences

According to the USGS, 123 earthquakes occurred in Gunnison County between 1889 and July 2025.[39] As shown on the map below, most earthquakes occurred in northern Gunnison County, with half occurring near the Town of Ridgway. The following statistics show the breakdown of reported earthquakes by magnitude and location.



Source: USGS, 1889-July 2025

Average Annual Losses

According to SHELDUS data from 1960 to 2023, there was no property or crop damage from earthquakes in Gunnison County.[40] According to the 2020 Gunnison County Hazard Mitigation Plan, a major earthquake occurred in 1944, with an intensity of VI. A few minor earthquakes were felt in the Crested Butte area in 1986, beginning in April and continuing through October. The average magnitude of these earthquakes was 2.5. The highest magnitude occurred on September 3rd, registering a 3.5.

Historical Probability & Future Likelihood

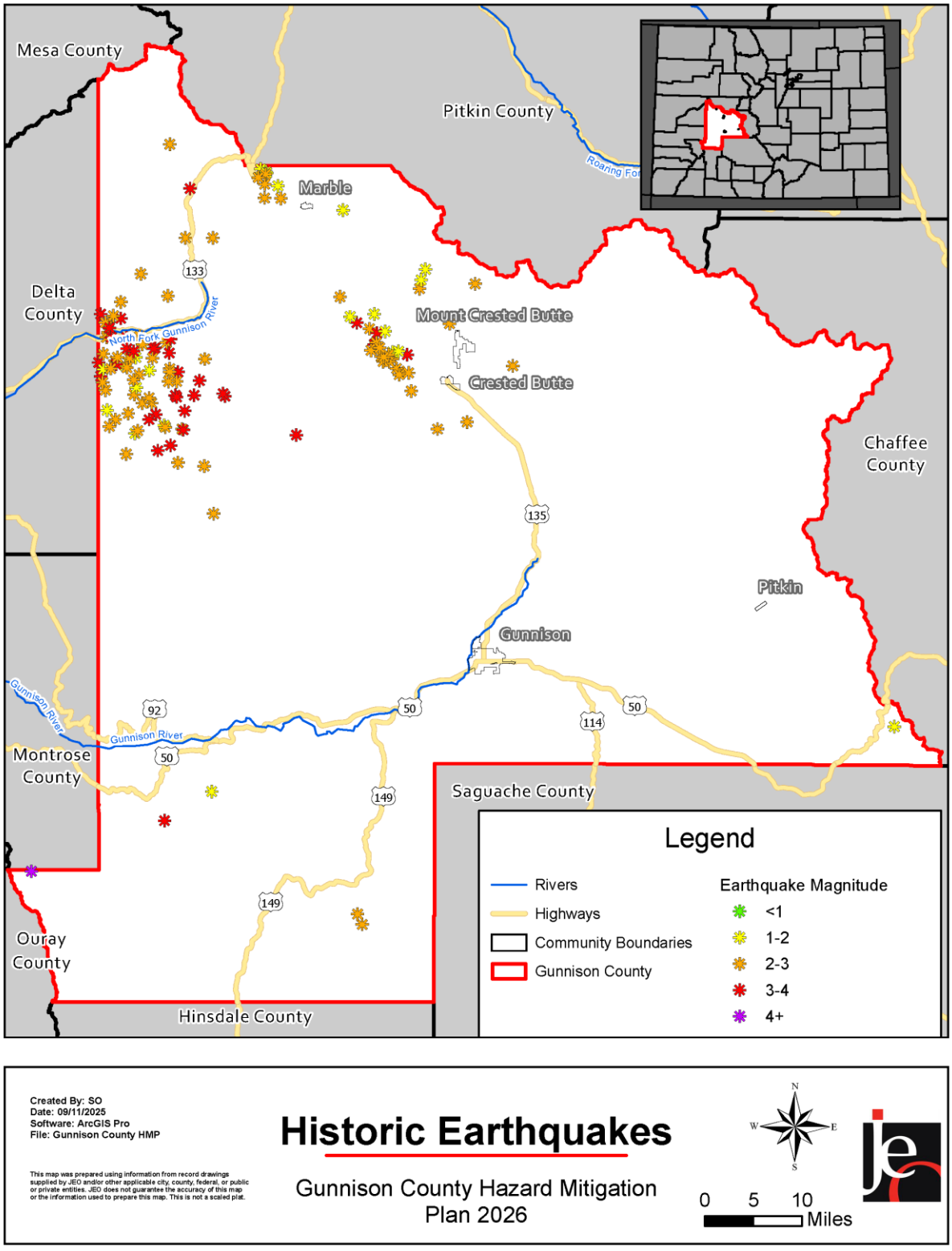
Given the historical record of earthquakes in Gunnison County (32 out of 137 years), the historical probability of an earthquake is 23 percent. The 2014 Seismic Hazard summarizes the probability of any earthquake occurring in the county in the next 50 years. Most of Gunnison County falls in the 20-30% or 14-20% range. With no recorded earthquakes over 3.6 in the last 60 years, it is unlikely that a large earthquake will occur, but small-magnitude earthquakes are expected to continue.

Historical Probability & Future Likelihood – Earthquake

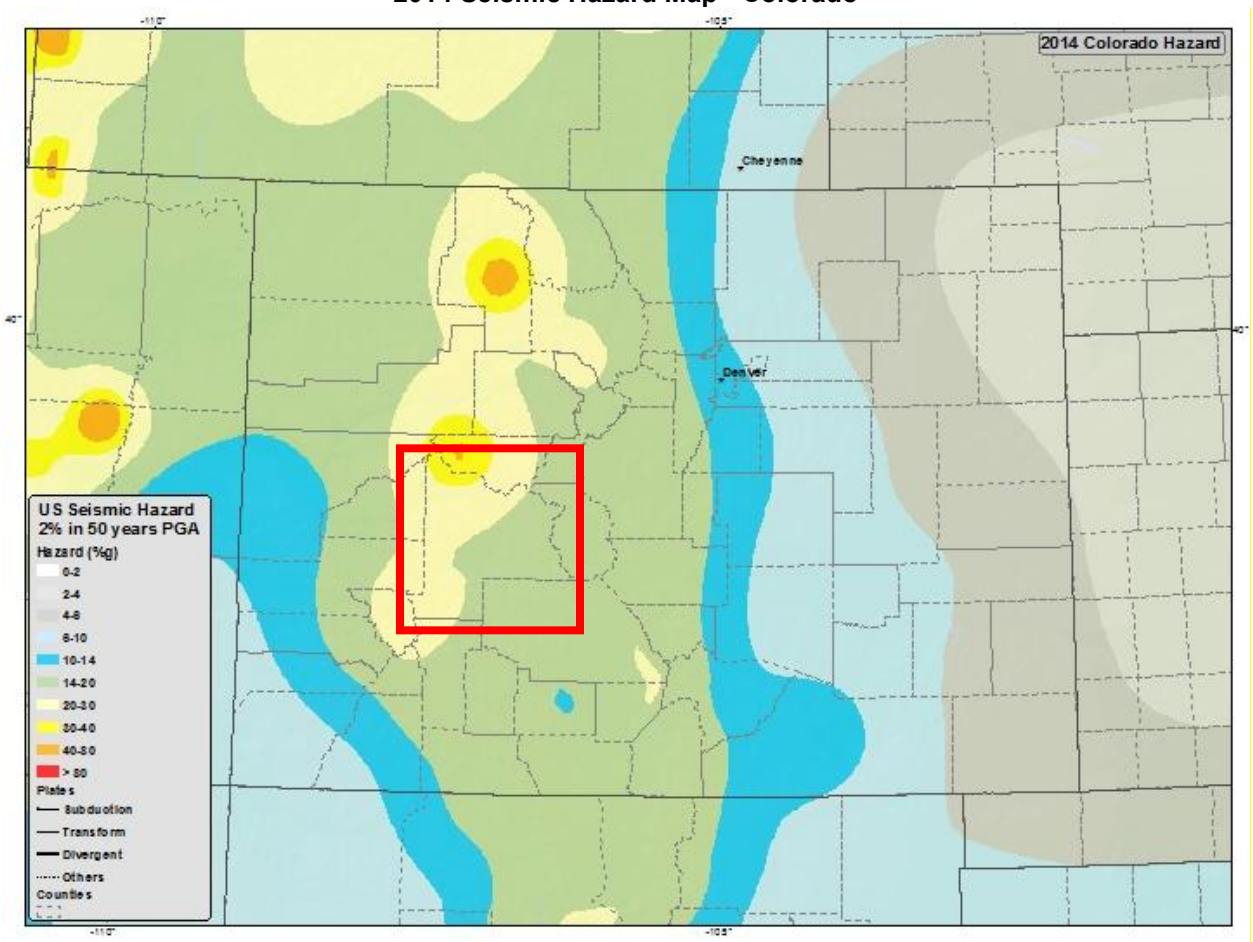
Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
23%	No Change in Frequency or Impact	Increase in Impact	**Very Likely**

39 U.S. Geological Survey. October 2025. “Search Earthquake Catalog”. https://earthquake.usgs.gov/earthquakes/search/.
40 Arizona State University. 2023. “Spatial Hazard Events and Losses Database for the United States”. https://sheldus.asu.edu/SHELDUS/.

Earthquake Events in Gunnison County



2014 Seismic Hazard Map - Colorado



Source: USGS, 2014[41]

Climate Change

There is no known direct association between climate change and earthquake events. However, as climate change exacerbates the effects of other hazard types, such as drought, it may produce more frequent or larger earthquake events. A 2017 report by NASA's Jet Propulsion Laboratory found that alternating periods of drought and heavy precipitation caused the Sierra Mountain Range in California to rise and fall as the ground swelled/contracted. The study did not specifically examine potential impacts on fault lines, but such stress changes could be felt along faults.

Future Developments

Any population growth and development in the county will not likely be dictated by earthquake risk. Any new construction built to code should be able to withstand earthquakes, but the potential for nonstructural damage will increase with new development.

41 United States Geological Survey. 2014. "2014 Seismic Hazard Map – Colorado". https://www.usgs.gov/media/images/2014-seismic-hazard-map-colorado.

Vulnerabilities

It can be assumed that all existing and future buildings and populations are at risk of earthquakes. However, building codes can help reduce the risk to structures during an earthquake. Historical structures are more at risk because many were built before code regulations.

Although the frequency of earthquakes in Colorado is relatively low, seismic events remain a potential hazard in Gunnison County due to nearby fault zones and the area's underlying geologic conditions. Even moderate earthquakes can produce significant impacts on the county's built environment and critical infrastructure.

Structural damage, injury, and loss of life are among the most serious consequences of an earthquake. Community lifelines such as hospitals, schools, and emergency service buildings, along with lifeline systems, water, power, communications, and transportation, are particularly vulnerable. Damage and loss of life can be especially severe in areas where buildings and infrastructure were not designed or retrofitted to withstand seismic forces, including many of the county's historic structures and older housing stock.

In addition to ground shaking, earthquakes can cause surface rupture, settlement, fissuring, and permanent horizontal or vertical ground displacement. Secondary hazards, such as landslides, rockfalls, liquefaction, dam failures, and fires, can compound damage and disrupt recovery efforts. Areas with steep terrain, unstable slopes, or older dams and reservoirs are at greater risk of cascading impacts.

A key challenge in managing earthquake risk is the lack of warning. Main shocks typically last only seconds and rarely exceed one minute, but aftershocks may continue for days, weeks, or months, prolonging the disruption and increasing the potential for additional damage.

While geologic studies of regional faults provide valuable information about past seismic activity, the limited historical record and infrequent occurrence of earthquakes in Colorado make it difficult to predict the timing, location, or magnitude of future events. This uncertainty underscores the importance of ongoing mitigation efforts, including enforcing seismic-resistant building standards, evaluating and retrofitting critical infrastructure, conducting public education and training, and incorporating seismic considerations into land-use and emergency planning.

Through proactive planning and community awareness, Gunnison County can reduce vulnerability and enhance resilience in the face of future earthquakes. The report shows a good correlation between the fault locations and recorded seismicity.[42]

There are also secondary impacts associated with earthquakes. They can trigger landslides, avalanches, or dam failures. Landslides triggered by seismic activity could occur on steep slopes, especially in areas like Crested Butte, Mt Crested Butte, and Marble.

42 Colorado Geological Survey. 2000. "Colorado Earthquake Information, 1867-1996". https://coloradogeologicalsurvey.org/publications/colorado-earthquake-information-1867-1996/.

County Earthquake Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death from falling objects and structures -Low-income individuals and families may lack the financial resources to improve their homes to prevent earthquake damage -Mobility-limited individuals may have difficulty evacuating or sheltering in place
Economic	-Short-term to long-term interruption of business
Built Environment	-Damage to buildings, homes, or other structures from foundation cracking, falling objects, shattered windows, etc. -Historic buildings are at an increased risk of damage
Community Lifelines	-Damage to subterranean infrastructure (i.e., waterlines, gas lines) -Damage to roadways -Many community lifeline buildings are housed in older buildings that earthquakes could more easily damage
Recreation	-Landslides or rockfalls triggered by earthquakes can cause blocked paths or injuries

Community Lifeline Potential Impacts

Earthquake Impacts

Level of Concern for Earthquakes.

The table below lists the earthquake-concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Earthquakes.

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Low
City of Gunnison	Low
Town of Crested Butte	Low
Town of Mt. Crested Butte	Low
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Low

Extreme Cold

Extreme cold varies from region to region but is generally defined as temperatures significantly below average. For this plan, extreme cold is defined as below -15°F. At -15°F, human safety decreases, and infrastructure systems begin to fail.

Location

Extreme cold can affect the entire county, with high elevations especially dangerous.

Extent

The National Weather Service (NWS) is responsible for issuing excessive cold temperature outlooks, forecasts, watches, or warnings. The NWS definitions are provided below.[43,]

- **Cold Weather Advisory: Be Aware.** A Cold Weather Advisory is issued when seasonably cold air temperatures or wind chill values are expected or are occurring. Be sure you and your loved ones dress appropriately and cover exposed skin when venturing outdoors.

- **Extreme Cold Watch: Be Prepared.** An Extreme Cold Watch is issued when dangerously cold air temperatures or wind chill values are possible. As with a Warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least half a tank of gas, and update your winter survival kit.

- **Extreme Cold Warning: Take Action!** An Extreme Cold Warning is issued when dangerously cold air temperatures or wind chill values are expected or occurring. If you are in an area with an Extreme Cold Warning, avoid going outside. If you have to go outside, dress in layers, cover exposed skin, and make sure at least one other person knows your whereabouts. Update them when you arrive safely at your destination.

Wind chills are a key factor in extreme cold situations. The NWS developed the Wind Chill Index to determine the decrease in air temperature felt by the body on exposed skin due to wind. The wind chill is always lower than the air temperature and can accelerate the onset of hypothermia or frostbite as it drops. The figure on the next page shows the Wind Chill Index used by the NWS.

In the county, the coldest months are December, January, and February. The average low temperatures for these months are all below freezing (the average low for the three months is 16.3°F). The average high temperature for these months is 28.3°F. In the county, the months with the highest temperatures are June, July, and August. The average high temperature for these months is approximately 77.7°F, while the average low temperature is 41.0°F.

43 National Weather Service. 2024. “Understanding Cold Weather Alerts”. https://www.weather.gov/safety/cold-ww.

Wind Chill Index Chart

Temperature (°F)

Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-82	-89	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

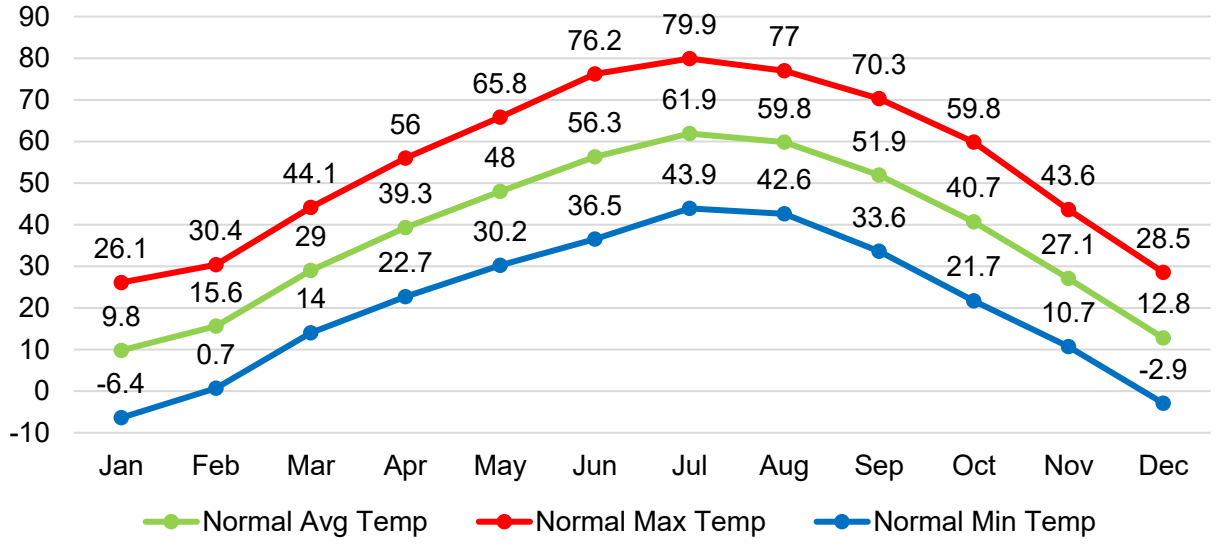
Frostbite Times — 30 Minutes — 10 MInutes — 5 Minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75($V^{0.16}$) + 0.4275T($V^{0.16}$)

T = Air Tempurature (°F) **V** = Wind Speed (mph)

Source: NWS[44]

Monthly Climate Normal Temperature (°F)



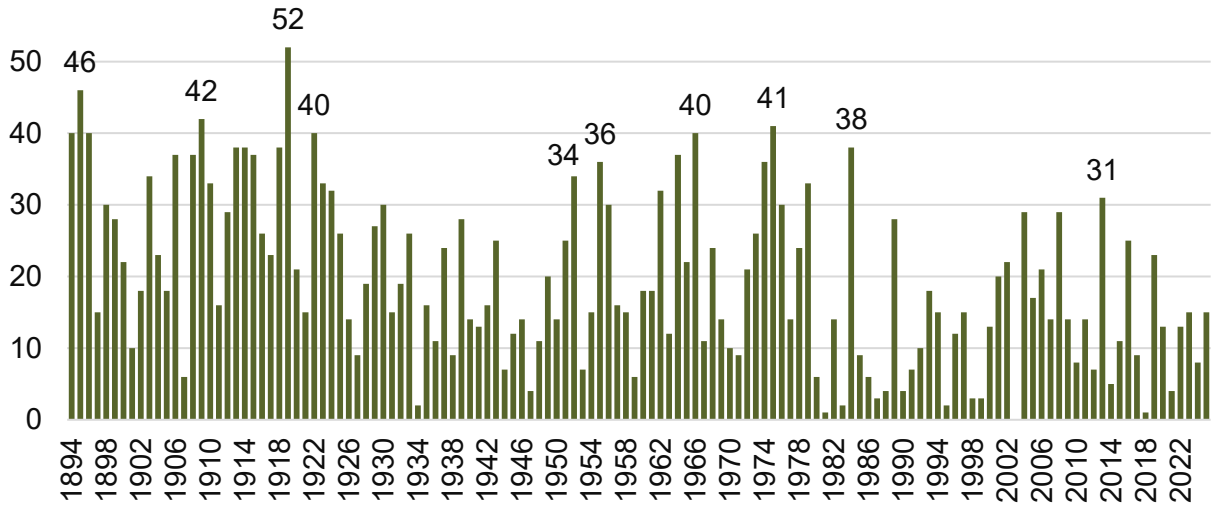
Source: NOAA, 1991-2020[45]

44 NOAA National Weather Service. 2001. "Wind Chill Chart". http://www.nws.noaa.gov/om/cold/wind_chill.shtml.
45 National Oceanic and Atmospheric Administration National Centers for Environmental Information. November 2024. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.

Historical Occurrences

According to the National Oceanic and Atmospheric Administration (NOAA), the county experiences around 19 days a year. It is important to note that this is the number of days that reached a low of -15°F or lower. The county experienced the most days on record with a low below -15°F in 1919, with 52 days.

Number of Days Below -15°F – Planning Area



Source: NOAA, 1894-2025[46]

Average Annual Losses

Average annual property and crop losses are unavailable through the NCEI Storm Events Database and other sources. The direct and indirect effects of extreme temperatures are difficult to quantify. Losses such as power outages could affect businesses, homes, and community lifelines. High demand and heavy use of heaters can overload electrical systems and damage infrastructure.

Historical Probability & Future Likelihood

Extreme temperatures are a regular part of the county's climate. With 130 of 131 years having at least one day with temperatures below -15°F, the historical probability of extreme cold is 99%. Due to anticipated impacts of climate change and future development, the future likelihood of extreme cold events are very likely in the county.

Historical Probability & Future Likelihood – Extreme Cold

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
99%	Very Little Change in Frequency and Extent	Increase Exposure	**Very Likely**

Climate Change

The Fifth National Climate Assessment found that, overall, cold extremes are becoming less frequent and milder, with fewer days below freezing. However, some studies have found that Arctic warming leads to the polar vortex spilling southward over the United States.[47] The table below shows the number of freezing days in Gunnison County with different warming scenarios.

46 National Oceanic and Atmospheric Administration ACIS. November 2024. "SC ACIS". 1947-2024. https://scacis.rcc-acis.org/.
47 U.S. Global Change Research Program. 2023. “Fifth National Climate Assessment”. https://nca2023.globalchange.gov/.

The number of freezing days is expected to remain the same despite higher warming temperatures, likely due to the county's high elevation.

Number of Freezing Days

	Warming Scenarios			
	1° C	1.5° C	2° C	3° C
Number of Freezing Days	31-180 Days per Year	31-180 Days per Year	31-180 Days per Year	31-180 Days per Year

Source: Probable Futures[48]

Future Development

Any increases in population and development will elevate exposure levels to extreme cold. There are several ways for communities to minimize the impacts of extreme cold. Communities can ensure that building codes protect against extreme cold. Many of these options can be required during new development, but can also be added to already developed areas. Facilities such as nursing homes, hospitals, clinics, and daycares should be designed with access to backup power generation. Public warming centers should be established across the planning area for residents.

Vulnerabilities

Many vulnerable communities and populations at risk face greater exposure to cold, have fewer resources to respond or escape conditions, and are more likely to suffer severe consequences if left unassisted. Populations at highest risk are those who work outside, are without shelter, are stranded, or live in poorly insulated homes or without adequate HVAC systems. Other impacts of extreme temperatures include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters; household fires, which fireplaces and emergency heaters can cause; and frozen/burst pipes. The elderly and young children are considered particularly vulnerable to the impacts of extreme cold events. Extreme cold can cause people to overuse furnaces, leading to power failures. Power outages for prolonged periods increase the risk of health events such as hypothermia and subsequent fatalities.

Extreme cold can occasionally disrupt communications facilities, and freeze-thaw cycles can severely damage roads and contribute to rockfall. Along with humans, animals also can be affected by extreme cold. Gunnison County residents can also experience difficulties from extreme cold, including burst pipes, gelled diesel engines, and delayed transit as vehicles break down.

48 Probable Futures. October 2024. “Maps of Temperature”. https://probablefutures.org/.

County Extreme Cold Vulnerabilities

Sector	Vulnerability
People	-Hypothermia Vulnerable populations include: -People working or recreating outdoors -People without adequate heating -Young children outdoors or without heating -Elderly outdoors or without heating
Economic	-Short-term interruption of business -Agricultural and livestock losses
Built Environment	-Damage to heating systems if overworked -Older buildings that may lack insulation or modern heating systems -Frozen and broken pipes -Fuel congealed
Community Lifelines	-Damages to roadways (freeze-thaw) -Stressing electrical systems (brownouts during peak usage) -Loss of power
Recreation	-People recreating outdoors for extended periods -Visitors who are unfamiliar with local temperature extremes

Community Lifeline Potential Impacts

Extreme Cold Impacts

Level of Concern for Extreme Cold.

The table below lists the extreme cold concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Extreme Cold.

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	High
Town of Crested Butte	High
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Flooding and Ice Jams

The National Weather Service defines a flood as "*An overflow of water onto normally dry land. The inundation of a normally dry area caused by rising water in an existing waterway, such as a river, stream, or drainage ditch.*" Typical river flooding gradually begins and may last days or weeks, while flash flooding may occur in minutes.

Floods can occur locally, sometimes affecting only a few streets, but can also extend throughout a large area, affecting whole drainage basins and property in multiple states. Heavy accumulations of ice or snow can also cause flooding during the melting and freezing stages. These events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are three main types of flooding in western Colorado: river flooding, flash flooding, and ice jams.

River Flooding

River floods occur when river levels rise and overflow their banks or the edges of their main channel, inundating usually dry areas. The rate of water level rise is slower than in a flash flood. However, it typically covers a larger area. River flooding in Colorado is generally caused by:

- **Snow Melt:** Most often occurs in the spring when rapidly warming temperatures quickly melt the snow. If the ground is completely saturated, melted snow runs off into nearby streams and rivers. If the rate of snowmelt is high, the volume of excess runoff will begin to exceed the capacity of the channel banks. However, this rate is highly dependent on spring weather patterns.

- **Excessive Runoff from longer-lasting rainstorms** is most likely to occur during the North American Monsoon, which typically impacts western Colorado from July through September. After prolonged rain over the same area, the ground may become saturated. Any additional rainfall at this point becomes runoff, filling nearby streams and rivers, which can cause water levels to exceed riverbanks.

Flash Flooding

Flash floods generally occur over a short period, creating a rapid rise in the water level of a stream or normally dry channel. Flash floods frequently carry mud and debris, are challenging to model, and commonly affect areas outside identified flood hazard zones. Flash flood events can be caused by the following.

- **Heavy rainfall** over a localized area is the most common cause of flash flooding. This can occur when slow-moving or multiple thunderstorms move over the same location and drop heavy precipitation over a short period. These sudden downpours can rapidly raise water levels in streams and creeks, turning small waterways into violent, raging rivers. Flash floods caused by intense rainfall may also contain significant mud and debris. Thunderstorms with the highest risk of causing this type of flash flooding typically occur during the monsoon season (June 15 – September 30).

- **Burn scar debris/mud flow** results from post-wildfire conditions, when vegetation has burned away, and soil properties are altered, leaving behind light, ashy debris and bare

ground that tend to repel water. When heavy rain falls on a burn scar, the ground cannot absorb the water, and it can flow rapidly downhill. Burn scar flash flooding frequently results in fast currents and high volumes of debris, ash, mud, and even large boulders that can overwhelm drainages and cause significant damage to homes and infrastructure.

- **Ice/debris jam release** occurs when the ice melts or the jam weakens enough for the ice to release downstream. This can result in a wall of water and a rapid rise in water levels in areas downstream.

- **Rain on snow events** result from an unusually warm storm producing rain over mountain snowpack. These events can trigger flash flooding conditions when the surface is already saturated, and all rainfall can run into nearby streams and rivers. The intensity and duration of the rain event can trigger an elevated response in snowmelt, leading to rapidly rising river/drainage levels.

Ice Jams

Ice jams occur when chunks of ice get stuck in a narrow passage of the river. The ice chunks continue to block the natural flow of water downstream, which can contribute to flooding in the surrounding area. Ice jams can form anywhere that has winter cold enough for rivers to freeze.

- **Ice/debris jam release** occurs when the ice melts or the jam weakens enough for the ice to release downstream. This can result in a wall of water and a rapid rise in water levels in areas downstream.

Location

The Gunnison River and its tributaries are the primary sources of flooding in the county. These rivers and creeks are highly susceptible to flooding driven by snowmelt and rainfall. The smaller channels that feed into creeks and rivers can quickly become overwhelmed and overtop their banks. This is especially prevalent in the winter months due to ice jams. Areas near the Town of Crested Butte and in the City of Gunnison, along Ohio Creek, Tomichi Creek, and the Gunnison River, have a high groundwater table, which can lead to basement flooding.

The table below shows the current statuses of Flood Insurance Rate Map panels. The figures on the following few pages show the mapped floodplain for Gunnison County. For jurisdictional-specific maps, please refer to *Section Eight: Participant Profiles.* While not in a mapped floodplain, the planning team identified Box Canyon as a location that floods due to narrow passages and steep terrain.

FEMA Flood Insurance Rate Map Panel Status

Jurisdiction	Panel Number	Effective Date
Gunnison County	08051C0075D, 08051C0150D, 08051C0175D, 08051C0180D, 08051C0185D, 08051C0345D, 08051C0365D, 08051C0375D, 08051C0400D, 08051C0450D, 08051C0463D, 08051C0465D, 08051C0725D, 08051C0726D, 08051C0727D, 08051C0727D, 08051C0729D, 08051C0733D, 08051C0734D, 08051C0735D, 08051C0742D, 08051C0761D, 08051C0763D, 08051C0775D, 08051C0800D, 08051C0850D, 08051C1000D, 08051C1025D, 08051C1026D, 08051C1028D, 08051C1030D, 08051C1036D, 08051C1038D, 08051C1040D, 08051C1050D, 08051C1075D, 08051C1125D, 08051C1250D, 08051C1255D, 08051C1256D, 08051C1257D, 08051C1258D, 08051C1259D, 08051C1262D,	05/16/2013

Jurisdiction	Panel Number	Effective Date
	08051C1264D, 08051C1265D, 08051C1266D, 08051C1267D, 08051C1268D, 08051C1276D, 08051C1300D, 08051C1325D, 08051C1335D, 08051C1425D, 08051C1450D, 08051C1475D, 08051C1500D, 08051C1525D, 08051C1550D, 08051C1575D, 08051C1600D, 08051C1625D, 08051C1750D, 08051C1775D, 08051C1800D, 08051C1825D, 08051C1850D, 08051C1900D, 08051C1925D, 08051C1950D, 08051C1975D, 08051CIND1A, 08051CIND2A	
City of Gunnison	08051C1262D, 08051C1264D, 08051C1266D, 08051C1267D, 08051C1268D, 08051CIND1A, 08051CIND2A	05/16/2013
Town of Crested Butte	08051C0726D, 08051C0727D, 0805CIND1A, 08051CIND2A	05/16/2013
Town of Marble	08051C0180D, 08051C0185D, 08051CIND1A, 08051CIND2A	05/16/2013
Town of Mt. Crested Butte	08051C0463D, 08051C0465D, 08051CIND1A, 08051CIND2A	05/16/2013
Town of Pitkin	08051C1335D, 08051CIND1A, 08051CIND2A	05/16/2013

Source: FEMA, 2025[49]

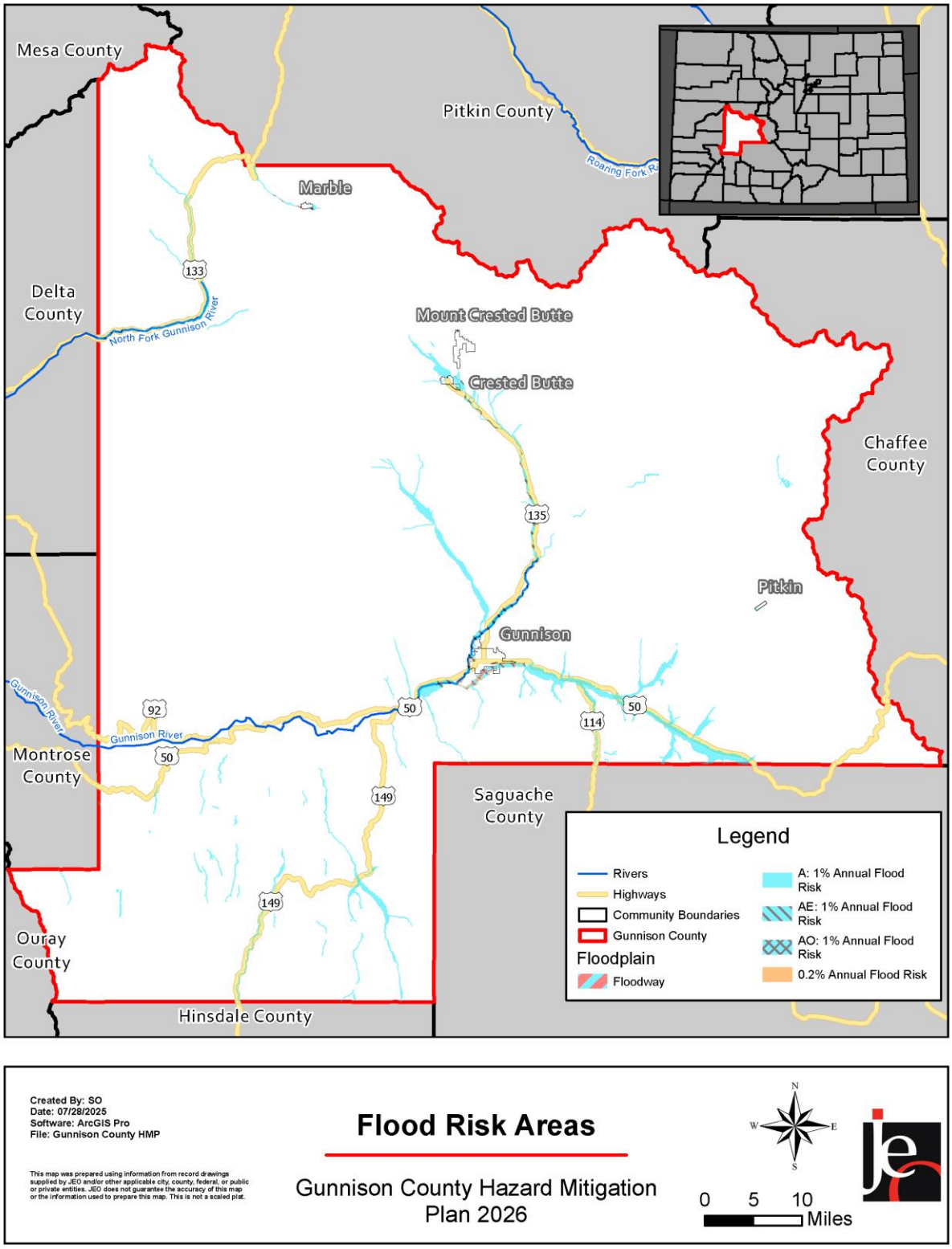
Extent

Flood events are typically described by frequency, such as the 100-year or 500-year flood. Frequencies are determined by plotting a graph of the sizes of all known floods in an area and counting how often floods of a particular size occur. Another way to express flood frequency is the chance of occurrence each year, which is the probability of flooding each year. For example, the 100-year flood has a 1% chance of occurring in any given year, while the 500-year flood has a 0.2% chance. Therefore, they are commonly called the 1% annual-chance flood and the 0.2% annual flood. It should be noted that flooding is possible every year and even multiple times each year.

Additionally, riverine flooding is common in Gunnison County, particularly during rapid spring snowmelt and rain. Flash floods occur very suddenly but usually dissipate within hours. Flash floods are typically preceded by warnings from the National Weather Service regarding flash flood advisories, watches, and warnings. According to the National Weather Service, a Flash Flood Watch is issued when conditions are favorable for a flash flood. A Flood Watch is issued when conditions are favorable for flooding. It does not mean flooding will occur, but it is possible. A Flash Flood Warning is issued when a flash flood is imminent or occurring.[50]

49 Federal Emergency Management Agency. 2025. “FEMA Flood Map Service Center”. http://msc.fema.gov/portal/advanceSearch.
National Weather Service. 2024. “Flood Warning VS. Watch”. HYPERLINK "https://www.weather.gov/safety/flood-watch-warning"https://www.weather.gov/safety/flood-watch-warning.

Flood Risk Areas – Gunnison County



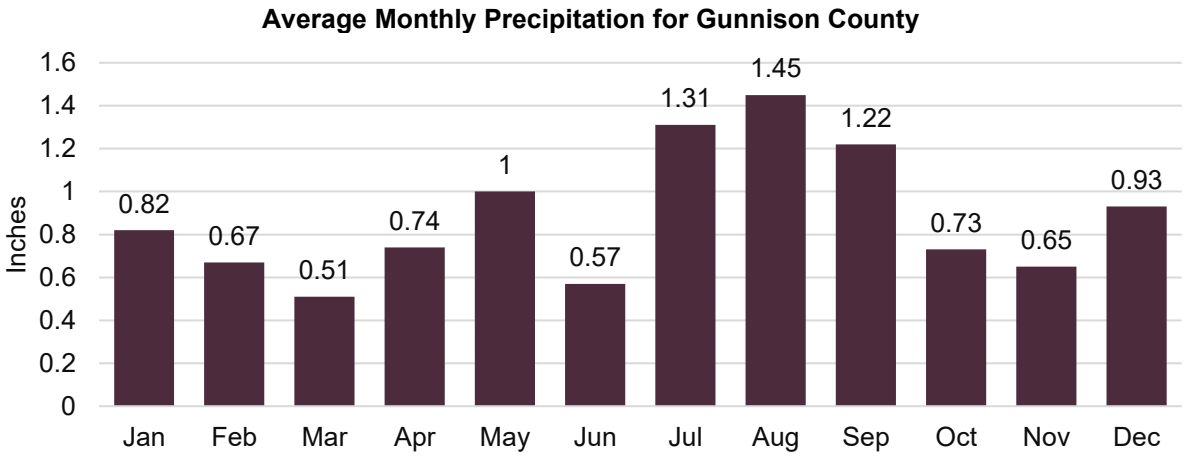
The National Weather Service has four flood severity categories, as indicated in the table below. Actual impacts will vary by community depending on the severity of the flood event and local conditions, such as the total developed area in the floodplain and the presence of existing flood risk-reduction structures.

Flooding Stages

Flood Stage	Description of flood impacts
Action Stage	Water may cause minor impacts and be a nuisance to people near the stream. Local governments or agencies may take actions to reduce property damage and danger to life.
Minor Flooding	Some property flooding and public threats may occur. Roadways, trails, parkland, and private property near the stream may become flooded.
Moderate Flooding	Flooding of structures and main roadways may occur. Residences and numerous roadways near the stream may become flooded. Evacuations may be necessary. Disruptions to daily life.
Major Flooding	Extensive flooding of structures, main roadways, and other critical infrastructure may occur. Schools, hospitals, police stations, fire stations, residences, businesses, and roadways may become flooded. Evacuations may be necessary. Significant disruptions to daily life.

Source: National Weather Service[51]

The figure below shows the normal average monthly precipitation for Gunnison County, which helps determine whether any given month is above, below, or near normal in precipitation. This does not include snowfall totals.



Source: NOAA, 1991-2020[52]

Historical Occurrences

According to the NCEI, seven flash flood events resulted in $62,000 in property damage, while 13 riverine flood events resulted in $561,500 in property damage in Gunnison County from 1996 to May 2025. These events resulted in two deaths, both occurring from the same 2019 event.[53] All of the flooding events occurred from May to August. SHELDUS data does not distinguish

51 National Weather Service. 2024. “Hydrology Terms and Definitions”. https://www.weather.gov/lot/hydrology_definitions.
52 National Oceanic and Atmospheric Administration National Centers for Environmental Information. November 2024. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.
National Centers for Environmental Information. March 2024. “Storm Events Database”. HYPERLINK "https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO"https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.

between riverine and flash flood damage. According to SHELDUS, the total crop loss is $173,414.[54] Descriptions of the most damaging flood events are listed below.

- **June 21, 2019 – Flood:** Gunnison County received significant rainfall and accelerated snowmelt due to above-normal temperatures, resulting in high, fast-flowing water on the Gunnison River. Two women died in separate recreational accidents caused by the dangerous water conditions. After both these accidented emergency personnel reiterated the importance of staying out of flood waters, as they can be fast-moving and lead to serious injuries or death.

- **April 30, 2023 – Flash Flood:** Near Paonia and Hotchkiss, accelerated snowmelt due to above-normal temperatures produced high, fast flows in the area. The runoff led to flooding near Bear Creek, where a culvert along Colorado Highway 133 failed, causing approximately $500,000 in damage and carving a gully through the road. The Colorado Department of Transportation (CDOT) had identified the culvert as vulnerable in 2020, but it remained low on a long list of repairs. The failure on April 29th allowed Bear Creek to wash out a 10-foot section of roadway, prompting CDOT to issue emergency bids for a temporary bridge, which was finished in June of 2023. Kebler Pass Road also suffered major washouts from the same runoff, with repairs led by Gunnison County Road and Bridge. The closure led to an estimated 50% decline in tourism in the area.[55]

- **May 24, 2023 – Flood:** Accelerated snowmelt from a near-record snowpack due to above-normal temperatures and precipitation produced high and fast flow on drainages in the county. As a result, flooding produced a washout on National Forest System Road #709-Coal Creek and National Forest System Road #711-Dry Fork of the Minnesota Creek located in the Paonia Ranger District. The roads remained impassable and closed. The event caused an estimated $35,000 in damage.

Average Annual Losses

The average damage per event estimate and the number of occurrences were determined from the NCEI Storm Events Database since 1996. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Flooding caused an average of $21,500 in property damage and $2,710 in yearly crop losses for Gunnison County.[56,57]

Flooding Loss Estimate

Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss [2]
20	0.7	$623,500	$21,500	$173,414	$2,710

Source: 1 Indicates data is from NCEI (1996 to May 2025)[58]; 2 Indicates data is from SHELDUS (1960 to 2023)[59]

54 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.
55 Aspen Daily News. October 2025. "Rushing water closes a highway in Gunnison County". https://www.aspendailynews.com/opinion/rushing-water-closes-a-highway-in-gunnison-county/article_a8add248-04f4-11ee-8bb1-57d0dc8688ff.html
56 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
57 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.
58 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
59 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Building Exposure in the Floodplain

The planning team acquired GIS parcel data from the County Assessor and Microsoft building footprint data to analyze the location, number, and value of buildings in the 100-year and 500-year floodplains. A summary of the results of this analysis is provided in the following tables.

Exposure in the 100-Year Floodplain (1% Annual Flood Risk Area)

Jurisdiction	Number of Structures	Total Value of Structures	Percentage of Structures
Gunnison County	803	$557,364,120	5.8%
City of Gunnison	198	$45,371,230	7.8%
Town of Crested Butte	22	$9,774,770	1.7%
Town of Marble	0	$0	0%
Town of Mt. Crested Butte	0	$0	0%
Town of Pitkin	0	$0	0%

Source: County Assessor, 2025; Microsoft, 2025

Exposure in the 500-Year (0.2% Annual Flood Risk Area)

Jurisdiction	Number of Structures	Total Value of Structures	Percentage of Structures
Gunnison County	31	$25,943,650	0.2%
City of Gunnison	78	$10,312,920	3.1%
Town of Crested Butte	0	$0	0%
Town of Marble	0	$0	0%
Town of Mt. Crested Butte	0	$0	0%
Town of Pitkin	0	$0	0%

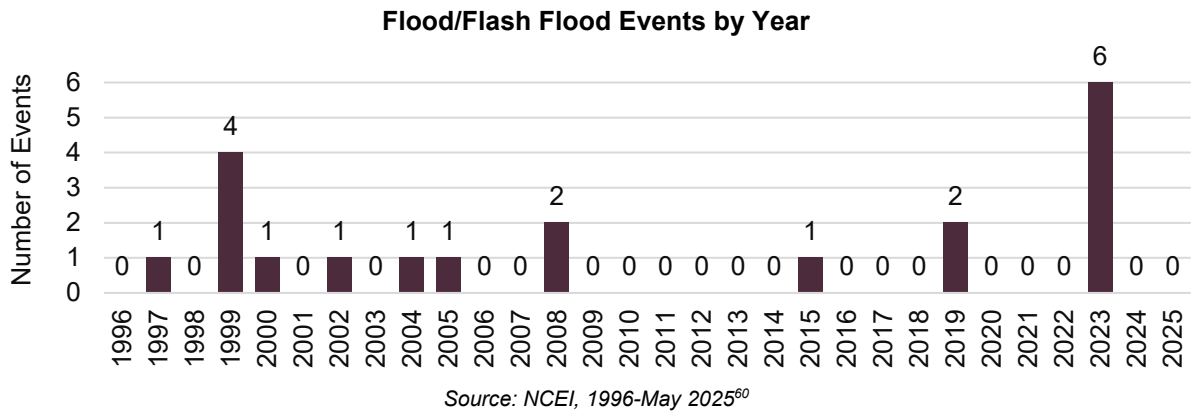
Structures identified in this table are in the 500-year floodplain but not the 100-year floodplain.
Source: County Assessor, 2025; Microsoft, 2025

Historical Probability & Future Likelihood

The NCEI reports 7 flash floods and 13 riverine flood events for a total of 20 events from 1996 to May 2025. Some years had multiple flood events. The figure below shows the events broken down by year. There is a 34% historical probability that floods will occur annually in Gunnison County. Due to the anticipated impacts of climate change and future development, the future likelihood of flooding events in the county are very likely.

Historical Probability & Future Likelihood – Flooding & Ice Jams

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
34%	Increased Frequency of Flash Flooding. Decreased Frequency of Riverine Flooding	No Impact on Frequency	**Very Likely**



Source: NCEI, 1996-May 2025[60]

Climate Change

Current climatic trends are expected to decrease summer precipitation, reducing streamflow in Colorado's major rivers. As a result, the risk of riverine flooding may be reduced. The likely decrease in snowpack and earlier snowmelt is attributed to general warming trends in mountain regions. This, combined with increased surface temperatures, would lead to earlier and larger spring runoffs, likely increasing riverine flooding during spring and early summer months and decreasing it thereafter. However, precipitation may increasingly come in the form of extreme storms. These high-intensity rainfall events could lead to increased flash-flooding, which is already a primary flooding concern for the county.[61]

A specific tool developed and utilized in the State of Colorado is the Future Avoided Cost Explorer, which assesses costs associated with flooding.[62] This tool provides an in-depth look at the potential economic impacts of flooding across specific sectors of the Colorado economy. The following table and figures show the expected consequences of flooding for the current climate and for projected "Moderate" and "More Severe Climate" impacts, with anticipated growth in Gunnison County.

Based on the Future Avoided Cost Explorer assessments, it is likely that Gunnison County will experience worsening flood impacts from climate change. At the current growth rate and only moderate climate impacts, Gunnison County may experience up to $6 million in total damages annually. Damages may vary across sectors and regions, such as bridges and buildings.

Future Avoided Cost Explorer Anticipated Damages for Flooding Matrix

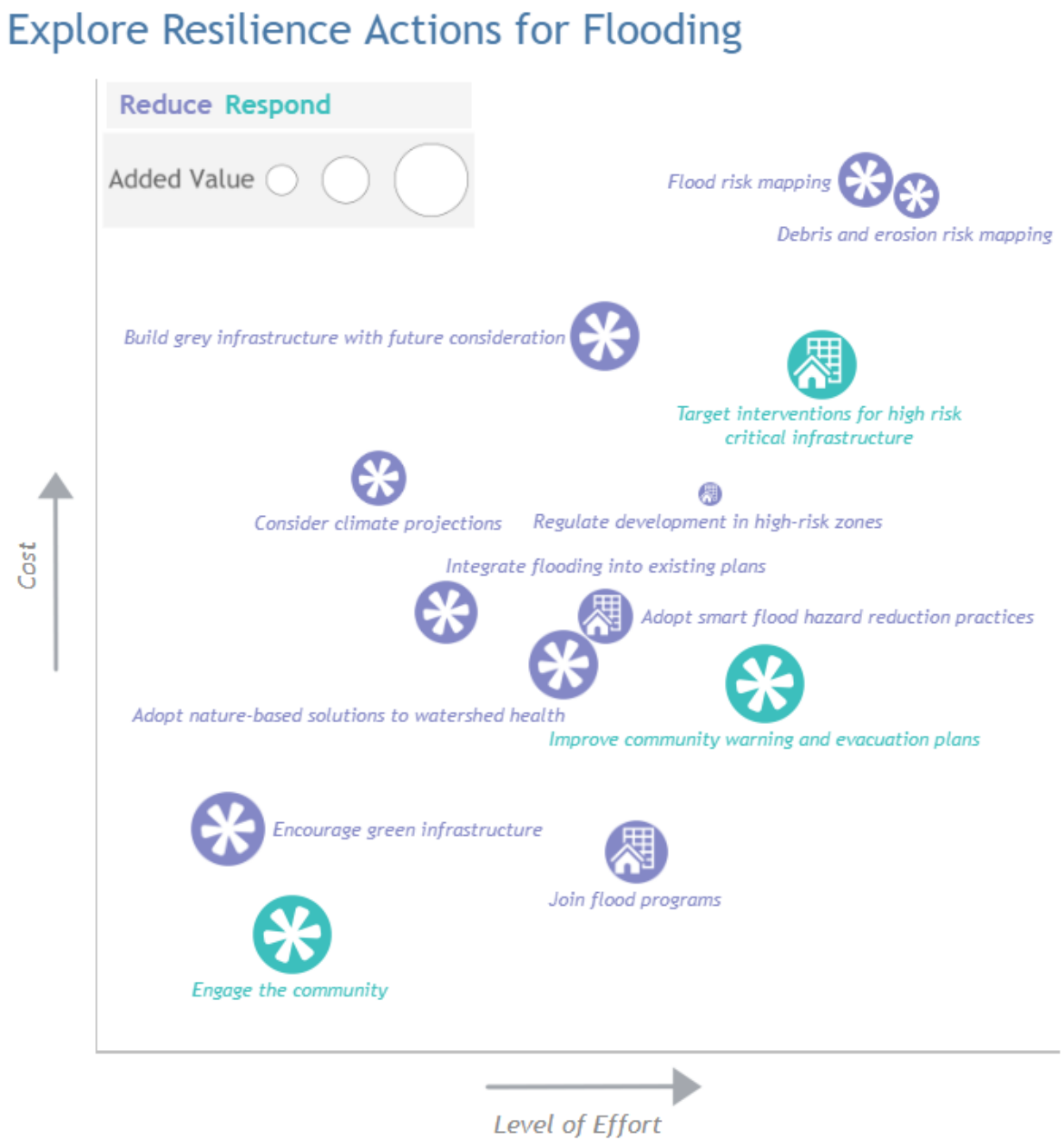
Population Scenario	Climate Scenario		
	Current Climate	Moderate Climate	More Severe Climate
Current Growth Rate	$2.9 million $180 per person	$6.0 million $370 per person	$10 million $620 per person
Low Growth Rate	$2.9 million $170 per person	$6.0 million $350 per person	$10 million $580 per person
Medium Growth Rate	$3.0 million $130 per person	$6.0 million $260 per person	$11 million $480 per person
High Growth Rate	$3.0 million $100 per person	$7.0 million $240 per person	$12 million $420 per person

Source: Colorado Water Conservation Board Future Avoided Cost Explorer

60 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
61 U.S. Global Change Research Program. 2023. "Fifth National Climate Assessment". https://nca2023.globalchange.gov/.
62 Colorado Water Conservation Board. Accessed October 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.

Suggested actions to improve resilience to flooding from Future Avoided Cost Explorer are shown in the graphic below.

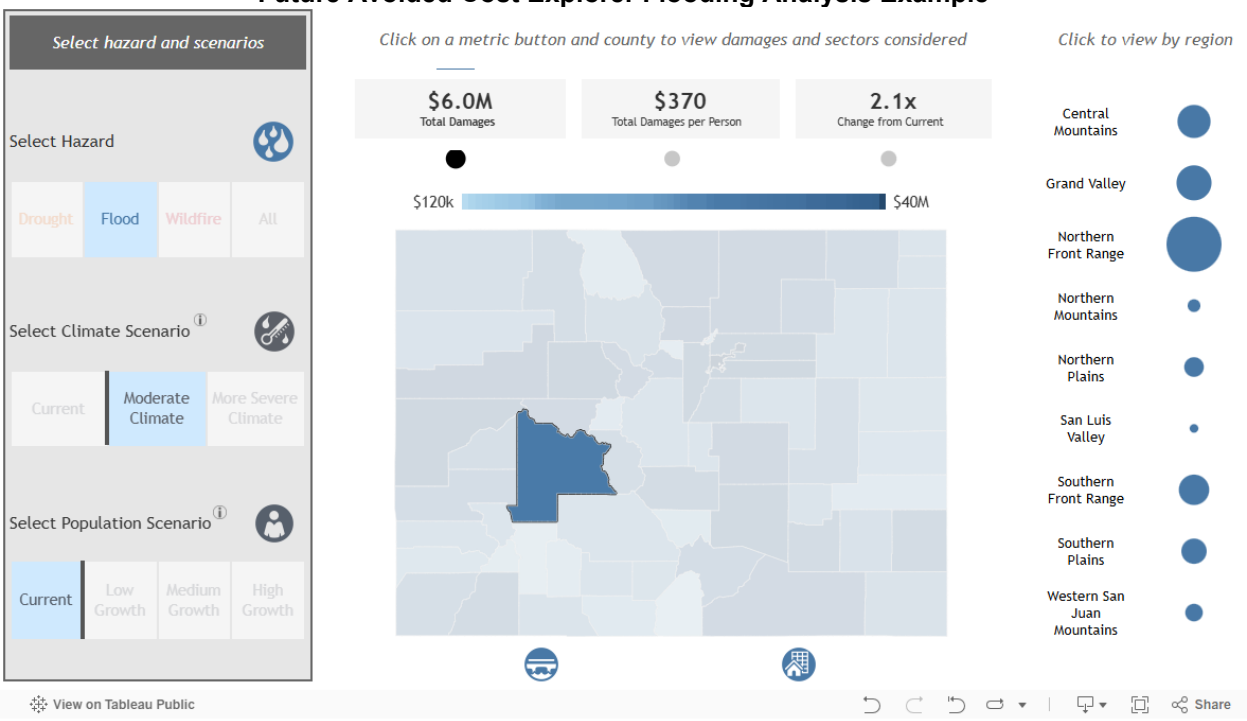
Exploring Resilience Actions for Flooding



Source: Colorado Water Conservation Board Future Avoided Cost Explorer [63]

63 Colorado Water Conservation Board. Accessed October 2024. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.

Future Avoided Cost Explorer Flooding Analysis Example



Source: Colorado Water Conservation Board Future Avoided Cost Explorer[64]

Future Development

Any future building or development inside the floodplain should be discouraged to protect future assets. Land-use regulations should be used to limit development in floodplains and other flood-prone areas, and to preserve natural flood-mitigation features. Buyout programs can eliminate properties in floodplains, especially properties that have experienced repetitive losses. Communities may also consider incorporating "Green Infrastructure" to address flooding concerns. Examples include using permeable surfaces for parking areas, installing rainwater retention swales, developing rain gardens, installing green roofs, and establishing greenways. To further reduce future flood risk, communities can implement stormwater management plans and participate in the National Pollutant Discharge Elimination System program, the National Flood Insurance Program, and the Community Rating System.

Vulnerabilities

An updated national study examining social vulnerability, as it relates to flood events, found that low-income and minority populations are disproportionately vulnerable to flood events.[65] These groups may lack the resources needed to mitigate potential flood events and to support evacuation and response. In addition, low-income residents are more likely to live in areas vulnerable to flooding but lack the resources to purchase flood insurance. The study found that flash floods are more often responsible for more injuries and fatalities than prolonged flood events.

Other groups that may be more vulnerable to floods, specifically flash floods, include older adults, those outdoors during rain events, and those in low-lying areas. Elderly residents may experience reduced or complete mobility and, as a result, be caught in flood-prone areas. Residents in

64 Colorado Water Conservation Board. Accessed October 2024. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.
65 Tate, E., Rahman, M.A., Emrich, C.T. et al. Flood exposure and social vulnerability in the United States. Nat Hazards (2021). https://doi.org/10.1007/s11069-020-04470-2.

campgrounds or public parks may be more vulnerable to flooding events. Many of these areas lie in natural floodplains and can experience rapid rises in water levels, leading to injuries or deaths.

Many tourist facilities in the county are located along the Gunnison River and could be at risk during a flood event. Roads closed due to flooding can cause severe transportation disruptions, given the limited number of roads in the county. Pipeline infrastructure could become damaged, impacting water and wastewater systems.

In total, 6 out of 112 community lifelines are within a mapped floodplain. These lifelines can be found in the *Participant Profiles Appendix*.

County Flooding Vulnerabilities

Sector	Vulnerability
People	-Low-income and minority populations may lack the resources needed for evacuation, response, or mitigation of the potential for flooding -Elderly or residents with decreased mobility may have trouble evacuating -Residents in low-lying areas, especially campgrounds, are vulnerable during flash flood events -Residents living in narrow canyons -Those without adequate notification (text alerts, sirens, internet, or cable access) may be at greater risk
Economic	-Business closures or damages -Closed tourist facilities -Closed roads would impact the commercial transportation of goods
Built Environment	-Buildings may be damaged
Community Lifelines	-Damages to roadways and bridges cause closed roads -Wastewater and water treatment facilities are at risk, particularly those in the floodplain -Pipeline infrastructure damages
Recreation	-Potential unsafe rafting, fishing, and hiking conditions -Loss of recreation tourism

Risk Mapping, Assessment, and Planning Products

Risk Mapping, Assessment, and Planning is a FEMA program that provides communities with flood information and additional flood risk data (e.g., flood depth grids, percent chance grids, areas of mitigation interest) to better protect their residents. Gunnison County has started the Risk MAP process through the Colorado Water Conservation Board. Draft floodplains have been created and are currently being reviewed by the county, communities, and stakeholders. Legal floodplain revisions are not expected to be finalized until sometime in 2027.

National Flood Insurance Program

The National Flood Insurance Program was established in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where feasible, by requiring flood-resistant design and construction practices, and by transferring the costs of flood losses to the owners of structures located in floodplains through flood insurance premiums.

In return for the availability of federally backed flood insurance, jurisdictions participating in the National Flood Insurance Program must agree to adopt and enforce floodplain management standards to regulate development in special flood hazard areas as defined by FEMA's flood maps. One of the program's strengths has been keeping people out of harm's way rather than keeping flooding away from people through historically expensive flood-control projects. The following tables summarize National Flood Insurance Program participation and active policies

within Gunnison County. Additional information about National Flood Insurance Program participation, implementation, and enforcement is located in the *Participant Profile Appendix*.

National Flood Insurance Program Participation

Jurisdiction	Participating in NFIP	Eligible-Regular Program	Date Current Map	Sanction	Suspension	Rescinded
Gunnison County	Yes	9/29/1989	5/16/2013	-	-	-
City of Gunnison	Yes	4/18/1983	5/16/2013	-	-	-
Town of Crested Butte	Yes	9/4/1985	5/16/2013	-	-	-
Town of Marble	Yes	10/1/1990	5/16/2013	-	-	-
Town of Mt. Crested Butte	Yes	5/16/2013	No Special Flood Hazard Area	-	-	-
Town of Pitkin	No	-	5/16/2013	6/20/1979	-	-

Source: FEMA[66]

National Flood Insurance Program Policies in Force and Total Payments

Jurisdiction	Policies In Force	Total Coverage	Total Losses	Total Payments
Gunnison County	92	$27,511,000	36	$113,168
City of Gunnison	44	$11,199,000	3	$6,331
Town of Crested Butte	12	$3,285,000	3	$1,197
Town of Marble	4	$1,293,000	0	$0
Town of Mt. Crested Butte	0	$0	0	$0
Town of Pitkin	-	-	-	-

Source: FEMA[67]

It should be noted that while the number of policies in force may change monthly and annually as representatives enroll, maintain, or lapse policies, the total number of losses and payments is cumulative over time.

All participating counties and communities have confirmed they will remain in good standing and continue involvement with the National Flood Insurance Program. Compliance with the National Flood Insurance Program should remain a top priority for each participant. Jurisdictions are encouraged to initiate activities above the minimum participation requirements described in the Community Rating System (CRS) Coordinator's Manual (FIA-15/2017) and its 2021 Addendum. Three jurisdictions participate in the CRS program in the county. The following table summarizes CRS participation.

66 FEMA. September 2025. "Community Status Book Report". https://www.fema.gov/cis/CO.pdf.
67 FEMA. Apil 2025. "Policy and Loss Data by Geography (HUDEX)". https://nfipservices.floodsmart.gov/reports-flood-insurance-data.

Community Rating System Program Participation

Jurisdiction	Participating in CRS	CRS Entry Date	Current Effective Date	Current Class
Gunnison County	Yes	10/1/1994	5/1/2018	9
City of Gunnison	Yes	10/1/1995	4/1/2022	7
Town of Crested Butte	Yes	10/1/2023	10/1/2023	6
Town of Marble	No	-	-	-
Town of Mt. Crested Butte	No	-	-	-
Town of Pitkin	No	-	-	-

Source: FEMA[68]

National Flood Insurance Program Repetitive Loss Structures

The Colorado Department of Natural Resources was contacted to determine if any existing properties are classified as National Flood Insurance Program Repetitive Loss Structures. Note that there are two definitions for repetitive loss structures. Severe repetitive loss is a grant definition for HMA purposes with specific criteria, while repetitive loss is a general National Flood Insurance Program definition. There is one repetitive loss property and no severe repetitive loss properties located in Gunnison County as of February 2026. Information about the property is provided below. FEMA noted that the structure is now listed as mitigated. A mitigated indicator often means that structural improvements have been made to a property that previously suffered multiple losses, reducing its vulnerability to future damage.

Repetitive Loss Structures

Jurisdiction	Repetitive Loss Structures	Structure Type	Number of Losses	Total Payments
Gunnison County	1	Single-Family Residential	2	$39,723

Source: FEMA, 2026

National Flood Insurance Program Repetitive Loss: Repetitive Loss Structure refers to a structure covered by a contract for flood insurance under the National Flood Insurance Program that has incurred flood-related damage on two occasions during 10 years, each resulting in at least a $1,000 claim payment.

National Flood Insurance Program Severe Repetitive Loss: Severe Repetitive Loss Properties are defined as single or multifamily residential properties that are covered under a National Flood Insurance Program flood insurance policy and:

(1) That have incurred flood-related damage for which four or more separate claim payments have been made, with the amount of each claim (including building and contents payments) exceeding $5,000, and with the cumulative amount of such claim payments exceeding $20,000 or

(2) For which at least two separate claims payments (building payments only) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the building.

68 FEMA. September 2025. “Community Status Book Report”. https://www.fema.gov/cis/CO.pdf.

(3) In both instances, at least two of the claims must be within 10 years of each other, and claims made within 10 days of each other will be counted as one claim.

Hazard Mitigation Assistance Repetitive Loss: A repetitive loss property is a structure covered by a contract for flood insurance made available under the National Flood Insurance Program that:

(1) Has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and

(2) At the time of the second flood-related damage incident, the flood insurance contract included increased cost-of-compliance coverage.

Hazard Mitigation Assistance Severe Repetitive Loss: A severe repetitive loss property is a structure that:

(1) It is covered under a flood insurance policy issued through the National Flood Insurance Program.

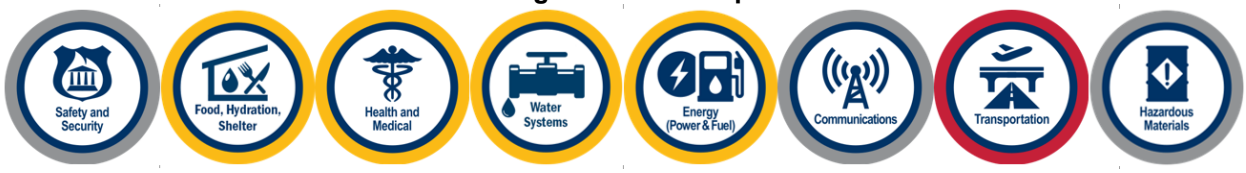
(2) Has incurred flood-related damage –

(a) For which four or more separate claims payments (including building and contents) have been made under flood insurance coverage, with the amount of each such claim exceeding $5,000 and with the cumulative amount of such claim payments exceeding $20,000, or

(b) For which at least two separate claims payments (including only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Community Lifeline Potential Impacts

Flooding & Ice Jams Impacts



Level of Concern for Flooding and Ice Jams

The table below lists the flooding and ice-jam level of concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Flooding and Ice Jams

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	High
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Ground Subsidence & Expansive Soils

Ground Subsidence

Ground subsidence is the sinking of land due to human-caused or natural underground voids and the settlement of native low-density soils. Natural causes of subsidence include the development of sinkholes, rock sliding downward along faults, natural sediment compaction, and melting of permafrost. Subsidence can occur gradually over time or virtually instantaneously. There are many types of subsidence; however, in Colorado, three warrant the most concern: settlement related to collapsing soils, sinkholes in karst areas, and ground subsidence over abandoned mines.

Collapsible soils are a group of soils that can rapidly settle or collapse the ground. The most common type of collapsible soil is hydrocompactive soil. These soils are low in density and in moisture content and are loosely packed together. Agents that bind these loosely packed particles together, such as clay and silk buttresses, are water-sensitive. When water is introduced to these soils, the binding agents may quickly break down, soften, disperse, or dissolve. This reorganizes soil particles into a denser arrangement, leading to a net volume loss and surface subsidence. Volume loss can range from 10% to 15%, resulting in several feet of surface-level displacement.

Sinkholes in karst areas are related to the dissolution of evaporite minerals or limestone. Evaporite minerals dissolve in water and include gypsum and halite. Rocks containing limestone also form sinkholes due to water dissolution. This dissolution of the rock creates caverns, open fissures, streams from bedrock, breccia pipes, subsidence sags, depressions, and sinkholes. Factors leading to the formation of sinkholes in these landscapes may be natural or may be induced by human activities. Natural factors include downward percolation of surface water or lateral movement of water within the water table. Human activities that may contribute include stream channel changes, irrigation ditches, leaking land irrigation, ponding of surface water, and mining of soluble materials through forced water circulation.

Abandoned mine subsidence is caused by the removal of minerals and rock that undermine underground support systems, leading to voids. These voids can then be affected by natural and human processes, such as caving, changes in flowage, or changes in the overlying rock and soil, leading to collapse. Hazards from these abandoned sites are complicated by the fact that many “final mine maps” are inaccurate or incomplete.

Expansive Soils

Expansive or swelling soils are soils or soft bedrock that increase in volume as they get wet and shrink as they dry out. Swelling soils contain a high percentage of clay particles that can absorb large amounts of water. Soil volume may expand ten percent or more as the clay becomes wet. The powerful force of expansion can exert pressures of 30,000 pounds per square foot or more on foundations, slabs, or other confining structures. These soils tend to remain at constant moisture content in their natural state. Exposure to natural or human-caused water sources throughout development results in swelling. In many instances, the soils do not regain their original dryness after construction but remain moist and expanded due to the changed environment.

Location

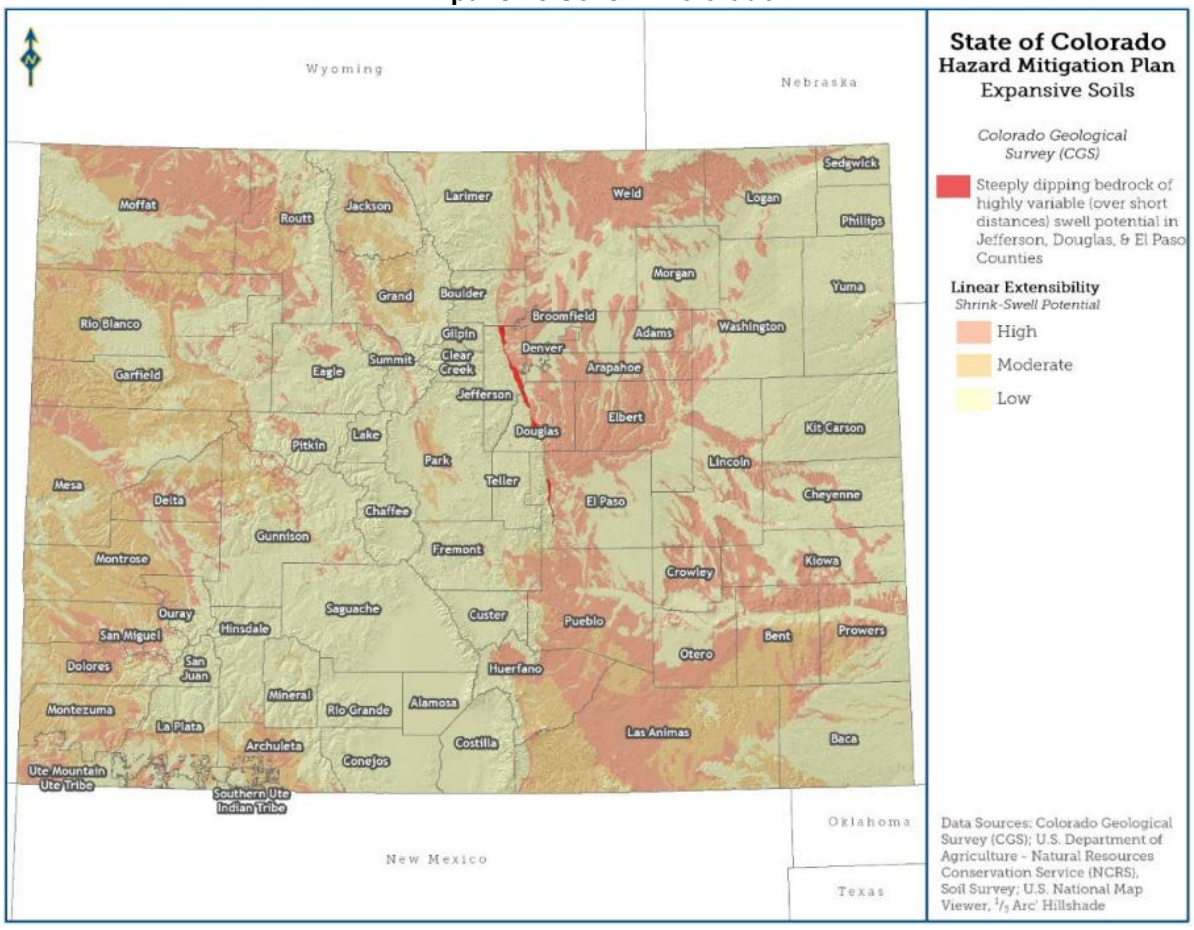
Ground Subsidence

In Gunnison County, areas prone to ground subsidence are generally associated with soluble bedrock, old mining sites, and variable groundwater conditions. The Ohio Creek Valley, Tomichi Creek Basin, and sections of the Gunnison River Valley contain sedimentary layers of limestone, shale, and gypsum that can dissolve over time, creating voids that lead to surface collapse. Historical coal mining activity near Crested Butte, Marble, and Somerset has also contributed to localized subsidence from abandoned underground workings. Additionally, fluctuations in groundwater levels, often driven by seasonal snowmelt or heavy precipitation, can accelerate soil instability, particularly in areas with alluvial deposits and reclaimed mine lands. While large, catastrophic sinkholes are relatively rare, smaller ground depressions and settlement issues are common in these geologically sensitive zones, warranting continued monitoring and careful land-use planning.

Expansive Soils

Expansive soils are located primarily in the northwest portion of Gunnison County, as shown in the figure below. Due to the softer nature of swelling clay and its increased erosion rate from wind and precipitation, expansive soils are more likely to occur in valleys, plains, and low-lying areas.

Expansive Soils in Colorado



Source: State of Colorado Enhanced HMP, 2018-2023

Extent

Ground Subsidence

Although infrequent, subsidence may occur abruptly, forming dangerous ground openings that could swallow any part of a structure that happens to lie at that location, or leaving a dangerous, steep-sided hole. According to the Colorado Geological Survey (CGS), merely an inch of differential subsidence beneath a residential structure can cause several thousand dollars of damage. Many factors affect the extent of a subsidence hazard. These may include the mine's size, the soil's susceptibility to collapse, and its composition. Areas may appear to be free of subsidence for many years, and then undergo renewed gradual or even drastic subsidence.

Expansive Soils

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than three percent; moderate if three to six percent; high if six to nine percent; and very high if more than nine percent. If linear extensibility exceeds three, shrinking and swelling can cause damage to buildings, roads, and other structures. Areas in Gunnison County are primarily rated as moderate or low risk.

Historical Occurrences

There were no reported ground subsidence or expansive soil events from the CGS, NCEI, or SHELDUS databases.

Average Annual Losses

With no historical reported subsidence or expansive soil events from the CGS, NCEI, or SHELDUS, the average annual losses for property and crops are $0.

Historical Probability & Future Likelihood

Subsidence and expansive soils are naturally occurring processes that have not been reported historically. Due to the anticipated impacts of climate change and future development, the future likelihood of a ground subsidence and expansive soils event is very unlikely.

Historical Probability & Future Likelihood – Ground Subsidence & Expansive Soils

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Ground Subsidence	<1%	Increase in Frequency	Increase in Frequency and Exposure	**Very Unlikely**
Expansive Soils	<1%	Increase in Frequency	Increase in Frequency and Exposure	**Very Unlikely**

Climate Change

It is likely that continued changes in regional climate will increase the frequency and intensity of drought and rainfall/flash-flooding events across the state. There are periods of heavy rain or prolonged dryness that can affect the frequency of soil subsidence and swelling. For this plan, it is assumed that, if current climate trends continue, subsidence events will likely increase in frequency in Gunnison County.

Future Developments

Any future development will potentially intersect subsidence hazard areas. Avoidance is generally the best mitigation solution where subsidence areas are identified. Many older sinkholes may be hidden. Only subsurface inspections, either by investigative trenching, borings, and observation made during lot grading or utility installation, can ascertain whether sinkholes exist within a development area. Ground modification and structural solutions can help mitigate the threat of localized subsidence. Drainage issues and proper water management are also important.

Any development that occurs in the county will continue to be built on soils with moderate or higher shrink-swell potential. With appropriate mitigation taken through development techniques and code enforcement, potential losses can be minimized.

Vulnerabilities

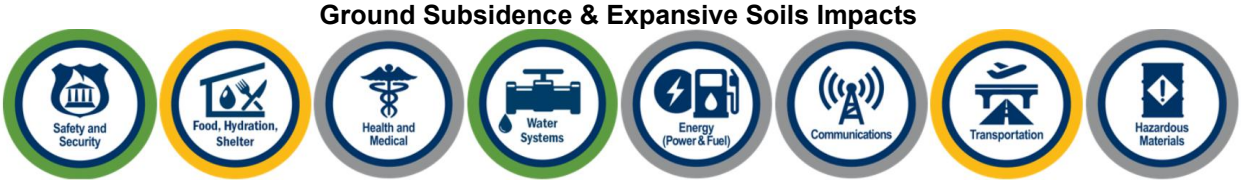
In Gunnison County, ground subsidence and expansive soils are likely to be localized, typically affecting individual built structures and infrastructure rather than causing widespread damage. Builds are likely to experience foundation cracking, settling, and structural instability. Pavement may crack or settle, and piles could break.

County Ground Subsidence & Expansive Soils Vulnerabilities

Sector	Vulnerability
People	- Residents living or traveling in areas prone to subsidence are at risk of injury - First responders performing duties after a site is impacted and unstable
Economic	-Limited due to losses of facilities or infrastructure function
Built Environment	-Localized damage to building foundations -Condemnation of damaged structures
Community Lifelines	-Damage to critical buildings -Damage to roadways -Structural damage to underground utilities and pipelines -Settling and damage to roadways -Structural damage to underground utilities and pipelines
Recreation	-Damage to trails, outdoor facilities, and other recreation opportunities

Community Lifeline Potential Impacts

Ground Subsidence & Expansive Soils Impacts



Level of Concern for Ground Subsidence & Expansive Soils

The table below lists the ground subsidence and expansive soils level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Ground Subsidence & Expansive Soils

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Low
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	None
Crested Butte Fire Protection District (Stakeholder)	Low
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Hailstorm

Hail occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. Recent studies suggest that super-cooled water may accumulate on frozen particles near the backside of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air and fall to the ground.

Hailstones grow in two ways: by wet growth or by dry growth. In wet growth, a tiny piece of ice is in an area where the air temperature is below freezing, but not super cold. When a tiny piece of ice collides with a supercooled drop, the water does not immediately freeze to the ice. Instead, liquid water spreads across tumbling hailstones and slowly freezes. Since the process is slow, air bubbles can escape, resulting in a layer of clear ice. Dry growth hailstones form when the air temperature is well below freezing, and the water droplet freezes immediately upon colliding with the ice particle. The air bubbles are “frozen” in place, leaving cloudy ice. Hailstones can have layers like an onion if they travel up and down in an updraft, or they can have few or no layers if they are “balanced” in an updraft. One can tell how many times a hailstone traveled to the top of the storm by counting its layers. Hailstones can begin to melt and then re-freeze together, forming large and very irregularly shaped hail.

Large hailstones can smash glass and dent metal, resulting in costly damage to roofs, windows, automobiles, landscaping, and crops, as well as occasional injuries. Large hail is often associated with the types of severe thunderstorms that can also produce tornadoes.

Location

The entire county is at risk of hail and its associated damage. However, the 2023 Colorado Enhanced Mitigation Plan states that there is a higher frequency of hailstorms in the eastern portion of the state and along the Front Range.

Extent

The Tornado and Storm Research Organization (TORRO) scale is used to classify hailstones and provides some detail on the potential impacts of hail. The table below outlines the TORRO Hailstorm Intensity Scale.

TORRO Hail Ranking

Scale	Intensity Category	Typical hail diameter (mm)	Typical Damage Impacts
H0	Hard hail	5	No damage
H1	Potentially damaging	5-15	Slight general damage to plants, crops
H2	Significant	10-20	Significant damage to fruit, crops, and vegetation
H3	Severe	20-30	Severe damage to fruit and crops, damage to glass and plastic structures, paint, and wood scored
H4	Severe	25-40	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	Wholesale destruction of glass, damage to tiled roofs, and a significant risk of injuries
H6	Destructive	40-60	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75	Severe roof damage, risk of serious injuries

Scale	Intensity Category	Typical hail diameter (mm)	Typical Damage Impacts
H8	Destructive	60-90	(Severest recorded in the British Isles) Severe damage to the aircraft's bodywork
H9	Super Hailstorms	75-100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: TORRO, 2017[69]

One hailstorm was reported in Gunnison County between 1996 and May 2025, according to NCEI data. It occurred in 2000, which resulted in 0.88-inch hail. Events of this magnitude correlate to an H3 Severe classification.

Historical Occurrence

The NCEI reports one hail event in the county from January 1996 to May 2025. No injuries or deaths were reported from this hail event.[70] There was $455 in crop damage from the event.[71]

Average Annual Losses

The average annual damage estimate was determined from damage records in the NCEI database since 1996. The average annual crop loss estimate was determined from SHELDUS data on recorded damages from 1960 to 2023. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Hail causes an average of $7 in crop loss per year.

Hail Loss

# of Events	Average # of Events per Year	Total Property Loss[1]	Average Annual Property Loss	Total Crop Loss[2]	Average Annual Crop Loss
1	<0	0	0	$455	$7

Source: 1 NCEI (1996-May 2025), 2 SHELDUS (1960-2023)

Historical Probability & Future Likelihood

Based on historical occurrences, the historical probability of hailstorms is 3%. Due to the anticipated impacts of climate change and future development, the future likelihood of a hail event is unlikely.

Historical Probability & Future Likelihood – Hailstorm

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
3%	Decrease in Frequency and Extent	Increase in Frequency and Exposure	**Unlikely**

69 Tornado and Storm Research Organization. 2017. "The TORRO Hailstorm Intensity Scale." https://www.torro.org.uk/research/hail/hscale.
70 National Centers for Environmental Information. May 2025. "Storm Events Database". [70] https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
71 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Climate Change

The 2023-2028 Colorado Enhanced HMP states that small hail events may become less frequent, owing to rising temperatures that cause hail to melt and fall as rain. Because of this, the extent and the likelihood of hail events are likely to decrease.[72]

Future Development

All future developments will be affected by hail. The ability to withstand impacts lies in sound land use practices and consistent enforcement of building codes and regulations for new construction. Municipalities that have adopted the current International Building Code have a lower risk of damage, as the code includes sections designed to address the impacts of hail events.

Vulnerabilities

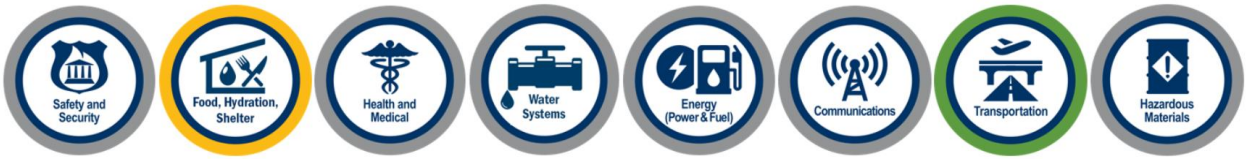
The older building stock (16.7% built before 1970) in the county is built to lower code standards or to none at all. These structures could be highly vulnerable to hail events. The following table provides information on county vulnerabilities; for jurisdiction-specific vulnerabilities, refer to *Section Seven: Participant Profiles.*

County Hailstorm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens with decreased mobility may have trouble seeking shelter -Injuries can occur from: not seeking shelter, standing near windows, and shattered windshields in vehicles -Power outages can be life-threatening to those depending on electricity for life support -Injuries to those outside, specifically hikers and campers who may not have a location to take shelter
Economic	-Damages to buildings and property can cause significant losses to business owners and employees -Damage to crops
Built Environment	-Roofs, siding, windows, gutters, HVAC systems, etc., can incur damage
Community Lifelines	-Critical buildings may sustain damage -Power outages from downed tree limbs
Recreation	-Damage to recreation areas -Hikers and other recreationalists may have trouble seeking shelter -Potential damage to recreation areas or perceptions of risk deterring tourism

Community Lifeline Potential Impacts

Hailstorm Impacts



Level of Concern for Hailstorm

The table below lists the hailstorm concern rating for each participating jurisdiction, as determined by the local planning teams.

72 Colorado Division of Homeland Security & Emergency Management. December 2023. "Colorado Enhanced State Hazard Mitigation Plan". https://drive.google.com/file/d/1MPL0Oiy-yZYDIMziTvYkR12s35FzG-G8/view.

Participant Levels of Concern – Hailstorm

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Low
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	None
Crested Butte Fire Protection District (Stakeholder)	None
Gunnison County Fire Protection District	None
Mt. Crested Butte Water & Sanitation District	Low

Hazardous Materials Release

The following description of hazardous materials is provided by the Federal Emergency Management Agency (FEMA):

> Chemicals are found everywhere. They purify drinking water, increase crop production, and simplify household chores. However, chemicals can also be hazardous to humans or the environment if used or released improperly. Hazards can occur during production, storage, transportation, use, or disposal. You and your community are at risk if a chemical is used unsafely or released in harmful amounts into the environment where you live, work, or play.[73]

Hazardous materials releases generally involve releases at fixed-site facilities that manufacture, store, process, or otherwise handle hazardous materials or along transportation routes such as major highways, railways, navigable waterways, and pipelines. Many spills also occur during the loading and unloading of chemicals.

Fixed sites involve chemical manufacturing sites, stationary storage facilities, and hazardous waste sites. The Environmental Protection Agency (EPA) requires that facilities within the state submit the types and locations of hazardous chemicals stored at each facility over the previous calendar year. This is completed by submitting a Tier II form to the EPA as required by the Emergency Planning and Community Right-to-Know Act of 1986.[74]

Likewise, through the U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA), the U.S. Department of Transportation has broad jurisdiction to regulate the transportation of hazardous materials, including the discretion to classify which materials as hazardous. These materials are placed into one of nine hazard classes based on their chemical and physical properties. The hazard schedules may be further subdivided into divisions based on their characteristics. Because the properties and characteristics of materials are crucial in understanding the dynamics of a spill during a transportation incident, response personnel need to understand the hazard classes and their divisions.

The table below shows the nine hazardous material classes according to the 2024 Emergency Response Guidebook.

73 Federal Emergency Management Agency. 2017. “Hazardous Materials Incidents”. https://www.ready.gov/hazardous-materials-incidents.
74 Emergency Planning and Community Right-to-Know Act of 1986, Pub. L. No. 116 § 10904.

Hazardous Materials Classes

Class	Type of Material	Divisions
1	Explosives	1.1 Explosives that have a mass explosion hazard 1.2 Explosives that have a projection hazard but not a mass explosion hazard 1.3 Explosives which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard 1.4 Explosives that present no significant hazard 1.5 Very insensitive explosives with a mass explosion hazard 1.6 Extremely insensitive articles which do not have a mass explosion hazard
2	Gases	2.1 Flammable gases 2.2 Non-flammable, non-toxic gases 2.3 Toxic gases
3	Flammable Liquids (and Combustible Liquids)	
4	Flammable Solids	4.1 Flammable solids, self-reactive substances, and solid-desensitized explosives 4.2 Substances liable to spontaneous combustion 4.3 Substances which, in contact with water, emit flammable gases
5	Oxidizing Substances and Organic Peroxides	5.1 Oxidizing substances 5.2 Organic peroxides
6	Toxic Substances and Infectious Substances	6.1 Toxic substances 6.2 Infectious substances
7	Radioactive Materials	-
8	Corrosive Substances	-
9	Miscellaneous Hazardous Materials/Dangerous Goods and Articles	-

Source: Emergency Response Guidebook, 2020[75]

Location

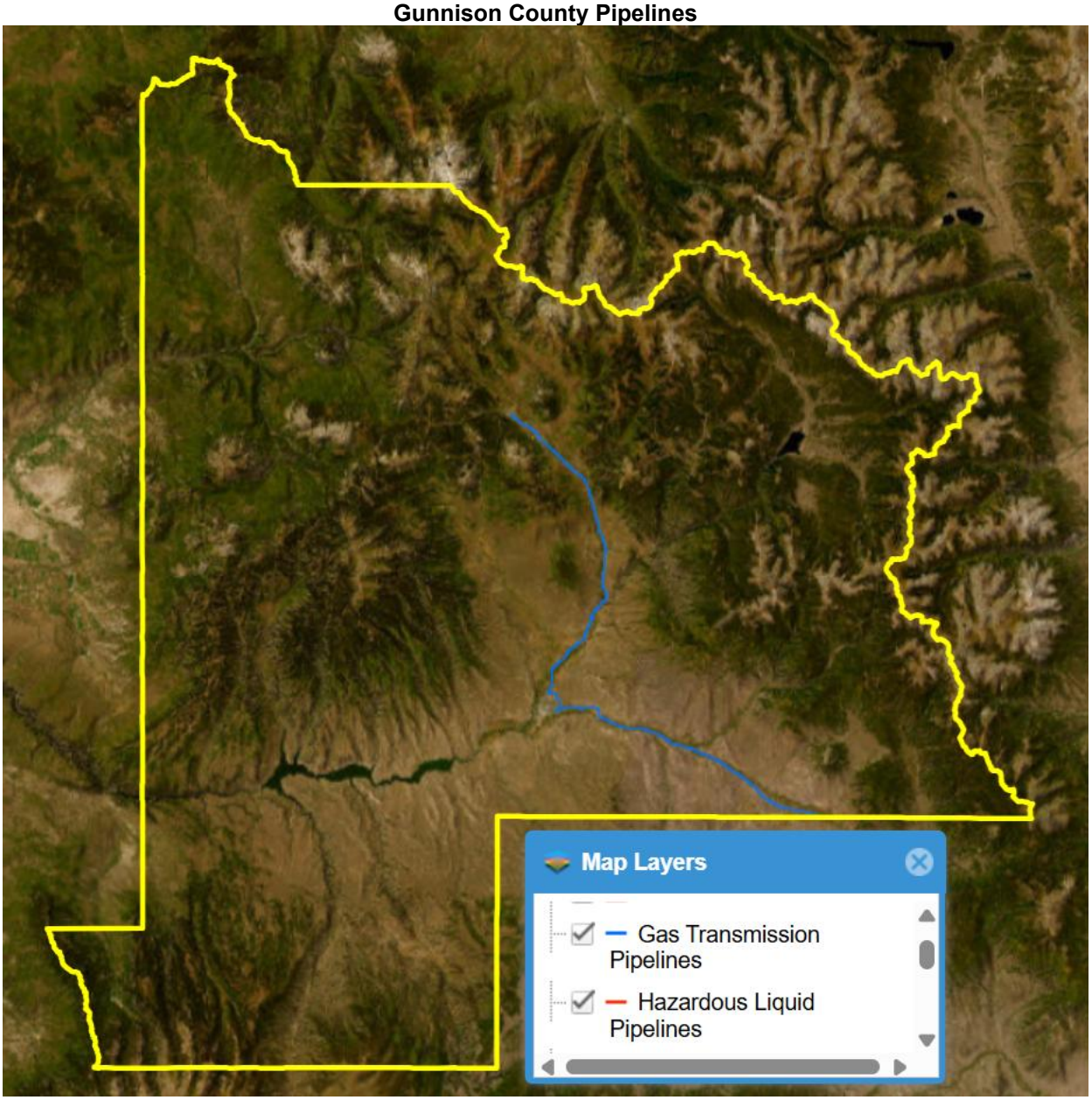
Transportation

U.S. Highway 50 is the only designated hazardous materials route through Gunnison County.[76] Since mountains and diverse terrain are part of Gunnison County, the transportation of chemicals is at higher risk of accidents due to severe weather, ice, wildlife, and debris on roadways.

Chemical transportation spills can also occur using pipelines. According to the National Pipeline Mapping System, there is one gas transmission pipeline in the county.[77] A map of the pipeline is shown below.

75 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2024. "2024 Emergency Response Guidebook". https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg.
76 Colorado State Patrol – Hazardous Materials Section. 2022. "Colorado Hazardous and Nuclear Materials Route Restrictions". https://dtdapps.coloradodot.info/staticdata/Downloads/StatewideMaps/HazMatMap.pdf.
77 National Pipeline Mapping System. July 2025. "National Pipeline Mapping System Public Viewer". https://pvnpms.phmsa.dot.gov/PublicViewer/.

Gunnison County Pipelines



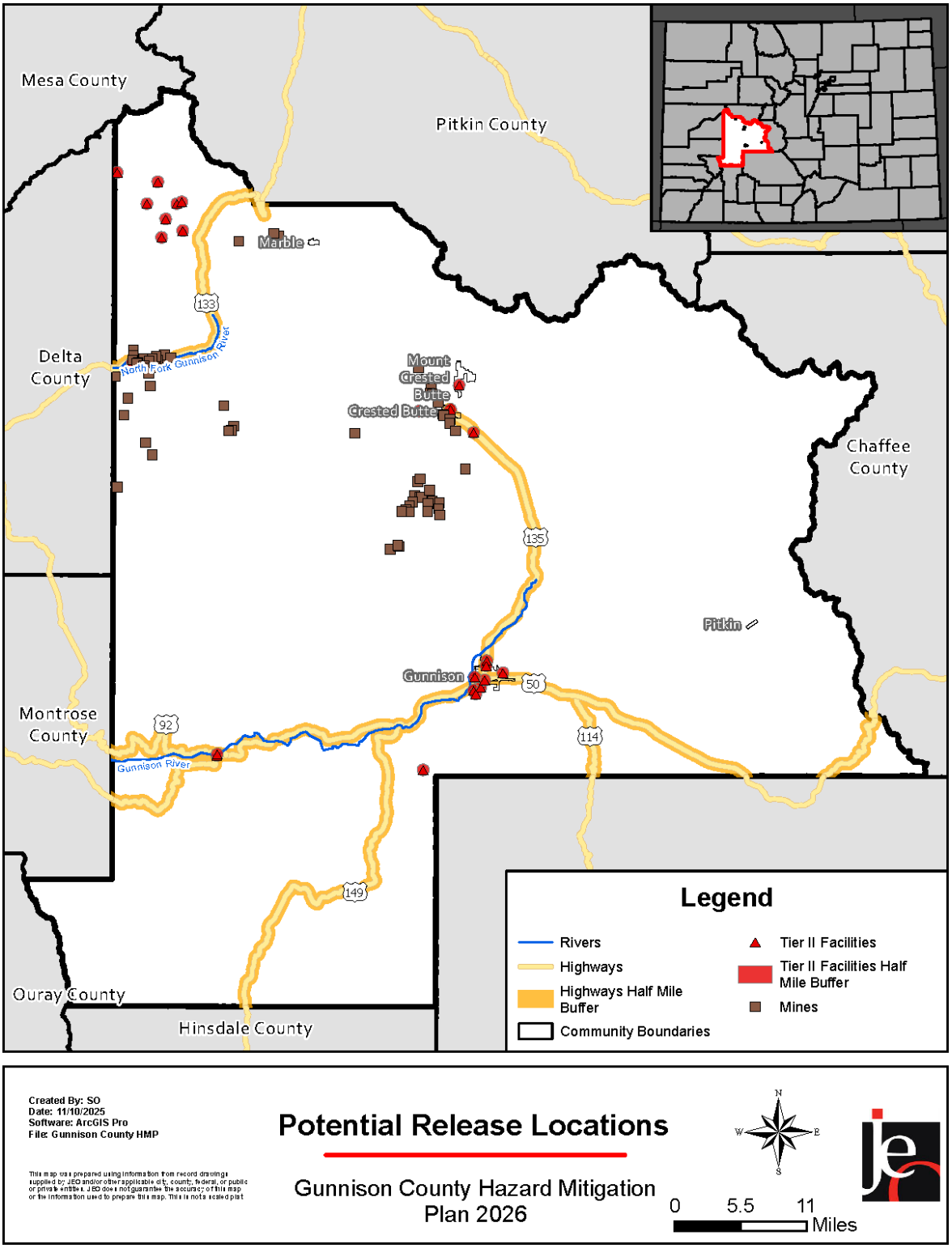
Source: National Pipeline Mapping System

Fixed Site

26 facility locations across Gunnison County submitted Tier II reports to the Colorado Department of Public Health and Environment in 2025. These locations are shown in the figure on the next page. The locations include a half-mile buffer to show the potential evacuation area during a hazardous materials release. A half mile was chosen because, in the 2024 Emergency Response Guidebook, the initial evacuation area for a "Mixed Load/Unidentified Cargo" involved in a fire is a half mile in all directions.[78] Chemical releases associated with the mining industry could also occur in Gunnison County.

78 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2024. "2024 Emergency Response Guidebook". https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg.

Potential Release Locations



Extent

The extent of hazardous material releases varies depending on the type of chemical released, with most events localized to the facility or container. Twenty-nine fixed-site and transportation releases have occurred in the county, with total amounts spilled ranging from 1 quart to 9,500 gallons.

Historical Occurrences

Fixed Site

According to the U.S. Coast Guard's National Response Center database (NRC), 20 hazardous materials releases occurred at fixed sites from 1990 to July 2025 in Gunnison County. There were no reported property damage, injuries, fatalities, or evacuations.[79] The following table displays information about each spill.

Fixed Site Hazardous Material Releases

Year of Event	Location of Release	Quantity Spilled	Material Involved	Incident Description
1990	Somerset	Unknown	Radioactive Material	Coal mine/normal operations.
1993	Crested Butte	15 gallons	Diesel Oil	Unknown, possibly a fuel hose leading to a snow cat/line ruptured or a faulty connection on the transfer hose.
1995	Marble	3,800 gallons	Oil, Fuel: No. 2-D	Storage tank/vandals opened the valve.
1996	Gunnison	25 gallons	Waste Oil	During storage or transfer of 1gal to 100gal containers, material was spilled in 5 areas ranging from 3ft to 20ft in diameter.
1998	Gunnison	Unknown	Other Oil	Irrigation system/unknown. A sheen was created on a nearby pond.
2000	Gunnison	1 quart	Oil, Misc: Lubricating	A float on a sump pump failed, causing the sump to overflow and release the material.
2000	Crested Butte	Unknown	Unknown Material	The old, abandoned mine has a huge tailing pile undergoing a chemical reaction and starting to burn.
2000	Lake Fork	750 gallons	Oil: Diesel	Due to an unknown cause, material was released from the motor of an underground sprinkler system, causing it to flow into the Gunnison River.
2002	Gunnison	Unknown	Gasoline: Automotive (Unleaded)	Caller reporting a release of material from an old gas line that had been disconnected from a storage tank.
2010	Crested Butte	Unknown	Oil, Misc: Motor	The caller stated that shop oil was observed coming out of the north side of the shop while walking past. It is believed the oil is coming from the shop's drain. The caller states there is a large oil stain in the snow above a river.

79 U.S. Coast Guard National Response Center. July 2025. "Chemical Pollution and Railroad Incidents, 1990-2025". https://nrc.uscg.mil/.

Year of Event	Location of Release	Quantity Spilled	Material Involved	Incident Description
2017	N/A	50 barrels	Drill Air Mist Fluid	Caller reported 50 barrels of air foam mist drilling fluid (does not contain hydrocarbons) from a drilling platform onto the dirt/soil.
2018	Gunnison	20 gallons	Herbicide 24d	The caller reports that the person has sprayed an estimated 20 gallons of herbicide (24D) onto the ground and into a drain. This has contaminated the well water and drinking water supply. The caller stated they had been poisoned by herbicide in the well water.
2019	N/A	125 gallons	Tack Oil (50% Diluted with Water)	Caller reported "tack oil" discharged onto soil from pavement due to heavy rainfall.
2019	Somerset	Unknown	Oil, Misc: Motor	Caller reporting that the listed SRP is using the land at a non-permitted junk/salvage yard. Srp is storing vehicles on the lot, and they are leaking oil onto the ground. This potentially can affect the North Fork Gunnison River.
2019	Somerset	Unknown	Oil, Misc: Motor	Caller reporting the SRP is using the land as a non-permitted junk/salvage yard. SRP is storing vehicles on the lot, and they are leaking oil onto the ground. This potentially can affect the North Fork Gunnison River.
2019	Marble	Unknown	Oil: Diesel	The caller reports a release of diesel fuel from a diesel tank used to power equipment at a mine located next to a creek. The caller was unsure of the amount released but was told it was about 7,000 gallons.
2020	Crested Butte	Unknown	Unknown Material (Unknown Dust Particles)	Caller states the suspected responsible party is conducting a demolition/remodeling project on a 100-year-old building that was once a restaurant, was also connected to a retail store, and had tenants who lived upstairs. The caller states the demolition activity is causing dust particles and possible asbestos to be released off-site and into surrounding properties. The activity is also making it difficult for people to breathe and causing sickness in others. This has been ongoing for over three months.
2020	Gunnison	45 gallons	Oil, Misc: Motor (Bearing Oil)	The caller reported that while filling a generator bearing tub, the tub was overfilled, causing a release of bearing oil (motor oil) into a sump pump at a hydraulic power plant facility. No waterways were impacted.

Year of Event	Location of Release	Quantity Spilled	Material Involved	Incident Description
2021		Unknown	Oil: Diesel	The caller is reporting a discharge of an unknown amount of diesel fuel onto a dirt road at the incident location. The exact source of the spill is unknown at this time. The spill on the road covers about 25 feet by 8 feet and is about 6 inches deep.
2022	Crested Butte	Unknown	Oil, Misc: Mineral	The caller is reporting a release of hydrogen sulfide, carbon monoxide, and hydrogen cyanide from a surge in a pad-mounted transformer. The caller states that the cause of the surge is unknown at this time. The caller also states that the conduit to the transformer is continuing to smolder, which could be dangerous to an old underground storage tank that may contain residual fumes. The local fire department discovered the release with their air monitoring equipment.

Source: NRC, 2024[80]

Transportation

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), nine hazardous materials releases occurred during transportation in the county between 1971 and 2025. During these events, there were no injuries, no fatalities, no evacuations, and $192,906 in damage.[81] The following table provides information about the spills.

Transportation Hazardous Material Releases

Year of Event	Location of Release	Material Involved	Amount	Method of Transportation	Total Damage
1994	Gunnison	Flammable Liquids, N.O.S.	55 LGA	Highway	$105,001
		Corrosive Liquids, N.O.S.	0 LGA		
		Flammable Liquids, N.O.S.	55 LGA		
1999	Gunnison	Fuel Oil, No. 1, 2, 4, 5, Or 6	9,500 LGA	Highway	$1,425
2008	Gunnison	Hypochlorite Solutions	220 LGA	Highway	$81,980
2014	Gunnison	Gasoline Includes Gasoline Mixed With Ethyl Alcohol, With Not More Than 10% Alcohol	0	Highway	$0
2015	Gunnison	Paint, including Paint, Enamel, Stain, Shellac Solutions, Varnish, Polish, Liquid Filler, and Liquid Lacquer Base	8 LGA	Highway	$0

80 U.S. Coast Guard National Response Center. July 2024. "Chemical Pollution and Railroad Incidents, 1990-2024". https://nrc.uscg.mil/.
81 U.S. Department of Transportation - Pipeline and Hazardous Materials Safety Administration. 1971-2025. "Incident Statistics". https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

Year of Event	Location of Release	Material Involved	Amount	Method of Transportation	Total Damage
2018	Crested Butte	Liquefied Petroleum Gas	0	Highway	$2,250
2018	Crested Butte	Liquefied Petroleum Gas	5,250 LGA	Highway	$2,250
2024	Gunnison	Isopropanol Or Isopropyl Alcohol	1 LGA	Highway	$0
2025	Gunnison	Corrosive Liquids, N.O.S.	2 LGA	Highway	$0

Source: PHMSA, 1971-2025[82]

Average Annual Losses

Using data from the tables above, average annual damage from hazardous material releases can be estimated. There have been twenty fixed-site spills in the county, as reported by the NRC, and nine transportation spills reported by PHMSA. Neither the NRC nor PHMSA tracks crop losses from chemical spills. These events resulted in reported damage of $196,546. This does not include losses from displacement, functional downtime, or economic loss.

Hazardous Materials Release Loss Estimate

Hazard Type	Number of Events	Events Per Year	Injuries	Fatalities	Total Damages	Average Annual Chemical Spill Loss
Fixed Site	20	.5	0	0	$0	$0
Transportation	9	0.2	0	0	$192,906	$3,640

Source: National Response Center, 1990-July 2025[83]*; PHMSA, 1971-2025*[84]

Historical Probability & Future Likelihood

Given the historical record of 14 years with a chemical spill out of 36 years (multiple years had two or more chemical spills), the annual historical probability of hazardous material releases at fixed sites is 39%. Due to the anticipated impacts of climate change and future development, the future likelihood of fixed-site chemical spills is likely.

Given the historical record of eight years with a chemical spill out of 55 years, the annual historical probability of a hazardous materials release during transportation is 15%. Due to the anticipated impacts of climate change and future development, the future likelihood of a transportation spill event is likely.

82 U.S. Department of Transportation - Pipeline and Hazardous Materials Safety Administration. 1971-2025. "Incident Statistics". https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.
83 U.S. Coast Guard National Response Center. July 2024. "Chemical Pollution and Railroad Incidents, 1990-2024." [datafile]. https://nrc.uscg.mil/.
84 U.S. Department of Transportation - Pipeline and Hazardous Materials Safety Administration. 1971-2025. "Incident Statistics". https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics.

Historical Probability & Future Likelihood – Hazardous Materials Release

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Fixed Site	39%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	**Likely**
Transportation	15%	Neither Increase nor Decrease in Frequency	Increase in Frequency and Exposure	**Likely**

Climate Change

Climate trends are not expected to directly affect hazardous material releases. However, future spills will likely occur as events continue to impact the infrastructure used for and by hazardous materials. For example, flash flooding is likely to increase, which could damage roadways and pipelines, leading to more spills.

Future Development

Future development will likely increase the frequency of hazardous-materials releases as more traffic and chemical storage sites are added. To reduce the risk to people and property damage, future development should encourage chemical storage and manufacturing facilities to be built away from community lifelines, such as hospitals, schools, daycares, nursing homes, and other residential areas. Likewise, residential development and locations that house vulnerable populations should be built away from major transportation corridors used for the transport of chemicals.

Vulnerabilities

Gunnison County is susceptible to accidents involving hazardous materials on roads, highways, and fixed facilities that manufacture, use, or store dangerous chemical substances. A hazardous materials release may occur during routine business operations or due to a natural disaster. The release of hazardous materials can threaten people and natural resources in the vicinity of the accident. Air releases can prompt large-scale population evacuations, and spills into water or onto the ground can adversely affect public water and sewer systems. A spill could cause road closures, which are a concern for the county due to limited access in and out. Additionally, the county's mountainous terrain and remote areas make it difficult for emergency responders to access locations quickly during an incident. Releases into the environment may require costly remediation and cause environmental damage, potentially impacting tourism and recreation in the county.

Hazardous materials in various forms can cause fatalities, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are routinely used and stored in homes. Chemicals posing a health hazard include carcinogens, toxic agents, reproductive toxins, irritants, and many other substances that can harm human organs or vital biological processes.

An analysis was performed using half-mile buffers around major transportation routes and fixed chemical sites to identify community lifelines within those buffers. The half-mile buffer was chosen because, in the 2020 Emergency Response Guidebook, the initial evacuation area for a "Mixed Load/Unidentified Cargo" involved in a fire is a half mile in all directions.[85] While some of the fixed chemical sites may not house chemical types or quantities that would require a half-mile evacuation area, this does give an idea of what may need to be evacuated until the impacted or

85 U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration. 2022. "2020 Emergency Response Guidebook". https://www.phmsa.dot.gov/hazmat/erg/emergency-response-guidebook-erg.

spilled material is identified. This does not mean that all identified community lifelines will be affected by every hazardous materials release; it merely shows that these lifelines are more vulnerable to such releases due to their proximity to these locations. In total, 86 out of 112 community lifelines are within a half mile of a major transportation route or a fixed chemical site. These lifelines can be found in the *Participant Profiles Appendix*.

County Hazardous Materials Release Vulnerabilities

Sector	Vulnerability
People	-Those near chemical fixed sites or transportation corridors could have minor to moderate health impacts -Possible evacuation
Economic	-Evacuations and closed transportation routes could impact businesses near the spill
Built Environment	-Risk of fire or explosion
Community Lifelines	-Transportation routes can be closed -Community lifelines are at risk of evacuation -Water systems could be compromised
Recreation	-Environmental damage causing a loss of tourism and recreation

Community Lifeline Potential Impacts

Hazardous Materials Release Impacts

Level of Concern for Hazardous Materials Release

The table below lists the hazardous materials release level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Hazardous Materials Release

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Low
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

High Wind

High winds typically accompany thunderstorms, winter storms, tornadoes, and other large low-pressure systems, which can cause significant crop damage, downed power lines, power outages, traffic disruptions, and considerable property damage, including trees.

There are several types of damaging winds:

- **Straight-line winds:** Any thunderstorm wind not associated with rotation; this term is used mainly to differentiate from tornado winds. Most thunderstorms produce some straight-line winds generated by the thunderstorm downdraft.

- **Downdrafts:** A small-scale column of air that rapidly sinks toward the ground.

- **Downbursts:** A strong downdraft with a horizontal dimension larger than 2.5 miles, resulting in an outward burst of damaging winds on or near the ground. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

- **Microbursts:** A small, concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally less than 2.5 miles across and short-lived, lasting only five to ten minutes, with maximum wind speeds of up to 168 mph.

- **Gust front:** A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds ahead of a thunderstorm. Sometimes, the winds push the air above them, forming a shelf cloud or detached roll cloud.

- **Bow Echo:** A bow echo is a linear wind front bent outward in a bow shape. Damaging straight-line winds often occur near the center of a bow echo. Bow echoes can be 200 miles long, last several hours, and produce extensive ground-level wind damage.

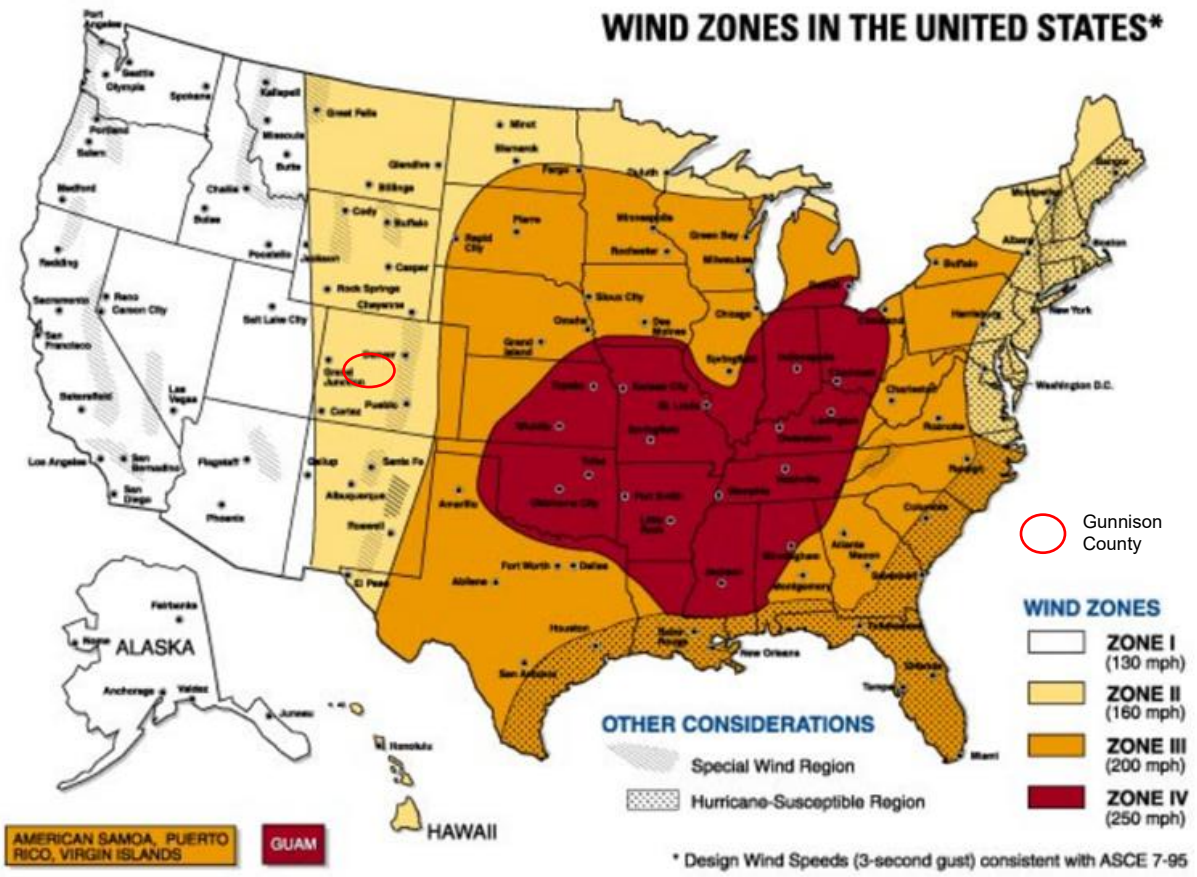
- **Chinook/Bora Winds:** Unique wintertime wind conditions typically felt in Colorado. These winds occur seasonally due to convective air movements where the Rocky Mountains meet the Great Plains. Warm, dry winds descend from the eastern slopes of the mountains, causing rapid temperature rises, snowmelt, and sometimes flooding.

High winds in Gunnison County are typically straight-line winds. Straight-line winds are generally any thunderstorm wind not associated with rotation (i.e., it is not a tornado). These winds, which can exceed 100 miles per hour, represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire counties (and multiple counties). Air pressure differences during the cold and warm seasons cause high winds in Colorado. The western part of the State typically doesn't experience the Chinook winds that impact the Front Range, but Bora winds are common in western Colorado. Bora winds are cold winds caused by a strong low-pressure system coupled with a high-pressure system to the west.

Location

High winds can occur throughout the county. The impacts would be greater in more densely populated areas, such as Gunnison, Crested Butte, and Mt. Crested Butte. Gunnison County is currently in Zone II of the U.S. wind zone map, meaning wind speeds can reach up to 160 mph.

Wind Zones in the U.S.



Source: FEMA[86]

Extent

The Beaufort Wind Scale can be used to classify wind strength. The following table outlines the Beaufort scale, including wind speed rankings, the range of wind speeds per ranking, and a brief description of the conditions for each.

86 FEMA. "Section 1: Understanding Hazards". Accessed December 2022. https://www.fema.gov/pdf/library/ism2_s1.pdf.

Beaufort Wind Ranking

Beaufort Wind Force Ranking	Range of Wind	Conditions
0	<1 mph	Smoke rises vertically
1	1-3 mph	Smoke drift indicates wind direction; still wind vanes
2	4-7 mph	Wind felt on the face; leaves rustle; wind vanes begin to move
3	8-12 mph	Leaves and small twigs are constantly moving; light flags are extended
4	13-18 mph	Dust, leaves, and loose paper lifted; small tree branches move
5	19-24 mph	Small trees in leaf begin to sway
6	25-31 mph	Large branches moving, whistling in wires
7	32-38 mph	Whole trees are moving; resistance is felt when walking against the wind
8	39-46 mph	Twigs breaking off trees generally impede progress
9	47-54 mph	Slight structural damage; slate blows off roofs
10	55-63 mph	Trees broken or uprooted; considerable structural damage
11	64-72 mph	Widespread damage; very rarely experienced
12	72+ mph	Hurricane; devastation

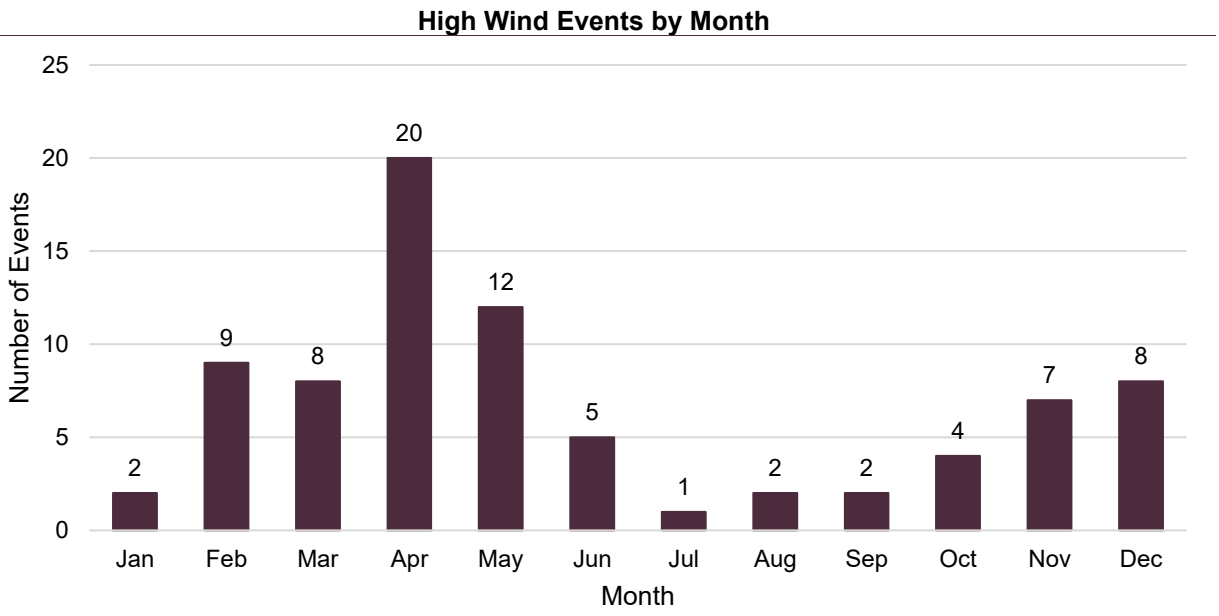
Source: Storm Prediction Center[87]

Using the NCEI-reported events since 1996, the average high wind event in the county is level 10 on the Beaufort Wind Ranking scale. The reported high wind events ranged from 35 mph to 106 mph, with an average speed of 62 mph.[88] The extent of damage from high wind events will vary depending on the severity of the event and the amount of infrastructure and development within a community or area.

Historical Occurrences

There were 82 high-wind events between 1996 and May 2025. These events resulted in $275,000 in property damage and $9,604 in reported crop damage. One death and no injuries were reported from these events. As shown in the figure below, most high-wind events occur in spring and winter.

87 Storm Prediction Center: National Oceanic and Atmospheric Administration. 1805. “Beaufort Wind Scale”. http://www.spc.noaa.gov/faq/tornado/beaufort.html.
88 National Centers for Environmental Information. May 2025. “Storm Events Database”. https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.



Source: NCEI, 1996-May 2025

Event descriptions from NCEI for the events that caused the most damage and the highest magnitude are provided below.

- **May 21, 2002** – Strong gradient winds caused damage to multiple homes and businesses in the area. Numerous trees were blown down near Montrose. An estimated $100,000 in property damage was reported from this event.

- **February 18, 2016** – Winds gusted from 60 to 80 mph across mountain passes and ridgetops in the Gunnison County area. One of the peak wind gusts, 117 mph, was measured by an automated weather station in Crested Butte.

Average Annual Losses

The average damage per event estimate was determined using the NCEI Storm Events Database from 1996 onward. SHELDUS data reports an estimated $9,604 in crop damage from high wind events between 1960 and 2023. These sources do not include losses from displacement, functional downtime, economic loss, injury, or loss of life. It is estimated that high wind events can cause an average of $9,483 per year in property damage and $150 and per year in crop damage.

High Wind Losses

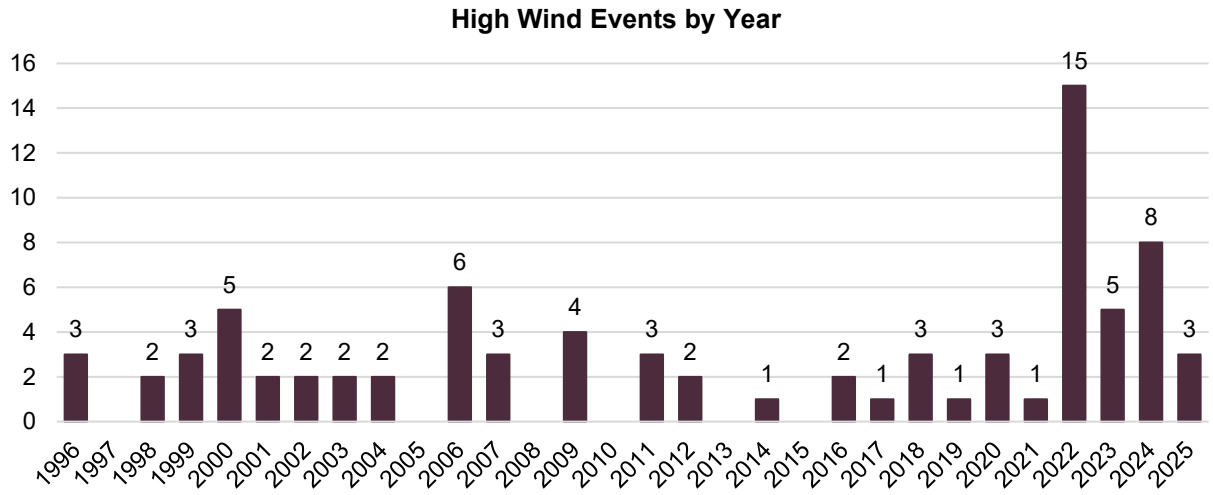
Number of Events[1]	Average Events Per Year	Total Property Loss[1]	Average Annual Property Loss [1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
82	2.8	$9,483	$14,033	$9,604	$150

Source: 1 Indicates data is from NCEI (Jan 1996 to May 2025)[89]; 2 Indicates data is from SHELDUS (1960 to 2023)[90]

89 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
90 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Historical Probability & Future Likelihood

Given the historical record of high temperatures in Gunnison County, as shown in the figure below (24 out of 29 years), the historical probability of a high wind occurrence is 83 percent. Due to the anticipated impacts of climate change and future development, the future likelihood of a high-wind event in the county is very likely.



Source: NCEI, 1996-May 2025

Historical Probability & Future Likelihood – High Wind

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
83%	No Impact on Extent and Frequency	Increase in Frequency and Impacts	**Very Likely**

Climate Change

For extreme events like high winds, there is uncertainty about how climate change will affect this hazard.[91] However, the location, extent, and frequency of high wind events are not projected to change. It is unknown whether the duration of these events will be affected by climate change, according to the Colorado Enhanced State Hazard Mitigation Plan.

Future Development

Any future development and population growth will elevate exposure of property and people to the impacts of tornadoes and high winds. Future development should take steps to reduce potential damage from these events. Building codes for new structures can be strengthened by requiring increased rebar in foundations, enhanced nailing patterns for wall sheathing, the use of Simpson Strong Ties and Straps, and the use of anchors and tie-downs for mobile homes. Additionally, individuals can choose to build an option Code Plus Standard, such as Fortified for Safer Living, or construct a tornado shelter on their property. The installation of public shelters to protect residents caught outside or in vulnerable areas, such as mobile home parks, can increase residents' safety in those areas. Development regulations that require safe rooms, basements, warning sirens, or other structures that reduce people's risk would also help decrease vulnerability.

91 Colorado Division of Homeland Security and Emergency Management. 2023. “Enhanced State Hazard Mitigation Plan (E-SHMP).” https://mars.colorado.gov/mitigation/enhanced-state-hazard-mitigation-plan-e-shmp.

Vulnerabilities

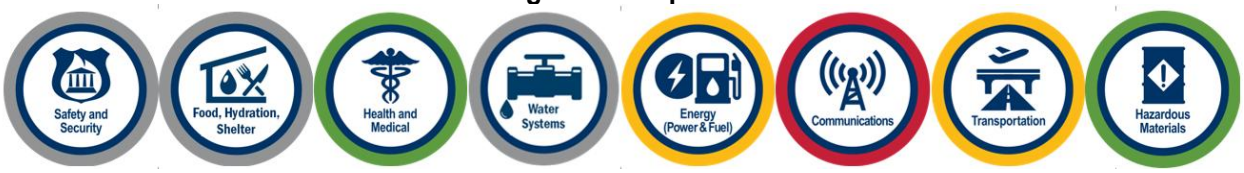
High winds can significantly impact power infrastructure. Downed power lines and poles can cause prolonged power outages. Long-term power outages also have cascading effects on nearly every sector of the county. High winds can also cause significant tree damage. Downed limbs can block roadways, making travel more difficult. Windstorms can also contribute to extreme fire behavior and impact the strength of winter weather events. During high-wind events, wildfires can spread rapidly due to blown embers, making containment nearly impossible.

High Wind Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include those living in mobile homes (especially if improperly anchored), nursing homes, schools, or in substandard housing -People outside during events -Populations dependent on electricity for medical reasons may be at risk
Economic	-Agricultural losses to both crops and livestock -Damages to businesses and prolonged power outages can cause significant impacts to the local economy, especially with EF3 tornadoes or greater
Built Environment	-All building stock is at risk of significant damages
Community Lifelines	-Downed power lines and power outages -All above-ground infrastructure is at risk of damage -Impassable roads due to debris blocking roadways -All community lifelines are at risk of damage
Recreation	-People engaging in outdoor activities are at higher risk of injury or loss of life from wind events -High wind events at higher elevations might also bring debris and dust, increasing risks for hikers and campers -Campsites with structures not securely anchored to the ground

Community Lifeline Potential Impacts

High Wind Impacts



Level of Concern for High Wind

The table below lists the high-wind level of concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – High Wind

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Landslides/Rockfall/Debris Flow

Landslides
Typical landslides are the downward and outward movement of soil, rocks, vegetation, and other debris. Landslides may also be called slumps, rockslides, debris slides, lateral spreading, debris avalanches, earth flows, and soil creep. The size of a landslide usually depends on the geology and landslide-triggering mechanism. Landslides initiated by rainfall tend to be smaller, while those triggered by earthquakes may be very large.

Landslides are typically triggered by periods of heavy rainfall or rapid snowmelt. Earthquakes, changes in hydrology, vegetation removal, and excavations may also trigger landslides. Certain geologic formations are more susceptible to landslides than others. Human activities, such as grading steep slopes, extensive irrigation, artificial fill, vegetation removal, construction of impermeable surfaces, and groundwater withdrawal, can also increase susceptibility to landslide events. Landslides on steep slopes are more dangerous because movements can be rapid. Some characteristics that determine the type of landslide are the slope of the hillside, moisture content, and the nature of the underlying materials.

Slow-moving landslides can occur on relatively gentle slopes and cause significant property damage. However, slow-moving landslides are far less likely to cause serious injuries than rapidly moving ones, which can leave little time for evacuation.

Rock Falls
Rock falls occur when blocks of material come loose on steep slopes. Weathering, erosion, or excavations, such as those along highways, can cause falls where the road has been cut through bedrock. They are fast-moving, with the materials free-falling or bouncing down the slope. The volume of material involved could be large or small, and the velocity of the fall may cause significant damage. Rockfalls can threaten human life, impact transportation corridors and communication systems, and damage other property. Spring is typically the rockfall season in Colorado as snow melts and saturates the soil, and temperatures enter freeze/thaw cycles.

Debris Flow
Debris flows are fast-moving landslides and often strike unexpectedly. These typically occur during periods of intense rainfall or rapid snowmelt along hillsides and mountains. A debris flow can travel at speeds up to 35 mph and carry large materials such as boulders, trees, and cars. Areas burned by wildfires are susceptible to debris flow, including areas outside and downslope of the burned area. Debris flows can also enter steep stream channels and travel miles to areas unaware of the hazard.[92]

Location

In 2002, the Colorado Geological Survey created the Critical Landslides of Colorado document that lists and ranks Colorado's most severe landslide, rockfall, and debris flow hazards. Areas are grouped by relative severity into three tiers:

92 U.S. Geological Survey. 2025. "What is a debris flow?" https://www.usgs.gov/faqs/what-a-debris-flow.

- **Tier One** listings are serious cases needing immediate or ongoing action or attention because of the severity of potential impacts.
- **Tier Two** listings are very significant but less severe; or where adequate information and/or some mitigation is in place; or where current development pressures are less extreme.
- **Tier Three** listings are similar to Tier Two but with less severe consequences or primarily local impacts.

The following areas were identified in the document for Gunnison County.[93] Additional information about each location can be found in the Critical Landslides of Colorado document.

- Tier One Landslide Area – North Fork of Gunnison River from Hotchkiss to the Paonia Reservoir
- Tier One Landslide and Rockfall Corridor – Black Mesa Colorado Highway 92
- Tier One Landslide Area – East Muddy Creek above the Paonia Reservoir
- Tier One Landslide Area – Red Creek along the north shore of the Blue Mesa Reservoir
- Tier One Debris Flow and Rockslide Area – Town of Marble
- Tier Three Landslide Area – West side of McClure Pass along Lee Creek

Other specific locations related to landslides, rockfalls, and debris flows are discussed below.

Landslides

Due to the mountainous topography, nearly all areas of Gunnison County with sloping terrain may experience landslide and rockfall hazards. Three high-risk areas for landslide activity identified in previous hazard mitigation plans are Muddy Creek, Ohio Creek along County Road 730, and Slate Creek in Marble. There are other landslide areas in and around the City of Gunnison, Highway 135, the Town of Mt. Crested Butte, and the Town of Crested Butte. Below is a map of known landslide locations in Gunnison County.

Rockfall

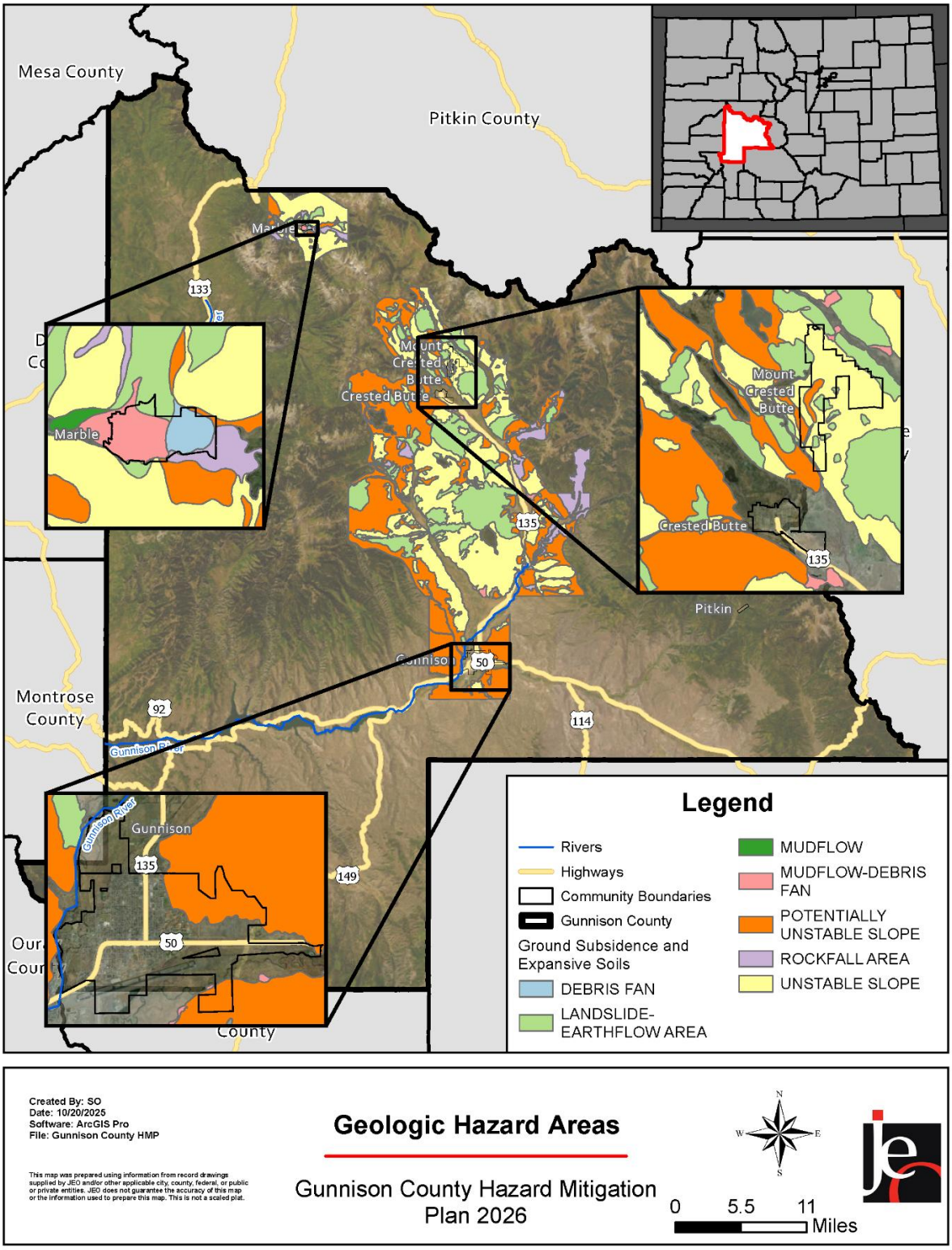
Rockfall hazard areas in Gunnison County are usually marked by fist- to boulder-sized rocks that accumulate below cliff areas, steep slopes, or talus fields on mountainsides. Steep slopes in the county are prone to this hazard, particularly around the Town of Marble and County Road 742. The map below shows known rockfall areas in the county.

Debris Flow

Debris flows can occur suddenly and quickly, typically impacting areas downslope of areas that experienced heavy rain or wildfires due to the barren landscape post-fire. Debris flows are known to start on slopes as low as 15 degrees, with faster events occurring on steeper slopes. About two-thirds of debris flows originate in hollows or troughs at the heads of small drainages and eventually travel downslope, collecting debris along the way. Debris flows tend to follow stream courses and spread out into flatter areas.[94] Gunnison County has mapped known debris-fan, mudflow, and mudflow-debris-flow-fan locations. Those locations are shown on the map below. Most of the locations are in and around the Town of Marble and near the Town of Mt. Crested Butte.

93 Colorado Geological Survey. 2002. "Critical Landslides of Colorado". https://coloradogeologicalsurvey.org/publications/critical-landslides-colorado/.
94 Colorado Geological Survey. 2021. "HAZ-2021-01 Post-wildfire hazards: mud slides :: debris flows." https://coloradogeologicalsurvey.org/publications/post-wildfire-mud-slides-debris-flows/.

Geologic Hazard Areas in Gunnison County



Extent

Landslides and Debris flows can be massive or disturb only a few cubic feet of material. Much of the extent depends on several contributing factors, including slope, vegetation, drainage, and soil type. Most events in Gunnison County are likely to cause limited property damage, no deaths or injuries, and little or no impact on community lifelines. However, events near populated areas or key infrastructure may have significant consequences.

A rockfall can be as small as one rock the size of a baseball to multiple rocks the size of a home. Rockfall on roadways can also present a risk to human life. Road obstructions can lead to motor vehicle accidents and traffic delays.

Historical Occurrences

According to SHELDUS data, there were 11 reported landslide, rockfall, and debris flow events in Gunnison County between 1960 and 2023. All of the reported events were documented as landslides. These events resulted in $71,083 in property damage, with no deaths or injuries reported.[95] It should be noted that these are not the only events to occur in the county; they are only the ones reported due to damage. The actual number of events is likely much higher, but they have occurred in remote areas or did not cause any damage. The Colorado Geological Survey has a map of known historical landslide events from different authors. It shows hundreds of historical landslide areas in the county. However, this data is not available for download, so the exact number is not known. The online only map can be found here:

https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=9dd73db7fbc34139abe51599396e2648.

According to the Marble Historical Society, a severe mud flow in Carbonate Creek destroyed the center of town in 1941. Another large mudflow in 1945 caused extensive damage to the town.[96] Due to the age of the events, additional information is not available.

Average Annual Losses

According to SHELDUS and local reports, 11 landslide events, 0 rockfall events, and two debris flow events were reported in Gunnison County from 1941 to 2023. These events resulted in $71,083 in property damage and no reported crop loss. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Landslide/Rockfall/Debris Flow Losses

Hazard	Number of Events	Average Events Per Year	Total Property Loss	Average Annual Property Loss	Total Crop Loss	Average Annual Crop Loss
Landslide	11	0.2	$71,083	$1,111	$0	$0
Rockfall	0	0	$0	$0	$0	$0
Debris Flow	2	0.02	$0	$0	$0	$0

Source: SHELDUS (1960 to 2023)[97], Local Reports

95 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.
96 Marble Historical Society. 2010. "Timeline". https://marblehistory.org/?page_id=8.
97 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Historical Probability & Future Likelihood

Given the historical record of landslide occurrences (6 out of 64 years), the historical probability of a landslide is 9%. Given the historical record of debris flow events (2 out of 83 years), the historical probability of debris flow is 2%. With no recorded rockfall events, the historical probability is less than 1%. However, the number of these events is likely much higher, as many are unreported. Due to the anticipated impacts of climate change and future development, the future likelihood of a landslide, rockfall, or debris flow event is likely to very likely.

Historical Probability & Future Likelihood – Landslide/Rockfall/Debris Flow

Hazard	Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
Landslide	**9%**	Increase in Frequency	Increase in Frequency and Exposure	**Very Likely**
Rockfall	**<1%**	Increase in Frequency	Increase in Frequency and Exposure	**Likely**
Debris Flow	**2%**	Increase in Frequency	Increase in Frequency and Exposure	**Likely**

Climate Change

According to the Colorado Geological Survey, increased precipitation and melting snowpack often trigger hazards such as landslides, rockfalls, and debris flows. This is why, historically, these hazards occur in Colorado during the spring and summer, when rainfall and snowmelt are greatest.[98] Climate modeling predictions are more dependable for temperature than for precipitation. Given this, a report from the Intergovernmental Panel on Climate Change, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, states the following.

> There is high confidence that changes in heat waves, glacial retreat, and/or permafrost degradation will affect high mountain phenomena such as slope instabilities, mass movements, and glacial lake outburst floods, and medium confidence that temperature-related changes will influence bedrock stability. There is also high confidence that changes in heavy precipitation will affect landslides in some regions. There is medium confidence that earlier snowmelt, continued mountain permafrost degradation, and glacier retreat will further decrease the stability of rock slopes. There is low confidence in the future locations and timing of large rock avalanches, as they depend on local geological conditions and other non-climatic factors.[99]

Future Developments

Although landslides, rockfalls, and debris flows are natural geological processes, the incidence of these hazards and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness and decrease the stability of a hill slope by adding weight to the top of the slope, removing support at the base, and increasing water content. Other human activities affecting landslides, rockfalls, and debris flows include excavation, drainage, alterations to groundwater, and changes in vegetation. If not accounted for in siting and design, future development could be vulnerable to landslides, rockfalls, and debris flows, as well as the infrastructure required to support this growth. Adverse effects can be mitigated by early recognition, avoiding incompatible land uses in these areas, or corrective

98 Colorado Geological Survey. 2024. “Landslides”. https://coloradogeologicalsurvey.org/hazards/landslides/.
99 The Intergovernmental Panel on Climate Change. 2012. “Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation”. https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/.

engineering. Risk of these hazards is considered during permitting and construction per the county's development regulations.

Vulnerabilities

Impacts from landslides, rockfalls, and debris flows are typically isolated to the direct area, and many of the issues can be mitigated with proper awareness and engineering design. Landslides could create flood hazards by blocking rivers or contributing to dam failures. Landslides, rockfalls, and debris flows pose hazards to several transportation corridors in the county. If these events were to cut off a major roadway, people could become stranded, deliveries of supplies could be delayed, emergency response could be hindered, and businesses could be impacted due to fewer visitors. Events like these, both within and outside the county, also pose a threat to power lines and infrastructure. A landslide or debris flow could damage power line infrastructure, thereby prolonging power outages. Increased backcountry recreation in the county also exposes people to debris flows, rockfalls, and landslides. All of these hazards can cause severe injuries and fatalities.

Based on the hazard maps, the northern and central areas of Gunnison County are susceptible to landslides, rockfalls, and debris flows. Highways 133 and 135 serve these areas and provide essential access to various locations within the county. The closure of these roads can hurt businesses and limit accessibility in Gunnison County.

In total, 11 out of 112 community lifelines are within a mapped landslide/rockfall/debris flow zone. These lifelines can be found in the *Participant Profiles Appendix*.

County Landslide/Rockfall/Debris Flow Vulnerabilities

Sector	Vulnerability
People	-Exposure is more likely to occur while driving on roadways and in sloped areas -People living in homes located on or near steep slopes or in downslope areas -First responders in areas that are still geologically unstable
Economic	-Disruption of local commerce due to the disruption of major transportation routes -Loss of accessibility and potential damage to businesses
Built Environment	-Damage building foundations due to moving soil -General damage to homes and other buildings located on slopes or downslope -Potential damage or blockage of roadways, bridges, and property
Community Lifelines	-Damage to roadways, bridges, and other structures -Damage or breaking of underground utility lines and water utilities -Power loss from downed lines and poles
Recreation	-Block hiking routes or cause injuries to hikers -Causes flooding from blocked creeks and streams -Potentially damage or impact to recreational sites

Level of Concern for Landslide/Rockfall/Debris Flow

The table below lists the landslide/rockfall/debris flow level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Landslide/Rockfall/Debris Flow

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Low
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Lightning

Lightning is an electrical discharge between a thunderstorm's positive and negative regions. A lightning flash comprises a series of strokes, averaging about four strokes per flash. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually, it takes place inside the cloud and appears from the outside as a diffuse, brightening that flickers. However, the flash may exit the cloud's boundary, and a bright channel can be visible for many miles.

Although not as common, cloud-to-ground lightning is the most damaging and dangerous form. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a minority of flashes carry a positive charge to Earth. These positive flashes often occur during the dissipating stage of a thunderstorm’s life. Positive flashes are also more common as a percentage of total ground strikes during winter. This type of lightning is hazardous for several reasons. It frequently strikes away from the rain core, ahead of or behind the thunderstorm. It can strike as far as five or ten miles from the storm in areas that most people do not consider a threat. Positive lightning also lasts longer, so fires are more easily ignited. And when lightning strikes, it usually carries a high peak current, potentially resulting in more significant damage.

The cloud-to-ground and intra-cloud lightning ratio can vary significantly from storm to storm. Depending on the cloud height above ground and changes in the electric field strength between the cloud and the earth, the discharge either stays within the cloud or contacts the earth.

Location

The entire county is at risk of lightning strikes. Exposed areas at high altitudes are particularly vulnerable to lightning strikes. Common locations for lightning strikes include open fields, under trees, tall buildings, boats, golf courses, near heavy or large-scale equipment, telephone poles, high-elevation locations, and raised platforms.

Extent

Cloud-to-ground lightning is the most dangerous because it can cause death, injury, wildfires, and property damage. The extent of lightning depends on many factors, some of which explain the geographic extent of the most frequent lightning strikes in Colorado. Ground elevation, ground humidity, and wind currents are all factors that increase lightning frequency.

Historical Occurrences

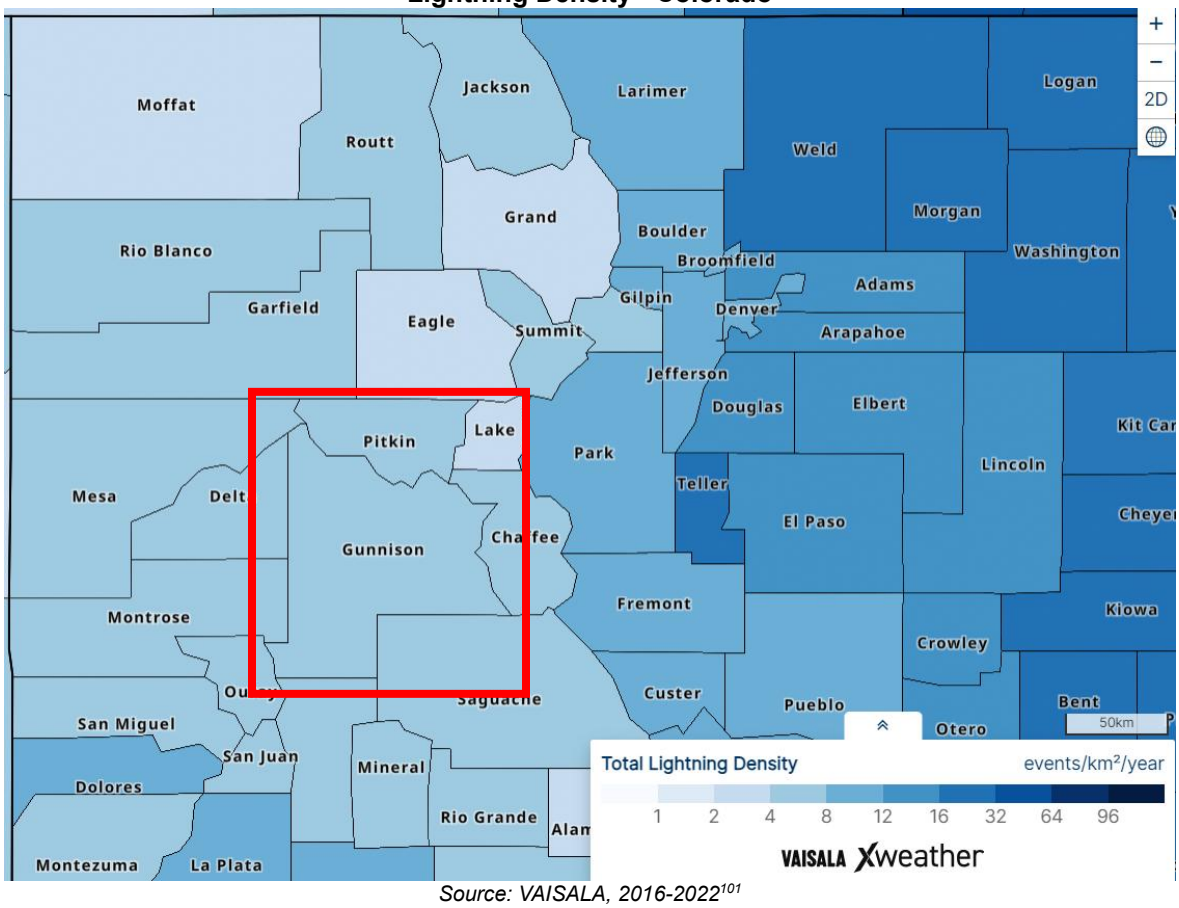
SHELDUS reports 12 lightning strikes in Gunnison County from 1960 to 2023. In total, these events caused $51,661 in property damage. There were 13 injuries from lightning during this time period.

- **July 17, 2006:** Seven hikers sought shelter under an alpine tree above the tree line at an elevation near 11,400 feet when lightning struck the tree. Four of the hikers made it to Marble and got help for the others.

- **July 17, 2020:** Scattered thunderstorms brought lightning, which struck near a campground. Three campers were injured.

The actual number of lightning strikes in the county is much higher than the reported figure. Most lightning strikes are not reported unless they cause damage, injury, or death. VAISALA data shows Gunnison County averages approximately 2,000 to 4,000 lightning strikes annually.[100] Additionally, lightning strikes are a common cause of wildfires in Gunnison County, and those impacts are characterized in the Wildfire risk assessment of this plan.

Lightning Density - Colorado



Source: VAISALA, 2016-2022[101]

Average Annual Losses

The average damage per event estimate was determined from SHELDUS records of damage from 1960 to 2023. This does not include losses from functional downtime, economic loss, injury, or loss of life. Lightning strikes cause an average of $807 in property damage per year.[102]

Lightning Loss Estimate

Number of Events	Average Events Per Year	Total Property Loss	Average Annual Property Loss	Total Crop Loss	Average Annual Crop Loss
12	0.2	$51,661	$807	$0	$0

Source: SHELDUS, 1960-2023

100 VAISALA. 2016-2022. "Global Lightning Density Map". https://interactive-lightning-map.vaisala.com/?_ga=2.241223942.528535091.1647036919-204568516.1647036919.
101 VAISALA. 2016-2022. "Global Lightning Density Map". https://interactive-lightning-map.vaisala.com/?_ga=2.241223942.528535091.1647036919-204568516.1647036919.
102 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Historical Probability & Future Likelihood

While SHELDUS reported lightning events in only 9 out of 62 years in the period of record, lightning is likely to occur several times annually in Gunnison County. For this plan, the historical probability of lightning is 100 percent. Due to the anticipated impacts of climate change and future development, the future likelihood of a lightning event is very likely.

Historical Probability & Future Likelihood – Lightning

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	No Change In Frequency or Exposure	Increase in Exposure	**Very Likely**

Climate Change

Currently, the impacts of climate change on lightning are not fully understood. The 2023-2028 Colorado Enhanced State Hazard Mitigation Plan anticipates little change in the intensity and frequency of lightning events.[103]

Future Development

Lightning strikes will continue to threaten future development throughout Gunnison County. Exposure will increase as the number of people, visitors, and buildings increases. For future development, adequate protection from lightning strikes should be incorporated into building designs and plans. Lightning rods, protected rooftop utilities, surge protectors, and fuel reduction projects are possible steps new developments can take to reduce impacts from lightning.

Vulnerabilities

Lightning can cause deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. It also causes wildland and structural fires. Damage from lightning occurs in four ways.

- Electrocution, severe electrical shock, and burns of humans and animals.
- Vaporization of materials in the path of the strike.
- Fire is caused by the high temperatures associated with lightning.
- Power surges can damage electrical and electronic equipment.

When people are struck by lightning, the result is deep burns at the point of contact (usually on the head, neck, and shoulders). Approximately 70% of lightning survivors experience residual effects such as vision and hearing loss or neuropsychiatric issues. These effects may develop slowly and only become apparent much later. Death occurs in 20% of lightning strike victims.

Aside from wildfire ignition, lightning strikes cause intense but localized damage. In contrast to other hazards, lightning does not typically cause widespread disruptions within the community. Structural fires, localized damage to buildings, damage to electronics and electrical appliances, and electrical power and communications outages are typical consequences of a lightning strike.

The indirect social and economic impacts of lightning damage are typically associated with power outages. Since society relies heavily on electric power, any disruption in the supply, even for a short time, can have significant consequences. Wildland fires can also be an indirect result of a lightning strike.

103 Colorado Division of Homeland Security & Emergency Management. December 2023. “Colorado Enhanced State Hazard Mitigation Plan”. https://drive.google.com/file/d/1MPL0Oiy-yZYDIMziTvYkR12s35FzG-G8/view.

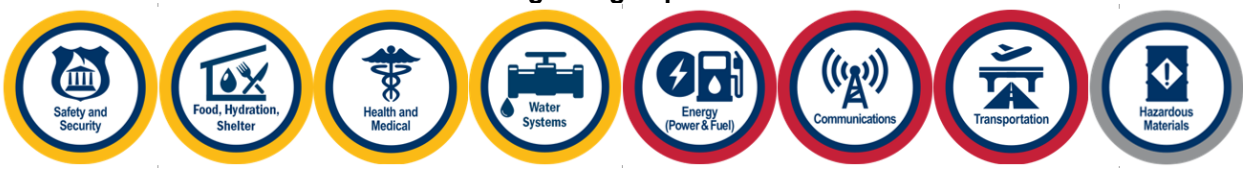
People recreating outside are at the highest risk of a lightning strike. Large influxes of people visiting Gunnison County during the summer months expose many people to lightning during the peak of the monsoon season, when most lightning strikes occur. Many people visit Gunnison County for outdoor beauty. If they are not prepared for the risks of lightning in the high country, tourists can be particularly vulnerable to strikes.

County Lightning Vulnerabilities

Sector	Vulnerability
People	-Injuries can occur from not seeking shelter, standing near windows, and shattered windshields in vehicles -Those who work outside and emergency responders are more vulnerable
Economic	-Damage to computers and other electronics due to power surges -Potential loss of business from power outages
Built Environment	-Damage to building and rooftop utilities
Community Lifelines	-Power outages -Loss of information systems -Damage to critical buildings and rooftop utilities
Recreation	-Rafting, fishing, and other activities near water are at an increased risk -Hikers and campers who may not have nearby sheltering locations are more at risk

Community Lifeline Potential Impacts

Lightning Impacts



Level of Concern for Lightning

The table below lists the lightning level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Lightning

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Low
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Mass Casualty Incident

In general, a mass casualty event is an incident in which local emergency response capabilities are overwhelmed by the number and severity of casualties. While many of the hazards profiled in this plan could result in such an incident, specific concerns are discussed within those individual hazard sections. This hazard concerns transportation incidents involving large numbers of people (e.g., a plane or bus crash). These incidents could be primary hazards or secondary effects of another hazard (e.g., an avalanche along a transportation corridor could bury vehicles). Several factors, including road and weather conditions, traffic density, type of roadway or transportation route, signage, and signaling, influence incidents. A plane crash in the rugged terrain of Gunnison County is likely to have few survivors, whereas a tour or school bus crash could result in multiple injuries and fatalities. Additionally, the mining industry continues to operate in the county. Mass casualty events sometimes occur in the mining industry due to cave-ins or explosions.

Location

Traffic and bus crashes are most likely to occur along the Highway corridors of 133, 135, 149, and 50. Higher crash crashes are more likely near the City of Gunnison, Crested Butte, along Highway 50 west of Sapinero, and near the Monarch Pass Trailhead in eastern Gunnison County.[104] Mass casualty events could also occur in the county's active mines. The figure below shows the major transportation routes in the county and the current permitted mines.

Extent

The extent of a mass casualty event is usually localized; however, catastrophic events can occur and would require assistance from outside jurisdictions. Transportation disruptions along Highways 135 and 50 can significantly impact surrounding counties and communities. A mass casualty incident would likely be a sudden, unpredictable occurrence.

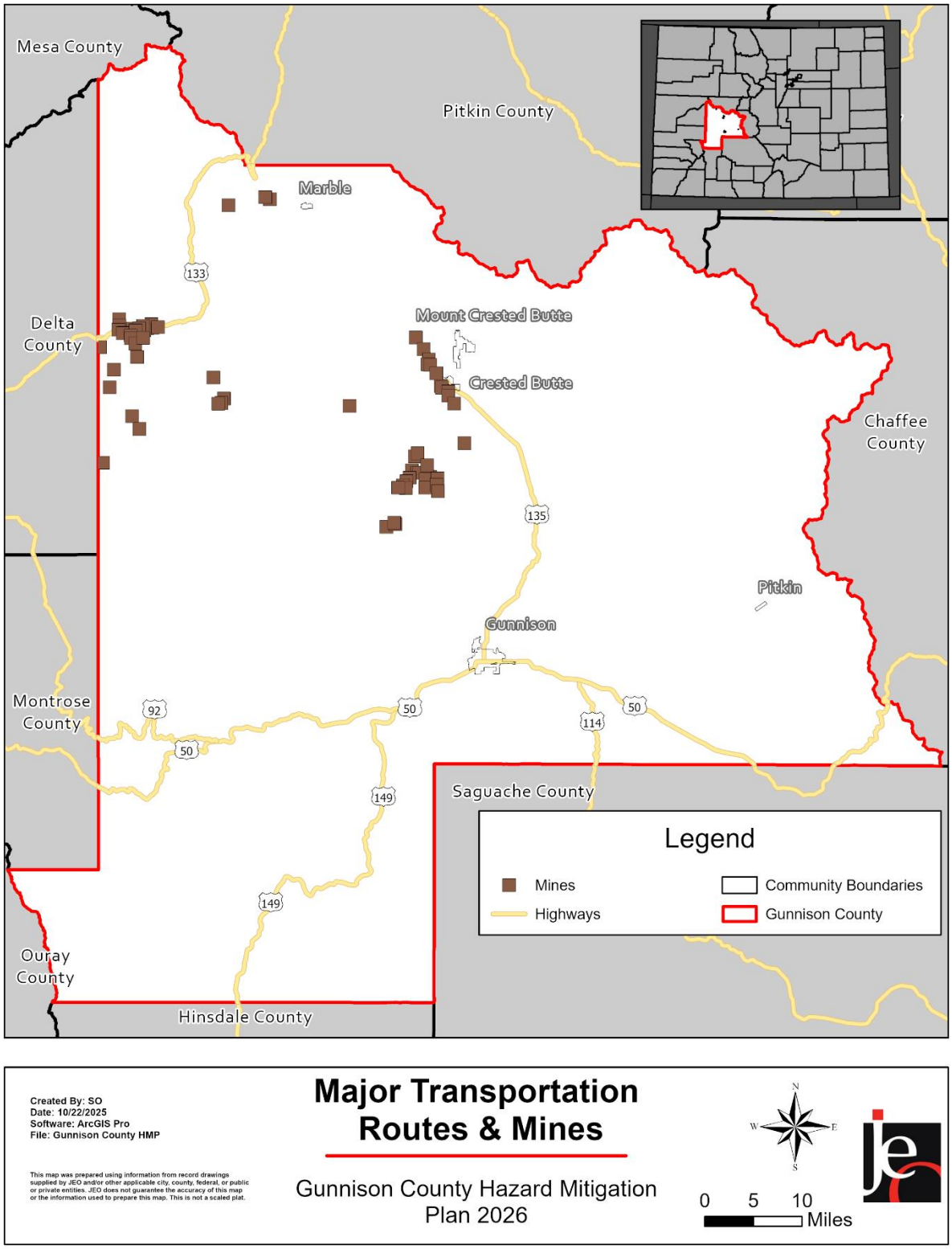
Historical Occurrences

Gunnison County has one recorded transportation incident where a school bus crashed, killing nine of the nearly 50 passengers on board. The event occurred on September 11, 1971, when the school bus attempted to pass a semitruck but lost control on Highway 50, rolling several times before landing on its roof. Passengers on the school bus were members of the high school football team traveling from Gunnison to Salida for a game. This transportation incident made national news and led to widespread school bus safety reforms.[105]

From 1962 to 2025, there were 49 aviation accidents in Gunnison County, as reported by the National Transportation Safety Board database. Only one of the crashes could be considered a mass casualty event, when eight people died in a crash on December 14, 1979.

104 Gunnison County. 2025. Gunnison County Comprehensive Safety Action Plan. https://www.gunnisoncounty.org/1115/Comprehensive-Safety-Action-Plan.
105 The Gunnison Country Times. June 24, 2021. "Gunnison Bus Crash led to widespread safety." https://www.gunnisontimes.com/articles/gunnison-bus-crash-led-to-widespread-safety/.

Major Transportation Routes and Mines in the County



Average Annual Losses

The damages from the events discussed above are unknown, so average annual losses cannot be determined. The two events resulted in 17 deaths.

Historical Probability & Future Likelihood

With two mass casualty events since 1962, the historical probability of a mass casualty event is 3%. Even with the anticipated impacts of climate change and future development, the future likelihood of a mass casualty event is unlikely.

Historical Probability & Future Likelihood – Mass Casualty Incident

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
3%	Slight Increase in Frequency	Increase in Frequency	**Unlikely**

Climate Change

Climate trends are not anticipated to have a direct impact on mass casualty incidents. However, transportation routes may be affected by increased other hazards. For example, debris flows, rockfalls, and avalanches are likely to increase, which could damage roadways and increase the risk of a mass-casualty event.

Future Development

Future development and population growth will increase the likelihood of mass casualty events. Additionally, with continued increases in visitors and residents traveling to Crested Butte Mountain Resort, the risk on Highway 135 also increases.

Vulnerabilities

The impact on people would be the most severe in a mass casualty event due to the potentially large number of injuries and fatalities. Tourism is a significant economic driver in the county. This brings a large influx of visitors, mainly to see the county's natural beauty or to take part in recreational activities. This can mean driving along Highway 135 to Crested Butte Mountain Resort or other major transportation routes in the county. Local tourism and businesses could experience a decline after a mass-casualty event.

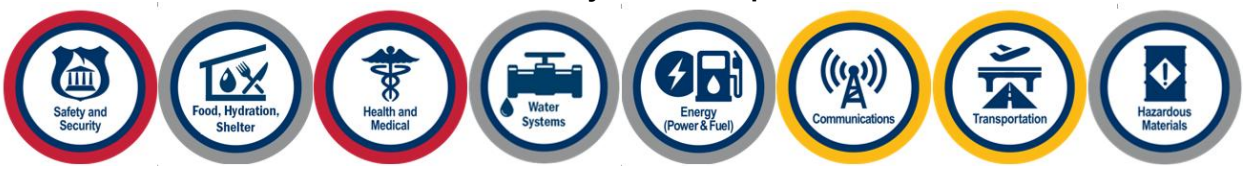
It is usual for people to suffer emotional and physical stress after a mass casualty event, even if they are not at or near the scene. This additional stress can worsen existing health conditions or trigger a new health problem.

County Mass Casualty Incident Vulnerabilities

Sector	Vulnerability
People	-A large number of Injuries and fatalities -Emotional and physical stress -Emergency responders are overwhelmed
Economic	-Loss of tourism and visitors
Built Environment	-Little to no damage unless the accident hits a building
Community Lifelines	-Transportation routes closed
Recreation	-Those using Highways 135 and 50 to get to recreation areas or activities are at a higher risk -Those visiting historic mines are at higher risk

Community Lifeline Potential Impacts

Mass Casualty Incident Impacts



Level of Concern for Mass Casualty Incident.

The table below lists the mass-casualty incident level of concern rating for each participating jurisdiction, as determined by the local planning teams.

Participant Levels of Concern – Mass Casualty Incident

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Pandemic

A pandemic is an epidemic of an infectious disease that spreads across a large region and usually affects a large number of people. Pandemic diseases typically spread quickly from person to person and cause serious illness. These diseases are known, e.g., influenza, but, as seen during the COVID-19 pandemic, new strains or diseases can emerge and trigger a pandemic. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems for detecting influenza outbreaks that could cause a pandemic and to support pandemic planning and preparation.

With the advent of sanitation sewer systems and other improvements in hygiene since the 19th century, the spread of infectious disease has greatly diminished. Additionally, the discovery of antibiotics and the implementation of universal childhood vaccination programs have played a major role in reducing the impact of human disease. Today, human disease incidence is carefully tracked by the Centers for Disease Control and Prevention (CDC) and state organizations to detect potential epidemics and implement control measures. Novel illnesses or diseases can emerge each year and significantly impact residents and public health systems.

Some of the most effective actions or treatments during a pandemic are nonpharmaceutical interventions (NPIs). These are readily available behaviors or actions, and response measures people and communities can take to help slow the spread of respiratory viruses such as influenza. Understanding NPIs and increasing the capacity to implement them promptly can improve overall community resilience during a pandemic. Using multiple NPIs simultaneously can reduce influenza transmission in communities even before vaccination is available.[106]

Location

Human disease outbreaks can occur anywhere in the county. Public health emergencies or pandemic threshold levels depend on the outbreak type, transmission vectors, location, and season. Normal patterns of infectious disease are changing due to increased human mobility and climate change. Areas with denser populations where more people are in contact with one another are more at risk of a pandemic. These areas include the City of Gunnison and the Town of Crested Butte.

Historical Occurrences

Cases and fatalities associated with Public Health Emergencies vary by illness type and the severity of the outbreak. Past major outbreaks in Colorado have specifically included the H1N1 Swine Flu in 2009 and COVID-19 in 2020.

- **Spanish Influenza (1918) –** This flu is estimated to have made 30% of the world's population sick. Over 20 million people lost their lives. Between 1918 and 1919, around 675,000 Americans died. The flu spread rapidly; many died within a few days of infection, and others from secondary complications. The attack rate and mortality were highest among adults 20-50 years old; the reasons for this are uncertain.[107] No vaccine was ever developed, and control efforts included self-isolation, quarantine, increased personal

106 U.S. Department of Health and Human Services. 2017. "Pandemic Influenza Plan: 2017 Update." https://www.cdc.gov/pandemic-flu/media/pan-flu-report-2017v2.pdf.
107 Centers for Disease Control and Prevention. 2018. "History of 1918 Flu Pandemic". https://archive.cdc.gov/www_cdc_gov/flu/pandemic-resources/1918-commemoration/1918-pandemic-history.htm.

hygiene, disinfectant use, and social distancing. Gunnison County enacted strict isolation measures that limited the spread of the flu during both waves.[108]

- **1957 H2N2 Virus –** A new influenza A virus emerged in Eastern Asia and eventually crossed into coastal U.S. cities in the summer of 1957. In total, 1.1 million people worldwide died of the flu, with 116,000 of those in the United States.

- **1968 H3N2 Virus –** An influenza A virus discovered in the United States in September 1968, which killed over 100,000 citizens. The majority of deaths occurred in people 65 years and older.

- **H1N1 Swine Flu (2009) –** outbreaks were first reported in mid-April 2009 and spread rapidly. The new flu strain for which immunity was nonexistent in persons under 60 years old was similar in many ways to typical seasonal influenza. Symptoms of H1N1 included fever greater than 100°F, cough, and sore throat. The CDC estimated the U.S. had over 60.8 million cases and 12,469 deaths. County-specific counts of H1N1 are not available; however, a total of 1,321 confirmed cases were reported in Colorado by August 30, 2009.[109] Outbreaks in Colorado were typically seen sporadically. The U.S. Public Health Emergency for the H1N1 Influenza outbreak expired on June 23, 2010. The CDC developed and encouraged all US residents to receive a yearly flu vaccination to protect against potential exposures. The H1N1 continues to appear annually, and persons in the planning area are at risk of infection in the future.

- **COVID-19 (2020) –** In January 2020, the CDC confirmed the first case of COVID-19 in the United States, and it quickly spread across the country. By March 2020, the World Health Organization declared COVID-19 a pandemic, and travel bans were instituted worldwide. Primary symptoms of the infection included cough, fever or chills, shortness of breath or difficulty breathing, fatigue, muscle and body aches, headache, loss of taste or smell, and sore throat. The first confirmed case of COVID-19 in the State of Colorado was a visitor who came to ski in Summit County. Cities throughout the county have instituted directed health measures to protect residents from COVID-19. Efforts to control and limit the virus included self-isolation, quarantine, increased cleaning measures, social distancing, and vaccinations. COVID-19 has caused significant impacts on the national and global economy.

County-specific data were not available for pandemics that occurred before the COVID-19 outbreak. In 2009, there were three confirmed cases of swine flu in Gunnison County, according to a local news report.[110] The table below displays COVID-19 confirmed cases and deaths as of July 23, 2023. This data will likely increase over time until the entire population is vaccinated.

108 Colorado Virtual Library. March 17, 2020. “How Gunnison dealt with the 1918 flu pandemic. https://www.coloradovirtuallibrary.org/digital-colorado/colorado-historic-newspapers-collection/how-gunnison-dealt-with-the-1918-spanish-flu-pandemic/.
109 Centers for Disease Control and Prevention. June 2009. “Novel H1N1 Flu Situation Update.” https://www.cdc.gov/h1n1flu/updates/061209.htm.
110 Crested Butte News. 2009. Confirmed cases of H1N1 flu virus reported in Gunnison area. https://crestedbuttenews.com/2009/07/confirmed-cases-of-h1n1-flu-virus-reported-in-gunnison-area/.

COVID-19 Cases in Gunnison County

Population	Confirmed Cases	Fatalities
16,918	3,432	14

Source: USAFacts[111]

Extent

According to the Colorado Department of Public Health and Environment, pandemics can occur at any time of year and are natural.[112] The extent varies from person to person, but the very young, very old, smokers, and people with preexisting conditions are at higher risk. In the county, 81% of residents have received at least one COVID-19 vaccine.[113] It is estimated that 12% of Gunnison County residents have received a flu vaccine during the 2025-26 administration year.[114]

Average Annual Losses

Annual losses to the county from public health emergencies are not known. Most losses associated with public health emergencies are primarily the impact on people, causing sickness and death. There have been at least 14 known fatalities from these events, but the actual number is likely much higher.

Public health emergencies have direct economic impacts through response costs, lost productivity at work and school, and reduced visitor numbers to the area. In 2007, the national economic burden of influenza was $10.4 billion in medical expenses, $26.8 billion in medical costs plus lost earnings, and $ 87.1 billion in total economic burden.[115] It is estimated that the COVID-19 pandemic caused a total economic loss of $16 trillion.[116] The direct and indirect effects of significant health impacts are challenging to quantify and will vary depending on the type and spread of the disease.

Historical Probability & Future Likelihood

Based on five previous worldwide pandemic outbreaks that impacted the United States between 1900 and 2025, the historical probability is 3%. The likelihood of a pandemic will increase as the anticipated impacts of climate change and future development unfold. However, there is no pattern as to when a pandemic will occur. Small-scale disease outbreaks will occur annually within the planning area. However, large-scale emergency events cannot be predicted.

Given the anticipated impacts of climate change and future development, the future likelihood of a pandemic event is unlikely.

111 USAFacts, 2023. “Gunnison County, Colorado coronavirus cases and deaths.” https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/colorado/county/gunnison-county/.
112 Colorado Department of Public Health & Environment. 2024. “Pandemic Influenza”. https://cdphe.colorado.gov/topics/pandemic-influenza.
113 Colorado Department of Public Health & Environment. 2024. “Colorado’s Covid-19 Vaccine Data”. https://cdphe.colorado.gov/covid-19/vaccine-data.
114 Colorado Department of Public Health & Environment. 2025. “Respiratory virus immunization data.” https://cdphe.colorado.gov/respiratory-virus-immunization-data.
115 Molinari, N.M., Ortega-Sanchez, I.R., Messonnier, M., Thompson, W.W., Wortley, P.M., Weintraub, E., & Bridges, C.B. April 2007. “The annual impact of seasonal influenza in the US: measuring disease burden and costs”. DOI: 10.1016/j.vaccine.2007.03.046.
116 Cutler, David, et. all. 2020. “The COVID-19 Pandemic and the $16 Trillion Virus”. https://pmc.ncbi.nlm.nih.gov/articles/PMC7604733/#R1.

Historical Probability & Future Likelihood – Pandemic

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
3%	No Direct Impacts	Increase in Frequency and Exposure	**Unlikely**

Climate Change

It is estimated that over the next 30 years, 143 million people will likely migrate to other areas due to the effects of climate change, such as rising sea levels, drought, and other climate-related disasters.[117] This global migration could lead to increased public health emergencies as different population groups come into closer contact and are exposed to various pathogens.

Future Development

As the county's population continues to grow, exposure to all public health emergency hazards increases. Additionally, as population density increases, diseases can spread more quickly. The impacts of a public health emergency could be lessened by building and/or designating mass vaccination sites and ensuring adequate rooms and beds at hospitals, nursing homes, and assisted living centers. Adding or replacing HVAC systems with improved filtration in these and other buildings, such as schools, would also lessen the impacts of this hazard.

Vulnerabilities

An independent study conducted in 2024 by the Trust for America's Health placed Colorado in the high-performance tier for public health emergency preparedness.[118] Those most affected by public health emergencies are typically the very young, the very old, the immunocompromised, the economically vulnerable, and the unvaccinated. Roughly 19% of the planning area's population is 19 years or younger, and nearly 21% of the planning area is 65 years or older. These factors increase vulnerability to the impacts of pandemics. The more densely populated areas of the county would likely be more susceptible to the spread of the flu and COVID-19. The influx of tourists in the county can increase the spread of contagious diseases.

Vulnerability to a public health emergency is closely tied to the proximity or availability of health centers and services. The County is home to Gunnison Valley Health, the only major hospital in the county. Gunnison Valley Health has multiple clinics in the county, including Mountain Clinic at Gunnison Valley Health in Mt. Crested Butte. The other nearby hospitals are in the Cities of Montrose and Buena Vista. Certain geographic areas, populations, and facilities may experience a shortage of healthcare professionals, resulting in a lack of access to healthcare. The Health Resources and Services Administration (HRSA) assigns specific designations to shortage areas to focus limited resources on communities with the most need. Shortage designations include Health Professional Shortage Areas (HPSAs), Medically Underserved Areas (MUAs), and Medically Underserved Populations (MUPs). Health Professional Shortage Areas are designated based on shortages in primary care, dental, or mental health providers in a geographic area, facility, or population. HPSAs are determined by the number of health professionals per high-need population. The following table identifies HPSA designations in the county.

117 Intergovernmental Panel on Climate Change. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability". https://www.ipcc.ch/report/ar6/wg2/.
118 Trust for America's Health. 2024. "State Profile: Colorado". https://www.tfah.org/state-details/colorado/.

Health Care Professional Shortage Areas in the Planning Area

Designation Type	Designation Date	Type of Care
Geographic HPSA	12/1/2005	Mental Health
Low Income Population HPSA	6/23/2008	Dental Health
Rural Health Clinic	2/4/2024	Primary Care
Rural Health Clinic	2/4/2024	Dental Health
Rural Health Clinic	2/4/2024	Mental Health

Source: Health Resources and Services Administration[119]

Medically Underserved Areas and Populations are designated by the HRSA as areas or populations having high poverty rates, high infant mortality rates, high elderly populations, or an insufficient number of primary care providers. Gunnison County is not designated as a Medically Underserved Area.[120]

County Pandemic Vulnerabilities

Sector	Vulnerability
People	-Vulnerable populations include the very young, the very old, the unvaccinated, the economically vulnerable, and those with immunodeficiency disorders. -Institutional settings such as prisons, dormitories, long-term care facilities, day cares, and schools are at higher risk of contagious diseases -Long-term public health emergencies can have negative impacts on residents' mental health
Economic	-Large-scale or prolonged events may cause businesses to close, which could lead to significant revenue loss and loss of income for workers
Built Environment	-Increased number of unoccupied business structures
Community Lifelines	-Healthcare facilities in the county may be overwhelmed quickly by widespread events -Community lifelines could see suspended action or reduced resources due to sick staff
Recreation	-Recreation areas could limit hours of operation due to sick staff or following health guidelines

Community Lifeline Potential Impacts

Pandemic Impacts

Level of Concern for Pandemic.

The table below lists the pandemic-level of concern rating for each participating jurisdiction, as determined by the local planning teams.

119 Health Resources and Services Administration. 2025. "HPSA Find". https://data.hrsa.gov/tools/shortage-area/hpsa-find.
120 Health Resources and Services Administration. 2024. "MUA Find". https://data.hrsa.gov/tools/shortage-area/hpsa-find.

Participant Levels of Concern – Pandemic.

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	Moderate
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Severe Winter Storm

Severe winter storms are an annual occurrence in Colorado and Gunnison County. Winter storms can bring extreme cold, freezing rain, heavy or drifting snow, snow squalls, and blizzards. Generally, winter storms occur from September through May. Heavy snow is usually the most defining element of a winter storm. Large snow events can cripple an entire jurisdiction by hindering transportation, knocking down tree limbs and utility lines, and structurally damaging buildings.

Freezing Rain

Along with snow events, winter storms can potentially deposit significant amounts of ice. Ice buildup on tree limbs and power lines can cause them to collapse. This is most likely to occur when rain falls that freezes upon contact, especially in the presence of wind. Freezing rain is rain that falls when surface temperatures are below freezing. Unlike a mixture of rain and snow, ice pellets, or hail, freezing rain is made entirely of liquid droplets. Freezing rain can also lead to slick roads, causing automobile accidents and making vehicle travel difficult.

Snow Squalls

A snow squall is an intense, short-lived burst of heavy snowfall that quickly reduces visibility and is often accompanied by gusty winds. They move in and out rapidly and typically last less than an hour. Sudden whiteout conditions and falling temperatures can turn icy roads in just a few minutes. Snow squalls can cause extreme localized impacts on the traveling public and commerce for brief periods. Unfortunately, there is a long history of deadly traffic accidents associated with snow squalls. Although snow accumulations are typically an inch or less, the combination of gusty winds, falling temperatures, and rapid reductions in visibility can create hazardous conditions.

Blizzards

Blizzards are particularly dangerous due to drifting snow and the potential for rapidly developing whiteout conditions, which significantly inhibit vehicular traffic. Defined by the National Weather Service as a combination of sustained winds or frequent gusts of 35 mph or greater in the valleys, sustained wind speeds of 50 mph with gusts of 75 mph or greater in the mountains, and visibilities of less than a quarter mile from falling or blowing snow for three hours or more. The reduced visibility makes travel treacherous and disrupts key local transportation nodes, including emergency response efforts.

Location

The entire county is at risk of severe winter storms. Gunnison County is accustomed to winter storms that bring heavy snowfall. Infrastructure and buildings at higher elevations or on steeper slopes will be at greater risk of snow and ice.

Extent

The Sperry-Piltz Ice Accumulation Index was developed by the National Weather Service to predict ice accumulation and resulting damage. The Sperry-Piltz Ice Accumulation Index assesses total precipitation, wind, and temperatures to predict the intensity of ice storms. The figure on the next page shows the Sperry-Piltz Ice Accumulation Index.

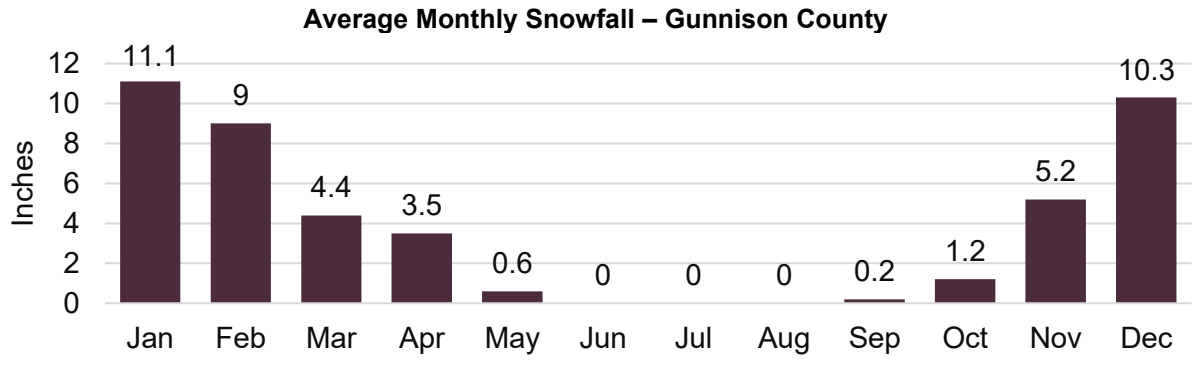
Sperry-Piltz Ice Accumulation Index

ICE DAMAGE INDEX	*AVERAGE ICE AMOUNT (in inches) *Revised: Oct. 2011*	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	<0.25	<15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 – 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	>15	
2	0.10 – 0.25	25 – 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 – 25	
	0.50 – 0.75	>15	
3	0.10 – 0.25	> – 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 – 35	
	0.50 – 0.75	15 – 25	
	0.75 –1.00	>15	
4	0.25 – 0.50	> – 35	Prolonged and widespread utility interruptions with extensive damage to main distribution feeder lines and some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 – 35	
	0.75 –1.00	15 – 25	
	1.00 –1.50	>15	
5	0.50 – 0.75	> – 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeeks in some areas. Shelters needed.
	0.75 –1.00	> – 25	
	1.00 –1.50	> – 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Source: Sperry-Piltz Ice Accumulation Index[121]

The average monthly snowfall for Gunnison County is shown in the figure below. It shows the snowiest months are between November and March. Snowfall totals from a single event can range from 1 inch to several feet. Locations in the county with higher elevations are likely to experience increased snowfall from severe winter storms.



Source: NOAA, 1991-2020[122]

121 SPIA-Index. 2009. "Sperry-Piltz Ice Accumulation Index". Accessed June 2017. http://www.spia-index.com/index.php.
122 National Oceanic and Atmospheric Administration National Centers for Environmental Information. November 2024. "Data Tools: 1991-2020 Normals". https://www.ncei.noaa.gov/access/us-climate-normals/.

Historical Occurrences

According to the NCEI, Gunnison County had 1,655 severe winter storm events from January 1996 to May 2025. SHELDUS data from 1960 to 2023 was used to calculate property damage, crop damage, injuries, and deaths. There was $1,043,544 in estimated property damage and $3,558,759 in estimated crop damage from severe winter storm events. Four fatalities and two injuries were reported. Specific large-scale events are discussed below.

- **January 2-6, 2017:** A long-duration snowfall event began across Gunnison County and western Colorado, with Gunnison County seeing 8 to 16 inches of snow. Just northeast of the City of Gunnison, 24 inches of snow fell over the five days.

- **September 8, 2020:** 5 to 8 inches of snow fell across Gunnison County. The heavy, wet snow, along with winds from the storm, brought down many power lines and trees across the county. Around $15,000 in property damage occurred due to this storm.

- **September 10, 2020:** 3 to 6 inches of snow fell across Gunnison County, with a peak wind gust of 56 mph recorded at the Gunnison-Crested Butte Regional Airport. The strong winds led to downed trees and power outages in the county.

Average Annual Losses

The number of events is based on NCEI data from 1996 to May 2025. The average annual damage estimate was determined from SHELDUS records of damage from 1960 to 2023. This does not include losses from functional downtime, economic loss, injury, or loss of life. Severe winter storms cause an average of $17,107 yearly in property damage and $58,340 yearly in crop damage.

Severe Winter Storms Loss Estimate

Hazard	Number of Events[1]	Average Events Per Year[1]	Total Property Loss[2]	Average Annual Property Loss[2]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Blizzard	13	0.4	$1,043,544	$17,107	$3,558,759	$58,340.31
Heavy Snow	245	8.2				
Winter Storm	492	16.4				
Winter Weather	905	30.2				

Source: 1 Indicates data is from NCEI (1996 to May 2025)[123]; 2 Indicates data is from SHELDUS (1960 to 2023)[124]

Historical Probability & Future Likelihood

Based on historical records, severe winter storm events are likely to occur annually. The NCEI reported a severe winter storm event each year, with a 100% historical probability. Even with the uncertainty about how climate change will affect severe winter storms, the future likelihood is very likely.

123 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.
124 Arizona State University. 2023. "Spatial Hazard Events and Losses Database for the United States". https://sheldus.asu.edu/SHELDUS/.

Historical Probability & Future Likelihood – Severe Winter Storm

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Increase Likelihood	Increase in Exposure	**Very Likely**

Climate Change

Winter conditions, including extreme temperatures and precipitation, are projected to change in the future. The number of extreme freeze-thaw days is likely to increase. Colorado is expected to receive more rain in the fall and spring, and more snow in mid-winter.[125] However, as temperatures continue to rise, earlier snowmelt may occur, altering the timing and efficiency of runoff.

Future Development

All future developments will be affected by winter storms. New infrastructure in Gunnison County increases the likelihood of winter-weather damage as more property is exposed to risk. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. Population growth in the county and increased visitor traffic can potentially increase the need for snow removal and emergency services.

Vulnerabilities

The threat to public safety is typically the greatest concern posed by winter storms. Many severe winter storm deaths occur because of traffic accidents on icy roads, heart attacks when shoveling snow, and hypothermia from prolonged exposure to the cold. Losing home heating temporarily can be tough for older adults, young children, and other vulnerable individuals. People who engage in backcountry recreation will remain susceptible to the impacts of winter storms.

These storms can also impact the local economy by disrupting transportation and commercial activities. Winter storms are occasionally severe enough to overwhelm snow removal efforts, transportation, livestock management, and business and commercial activities. Travelers on highways in Gunnison County, particularly along remote stretches, can become stranded, requiring search-and-rescue assistance and shelter. The county can experience high winds and drifting snow during winter storms, which can occasionally isolate individuals and entire communities and severely damage livestock and crops. Winter storms can also disrupt the delivery of food and fuel into the county. Limited phone and cell service in parts of the county may make emergency reporting impossible during severe winter storm events.

Structural damage from winter storms can result from severe snow loads on rooftops. Older buildings are more at risk, as are buildings with large flat rooftops (often found in public buildings such as schools). Additionally, ice, wind, and snow can affect the stability of trees, power and telephone lines, and TV and radio antennas. Downed trees and limbs can pose significant hazards to homes, cars, utilities, and other property. Below-freezing temperatures can also lead to breaks in uninsulated water lines.

Heavy winter snowfall can also lead to flooding or landslides in spring if the snowpack melts too quickly. Avalanche danger significantly increases during and immediately after heavy snowfall.

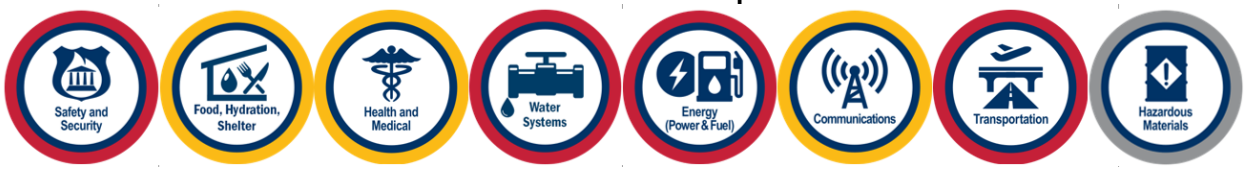
125 Colorado Department of Transportation. May 14, 2021. “Climate Study: Changing Climate and Extreme Weather Impacts on Geohazards in Colorado”. https://www.codot.gov/programs/planning/data-studies/cdot-climate-resilience-study.pdf.

County Severe Winter Storm Vulnerabilities

Sector	Vulnerability
People	-Elderly citizens are at higher risk of injury or death, especially during extreme cold and heavy snow accumulations -Citizens without adequate heat and shelter are at higher risk of injury or death -Exposure or injury to first responders during working conditions -Exposure for motorists, hikers, or other people outdoors -Those living in isolated areas of the county
Economic	-Closed roads and power outages can shut down a region for days, leading to significant revenue loss and loss of income for workers -Decreased tourism due to reduced access
Built Environment	-Heavy snow loads can cause roofs to collapse -Significant tree damage possible, downing power lines and blocking roads
Community Lifelines	-Heavy snow and ice accumulation can lead to downed power lines and prolonged power outages -Transportation may be difficult or impossible during blizzards, heavy snow, and ice events -Damage to underground utility lines -Emergency response and recovery operations, communications, water treatment plants, and others are at risk of power outages, impassable roads, and other damages -Loss of access to vital records and information
Recreation	-Outdoor activities may become more difficult and have a higher risk of exposure -Backcountry recreation may become more dangerous during winter storms

Community Lifeline Potential Impacts

Severe Winter Storm Impacts



Level of Concern for Severe Winter Storm

The table below lists the severe winter storm level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Severe Winter Storm

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	Moderate
City of Gunnison	Moderate
Town of Crested Butte	Low
Town of Mt. Crested Butte	High
Crested Butte Fire Protection District (Stakeholder)	Low
Gunnison County Fire Protection District	Low
Mt. Crested Butte Water & Sanitation District	Moderate

Terrorism & Cyber Attack

For this plan, this hazard includes terrorism, cyberattacks, active shooter incidents, and other intentional human-caused threats that pose a significant hazard to life safety, property, infrastructure, or the environment.

Active Shooter
One or more individuals actively engaged in killing or attempting to kill people in a populated area.

Domestic Terrorism
Violent, criminal acts committed by individuals and/or groups to further ideological goals stemming from domestic influences within the United States, such as those of a political, religious, social, racial, or environmental nature.

International Terrorism
Violent, criminal acts committed by individuals and/or groups who are inspired by, or associated with, designated foreign terrorist organizations or nations.

Intentional attacks and terrorist activity may be based on ideology (i.e., religious fundamentalism, national separatist movements, and social revolutionary movements). Still, attacks can also be random with no ties to ideological reasoning.

Threat assessment, mitigation, and response to terrorism are federal and state directives that work in conjunction with local law enforcement and county emergency management.

Cyber-Attack
A cyber-attack is an incident involving the theft or modification of information on computer systems that can compromise the system or potentially disrupt essential services. A cyberattack can impact governmental agencies, private utilities, and critical infrastructure/key resources such as power grids, public transportation systems, and wireless networks. Cyber infrastructure includes electronic information and communications systems, and the information contained in those systems. Computer systems, control systems, and networks such as the Internet are all part of the cyber infrastructure.

> "Many of the Nation's essential and emergency services, as well as our critical infrastructure, rely on the uninterrupted use of the Internet and the communications systems, data, monitoring, and control systems that comprise our cyber infrastructure. A cyber-attack could be debilitating to our highly interdependent critical infrastructure and key resources and ultimately to our economy and national security."
>
> - National Strategy for Homeland Security

Nation-states, criminal organizations, terrorists, and other malicious actors conduct attacks against critical cyber infrastructure on an ongoing basis. The impact of a serious cyber incident or successful cyber-attack would be devastating to regional and local governments' assets, systems, and/or networks; the information contained in those networks; and the confidence of those who trust governments to secure those systems.

A cyber-attack can affect a system's:

- Confidentiality: protecting a user's private information
- Integrity: ensuring that data is protected and cannot be altered by unauthorized parties
- Availability: keeping services running and giving administration access to key networks and controls.

Location

Terrorism and cyberattacks can occur throughout the entire planning process. Most attacks in the United States have occurred at business/commercial sites, in public open spaces, and in schools. However, government buildings, healthcare facilities, and houses of worship can also be targets for ideologically motivated attacks. Critical infrastructure and commercial, private, and government computer systems may also be targeted for physical or cyberattacks.[126]

According to the 2024 data from the Southern Poverty Law Center, there are 33 hate and anti-governmental groups in Colorado. Data is collected from public displays of hate groups and organizations. Information is collected through social media platforms, news articles, and tips submitted to the SPLC.[127]

Antigovernmental Groups in the Planning Area

Title	Ideology
Colorado Eagle Forum	Antigovernment General
Constitution Party - Colorado	Antigovernment General
Faith Education Commerce (FEC United) - Northern Colorado	Antigovernment General
Freedom First Society	Antigovernment General
Moms for Liberty - Boulder County, CO Chapter	Antigovernment General
Moms for Liberty - El Paso County, CO Chapter	Antigovernment General
Moms for Liberty - Larimer County, CO Chapter	Antigovernment General
Moms for Liberty - Mesa County, CO Chapter	Antigovernment General
Moms for Liberty - Weld County, CO Chapter	Antigovernment General
Parents Involved in Education - Colorado	Antigovernment General
Tactical Civics - Colorado	Antigovernment General
Tactical Civics - Colorado Springs, CO	Antigovernment General
Tactical Civics - Fountain, CO	Antigovernment General
Tactical Civics - Weld County, CO	Antigovernment General
Tactical Civics -Longmont, CO	Antigovernment General
We Are Change - Denver, CO	Antigovernment General
Colorado Alliance for Immigration Reform	Anti-Immigrant
Family Policy Alliance	Anti-LGBTQ
Family Research Institute	Anti-LGBTQ
Focus on the Family	Anti-LGBTQ
Gays Against Groomers - Colorado Chapter	Anti-LGBTQ
Generations	Anti-LGBTQ
The Pray in Jesus Name Project	Anti-LGBTQ
Scriptures for America Worldwide Ministries	Christian Identity
American Freedom Network	Conspiracy Propagandists
Northern Kingdom Prophets	General Hate

126 Federal Bureau of Investigation. 2022. "Active Shooter Incidents in the United States in 2022". https://www.fbi.gov/file-repository/active-shooter-incidents-in-the-us-2022-042623.pdf/view.
127 Southern Poverty Law Center. 2024. "Map of Hate Groups in the U.S." https://www.splcenter.org/.

Title	Ideology
Colorado Mountain Boys	Militia
Asatru Folk Assembly - Colorado	Neo-Volkisch
Colorado State Assembly	Sovereign Citizens Movement
People's Operation Restoration	Sovereign Citizens Movement
Team Law	Sovereign Citizens Movement
The American States Assembly - Colorado	Sovereign Citizens Movement
Patriot Front - Colorado	White Nationalist

Source: Southern Poverty Law, 2024

Extent

Terrorist and cyberattacks can vary greatly in scale and magnitude, depending on the location, method, and target. They can range from an entire water system to a single building or structure.

Historical Occurrences

Previous accounts of terrorism and cyber-attack were gathered from the local planning team. According to the members, there have been two cyberattacks in the county. The National Consortium reported no terrorism events in the Study of Terrorism and Responses to Terrorism database.

- **March 2021:** Global reports of a zero-day vulnerability in Exchange email servers surfaced, allowing perpetrators to gain access to email data. Gunnison County recovered from this event with minimal damage.

- **December 2021:** The finance department in Gunnison County received an email impersonating a vendor that attempted to transfer money to a fraudulent account. The fake vendor claimed the transfers were not going through, leading to three payments of $341,793, totaling a $1,025,379 loss. The county recovered a third of the funds, with the remaining amount covered by the county's cybersecurity insurance policy.[128]

Cyber-attacks are a common occurrence, and various types regularly target government and private-sector organizations. Most of these attacks have been stopped before any impact; however, the threat is ongoing and constantly evolving.

Average Annual Damages

According to county personnel, the December 2021 cyber-attack resulted in $1,025,379 in property loss. With data going back to 1970, this results in an annual average of $18,310 in property damage from cyberattacks or terrorist events in the county. In general, a terrorist or cyber-attack event could range from less than $1 million in rural areas to more than $10 million in urban areas.

Historical Probability & Future Likelihood

Based on historical occurrences, the historical probability is 2% (2 occurrences in the same year over 56 years). However, historical occurrences may not be a useful measure of future likelihood. At the national level, 2020-2024 saw a 70% increase in active shooter incidents compared to the previous five-year period (2015-2019).[129] The annual occurrence of active shooter attacks and

128 Crested Butte News. 2022. "Gunnison County cyber scam blunder results in new policy." https://crestedbuttenews.com/2022/08/gunnison-county-cyber-scam-blunder-results-in-new-policy/.
129 Federal Bureau of Investigation. 2024. "Active Shooter Incidents in the United States in 2024". https://www.fbi.gov/file-repository/reports-and-publications/2024-active-shooter-report/view.

ideologically motivated violence in the United States has increased substantially over the past 20 years.[130]

Cyber-attacks are occurring continuously across the state and region. While defense systems become more adept at catching cyber-attacks before they cause significant infrastructure or service disruption, the frequency and sophistication of cyber-attacks are expected to continue to increase.[131] Due to the anticipated impacts from climate change, future development, and increasing events nationwide, the future likelihood of terrorism and cyber-attack is Likely.

Historical Probability & Future Likelihood – Terrorism & Cyber-Attack

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
2%	Neither Increase nor Decrease in Frequency	Neither Increase nor Decrease in Frequency. Increase Exposure	**Likely**

Climate Change

Climate change will likely have a very limited direct impact on terrorism and cyberattacks. However, the impacts of these climate changes will likely put additional stress on social structures and may contribute to an increase in social disenfranchisement and politically motivated violence.

Future Development

Increased security measures at vulnerable locations, such as schools and government buildings, will reduce the likelihood and impact of terrorism and cyberattacks. Measures can include bollards to protect from vehicles, fencing, security cameras, advanced locks, etc. Strong cybersecurity can prevent bad actors from taking control of virtual systems with the intent to harm people and damage buildings.

Vulnerabilities

While Gunnison County lacks major metropolitan targets and a relatively low historical incidence of terrorism and cyber attacks, the risks still exist. Several asset types could be impacted. Critical infrastructure, including water and wastewater utilities, electrical distribution systems, communication towers, and transportation corridors, could be targeted. If any of these were damaged, it would cause large-scale disruptions across the county. Additionally, the county has a limited number of communication services and utility providers, which creates vulnerability.

A terrorist incident could cause a large number of injuries and fatalities. Gunnison County experiences seasonal population increases from tourism. This concentration of people in specific areas increases the potential impact and likelihood of an attack. A targeted attack on infrastructure could also damage the county's reputation as a safe and accessible destination.

A cyber-attack could disrupt payment systems, supply ordering, lodging reservations, payroll, and transportation logistics. Even short outages may lead to cascading economic losses.

130 Federal Bureau of Investigation. May 2021. "Active Shooter Incidents 20-Year Review, 2000-2019". https://www.fbi.gov/file-repository/active-shooter-incidents-20-year-review-2000-2019-060121.pdf/view.
131 Internet Crime Complaint Center. "2023 ICS Annual Report." 2023. https://www.ic3.gov/AnnualReport/Reports/2023_IC3Report.pdf.

County Terrorism & Cyber-Attack Vulnerabilities

Sector	Vulnerability
People	-Civilians at risk of injury or death -Students and staff at school facilities are at risk of injury or death from school shootings -Police officers and first responders are at risk of injury or death
Economic	-Damaged businesses can cause loss of revenue and loss of income for workers -Risk of violence in an area can reduce income flowing into and out of that area -Agricultural attacks could cause significant economic losses for the region
Built Environment	-Targeted buildings may sustain heavy damage
Community Lifelines	-Water supply, power plants, and utilities may be damaged -Police stations, schools, and government offices are at a higher risk
Recreation	-Water supply, power plants, and utilities may be damaged -Police stations, schools, and government offices are at a higher risk

Community Lifeline Potential Impacts

Terrorism & Cyber-Attack Impacts

Level of Concern for Terrorism & Cyber-Attack

The table below lists the terrorism and cyber-attack level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Terrorism & Cyber-Attack

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	High
City of Gunnison	High
Town of Crested Butte	Low
Town of Mt. Crested Butte	Low
Crested Butte Fire Protection District (Stakeholder)	High
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate

Wildfire

Wildfires, also known as wildland fires, grassfires, brushfires, or forest fires, are uncontrolled fires in the countryside, agricultural fields, or wildlands. Wildland areas may include, but are not limited to, grasslands, forests, woodlands, pastures, and other vegetated areas. Wildfires that begin in wildland areas can spread to structures and the built environment and vice versa.

Wildfires range in size from less than an acre to thousands of acres. Fire events can quickly spread from their source, change direction, and jump gaps such as roads, rivers, and fire breaks. Wildfire behavior mainly depends on local conditions, including temperature, humidity, wind speed and direction, slope, topography, and available fuel load. While some wildfires burn in remote forested regions and benefit the landscape, others can cause extensive damage to homes and other structures in the wildland-urban interface.

The risk of severe wildfires in Gunnison County poses an immediate threat to the health and safety of its residents. Large-scale, high-severity wildfires can lead to a host of negative long-term impacts, including the destruction of private property and infrastructure, suppression costs, loss of natural resources, burn scars, and reductions in water quality. Much has been accomplished to address wildfire risk in Gunnison County. However, more can be done to reduce vegetative fuels, educate the public, address structural ignitability, and increase wildfire capabilities. The recently completed Gunnison County Community Wildfire Protection Plan (CWPP) lists ongoing and planned wildfire-related activities.[132]

Fire Protection

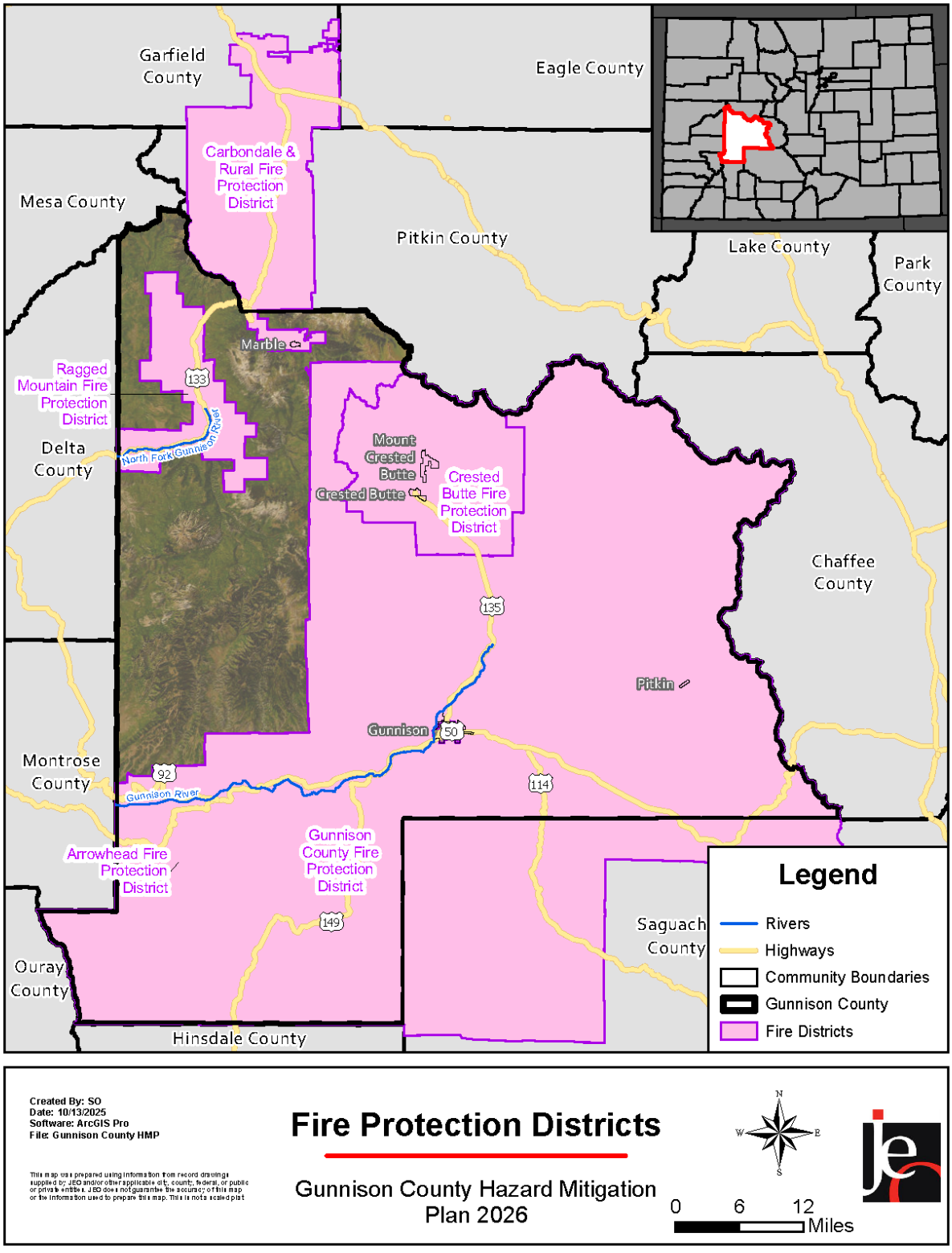
Five local fire districts and fire service providers are partially or entirely located in Gunnison County. The following is a list of fire departments, and the figure below shows their jurisdictional boundaries.

- Arrowhead Fire Protection District
- Carbondale & Rural Fire Protection District
- Crested Butte Fire Protection District
- Gunnison County Fire Protection District
- Ragged Mountain Fire Protection District

Fire response on non-federal lands is the responsibility of the fire protection district and/or fire department service area where the fire occurs. Federal agencies are responsible for wildfire protection on federal lands. The U.S. Forest Service and Bureau of Land Management serve fire response on federal lands in Gunnison County.

132 Gunnison County. June 2025. “Gunnison County Community Wildfire Protection Plan 2025”. https://www.gunnisoncounty.org/1112/Community-Wildfire-Protection-Plan.

Fire Districts in Gunnison County



Community Wildfire Protection Plans

Even though wildfire is a natural part of the ecosystem, it can present a substantial hazard to life and property, especially in the wildland-urban interface. The county recently completed the Gunnison County CWPP in June 2025. The CWPP assesses the countywide wildfire risk and identifies strategic investments to mitigate it and promote preparedness. In addition to Gunnison County's CWPP, eight other communities have created local CWPPs to prepare for and mitigate wildfire risk. These CWPPs discuss historical wildfire occurrences and impacts, identify areas most at risk of wildfire, outline protection capabilities, and identify wildfire mitigation strategies. A list of the CWPP's can be found below.

- Gunnison County CWPP (2025)
- Arrowhead Subdivision CWPP (2007)
- Blue Mesa Subdivision CWPP (2007)
- Ohio City CWPP (2011)
- Quartz Creek CWPP (2015)
- Rainbow Services Incorporated CWPP (2013)
- Star Mountain Ranch CWPP (2009)
- Upper Crystal River Valley CWPP (2011)
- Wilderness Streams CWPP (2009)

Location

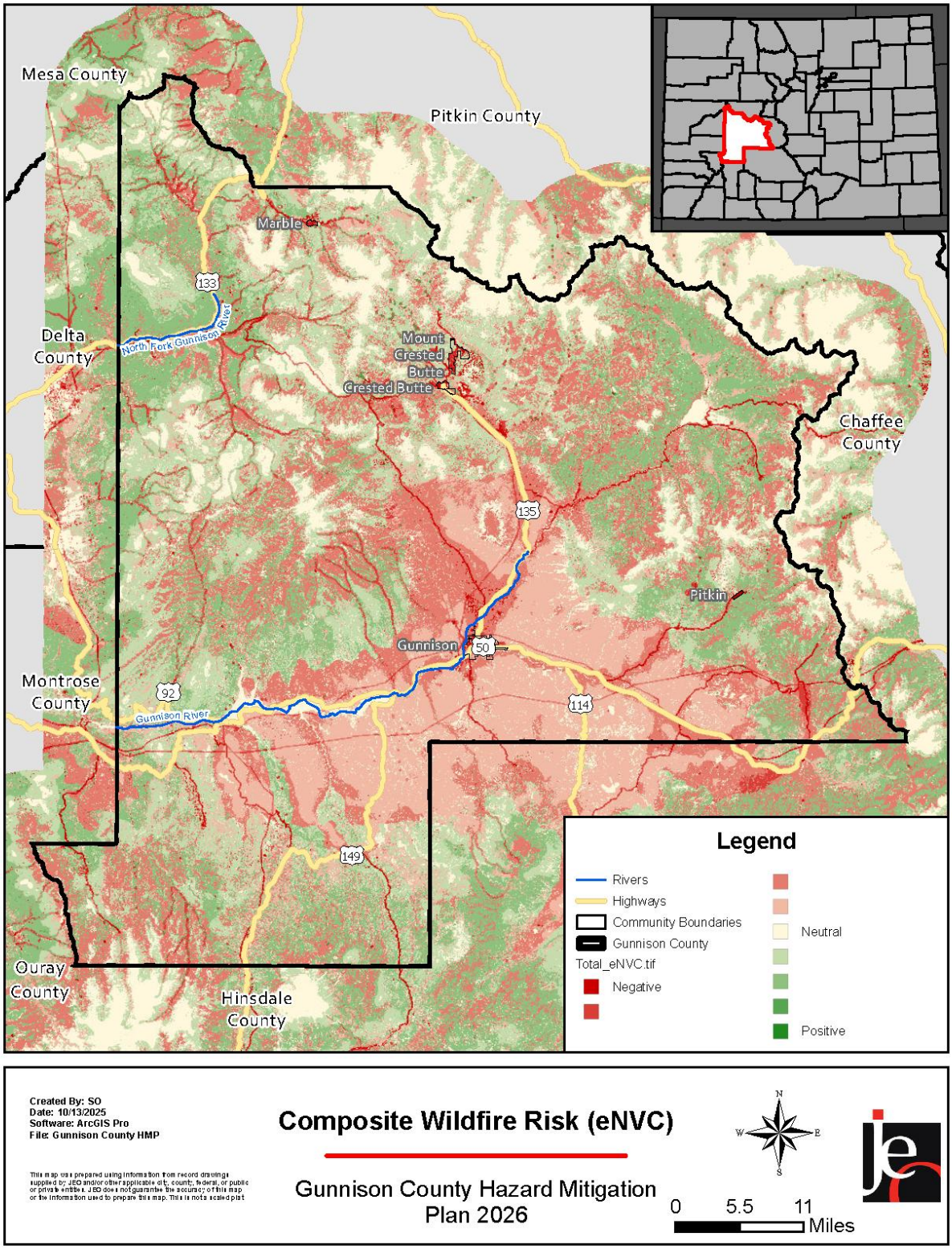
Wildfires can occur throughout Gunnison County. The 2025 Gunnison County CWPP created a composite wildfire risk map utilizing broad public input and cutting-edge wildfire modeling. This composite wildfire risk map calculates the expected impact of wildfire, also known as the expected net value change (eNVC). eNVC is calculated as a combination of fire likelihood, fire behavior, resource values, exposure, and susceptibility. The map on the next page displays the composite wildfire risk map (eNVC). Areas in green indicate regions where wildfire is expected to have a positive impact, while areas in red would likely be negatively affected. The intensity of the color reflects the severity of the expected impact, with darker shades of green and red indicating more substantial positive or negative effects, respectively.

Wildfire risk varies widely across the county due to differences in fire behavior, burn probability, vegetation types, high-value resource locations, and the response functions of various resources to wildfire. Within Gunnison County, the most significant wildfire risk is concentrated around the City of Gunnison and Town of Crested Butte, where there is a high density of infrastructure and primary evacuation routes. Additional wildfire risk information and background about map and model creation can be found in the Gunnison County CWPP.

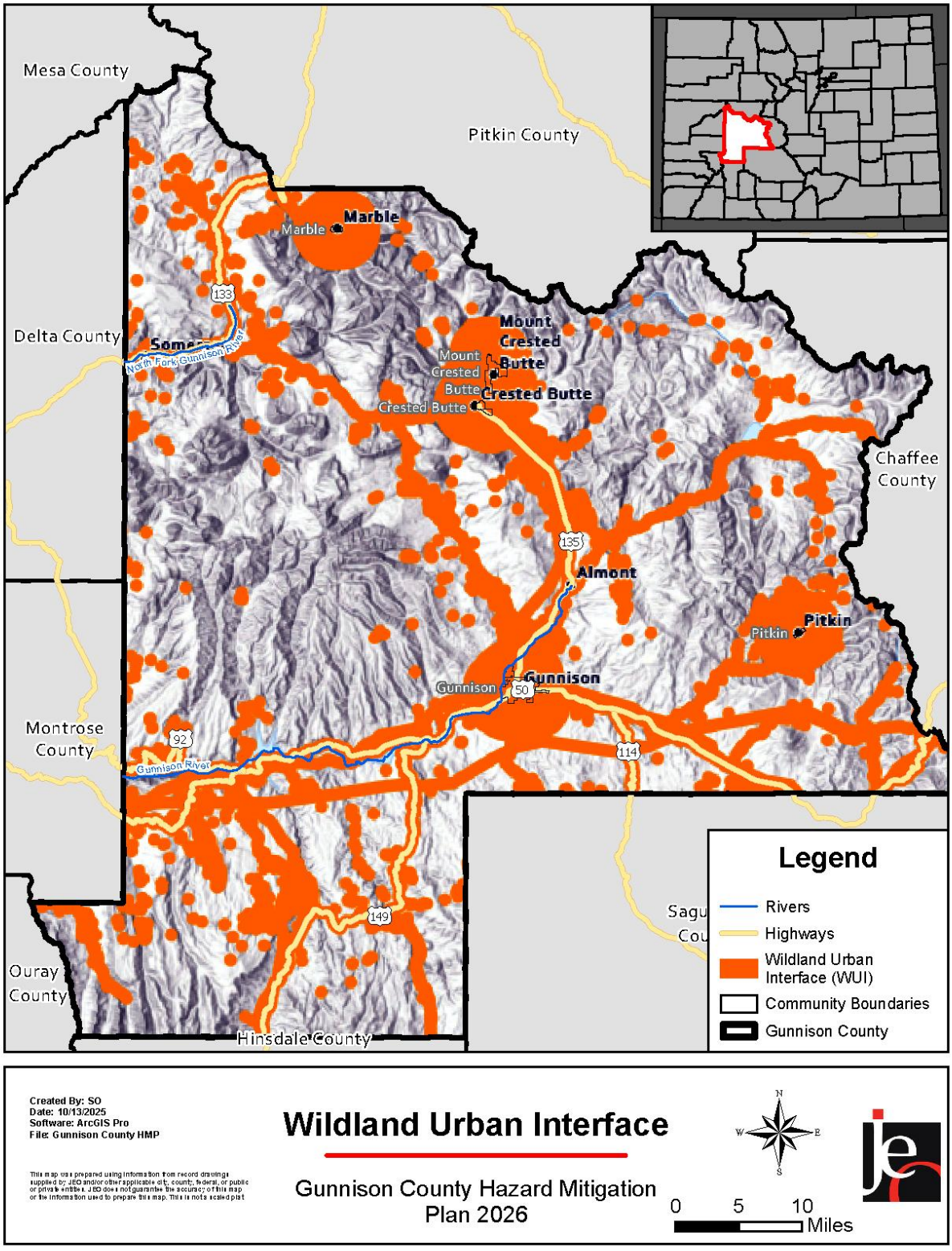
Wildland-Urban Interface

The wildland-urban interface (WUI) is generally defined as any area where improvements are built close to, or within, natural terrain and flammable vegetation and where potential for wildland fire exists. The 2025 Gunnison County CWPP defined the WUI as areas within a half-mile of primary evacuation routes, water infrastructure, transmission lines, structures, communication infrastructure, emergency service stations, monitoring infrastructure, substations, and within a three-mile buffer of incorporated communities in Gunnison County. The identified WUI is visualized in the map below.

Composite Wildfire Risk (eNVC) Map



Gunnison County Wildland-Urban Interface



Wildfire mitigation on private property in the WUI is essential because these areas are high-risk, where property, infrastructure, and people could be impacted by wildfire. Without proper mitigation, wildfires in the WUI can spread rapidly, endangering lives, overwhelming emergency responders, and causing devastating economic losses. Strategies such as creating defensible space and reducing structural ignitability (home hardening) can significantly lower the risk of fire spreading to homes and critical infrastructure.

Extent

The Fire Intensity Scale identifies areas with significant fuel hazards and associated potential for dangerous fire behavior. The scale consists of five classes, with a tenfold difference in order of magnitude between them. The five classes are shown in the table below, and a map of fire intensity in Gunnison County appears on the next page.

Fire Intensity Scale

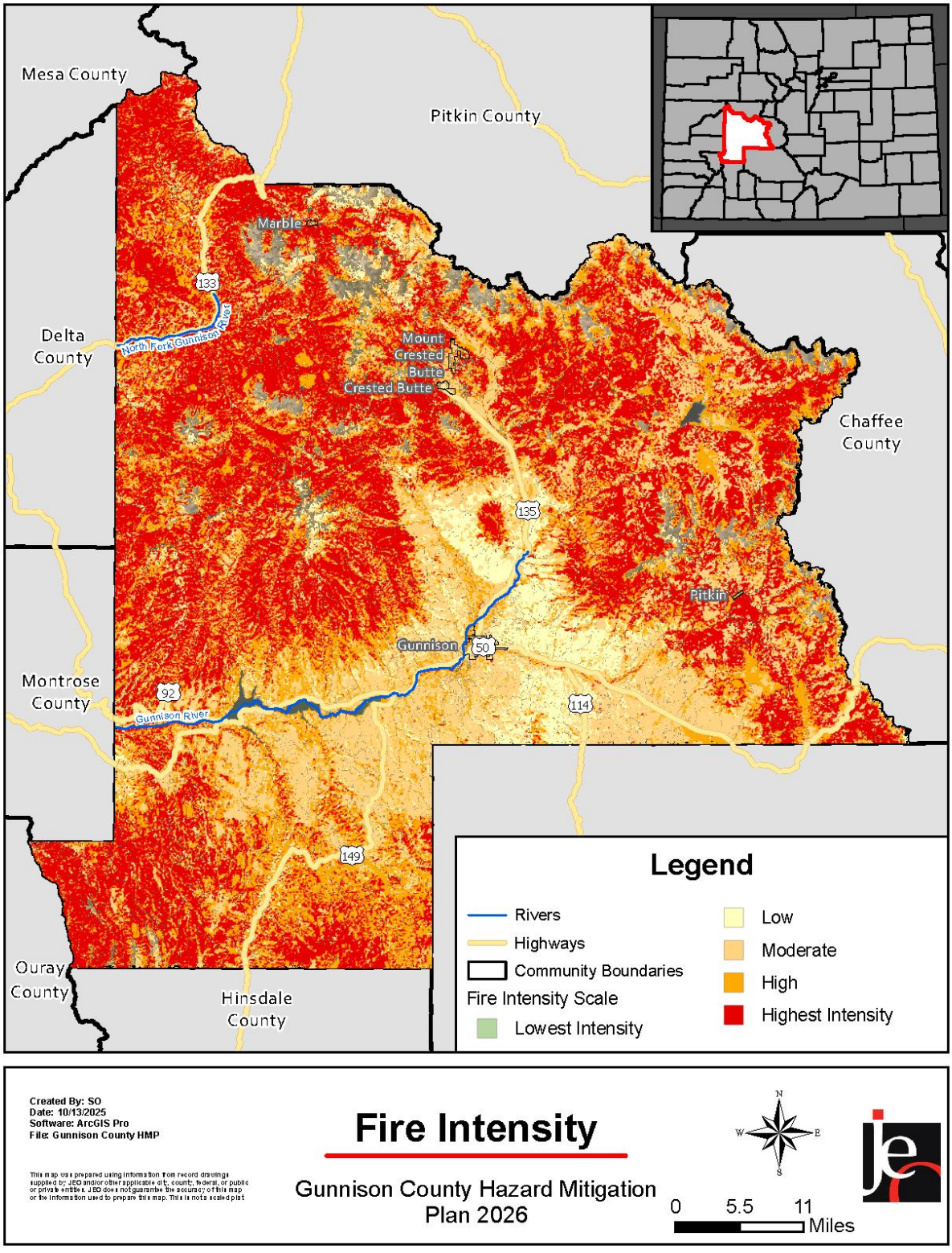
Class	Intensity	Description
Class 1	Lowest Intensity	Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy for firefighters with basic training and non-specialized equipment to suppress.
Class 2	Low Intensity	Small flames, usually less than 2 feet long; a small amount of very short-range spotting is possible. Trained firefighters, equipped with protective gear and specialized tools, easily suppress fires.
Class 3	Moderate Intensity	Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozers and plows are generally effective. Increasing potential for harm or damage to life and property.
Class 4	High Intensity	Large flames up to 30 feet in length; short-range spotting common; medium-range spotting possible. A direct attack by trained firefighters, engines, and dozers is generally ineffective, and an indirect attack may be effective.
Class 5	Highest Intensity	Very large flames up to 150 feet in length; profuse short-range spotting; frequent long-range spotting; strong fire-induced winds. An indirect attack is marginally effective at the head of the fire. Great potential for harm or damage to life and property.

Source: CSFS[133]

The average wildfire in Gunnison County burned 16 acres. Of the reported fires, 78 percent burned less than one acre. Approximately 2.5 percent of recorded fires burned more than 100 acres.[134]

133 Colorado State Forest Service. 2025. "Colorado Wildfire Risk Public Viewer". https://co-pub.coloradoforestatlas.org/docs/CSFS-Wildfire%20Risk%20Public%20Viewer-Identify_Fire_Intensity_Results_Help.pdf.
134 U.S. Forest Service. 2022. "Spatial Wildfire Occurrence Data for the United States, 1997-2020". https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6.

Gunnison County Fire Intensity



Historical Occurrences

Gunnison County is a fire-prone area with dense vegetation and annual fire events; however, there is no comprehensive database of these events. Fire events, magnitude, and local responses are reported voluntarily by local fire departments, and local reporting standards can vary between departments. Actual fire events and their impacts are likely underreported in the available data.

According to data from the U.S. Forest Service, 392 wildfire events were reported in Gunnison County between 1997 and 2020, averaging nearly 16 per year. Most reported wildfire events were small, burning one acre or less. However, several fires of over 1,000 acres have occurred in the county. The second-largest fire, the Lowline Fire, occurred in 2023.[135] Two injuries and no deaths were reported from these events. The figure below shows the wildfire locations in the county, along with large fire perimeters. Information about the fire events that burned over 1,000 acres can be found below.

- **Bear Creek Fire, 1950** – 2,365 acres burned along the Gunnison and Delta County border. Due to the age of the fire, additional information is not known.

- **Red Creek Fire, 1977** – This fire caused 1,386 acres to be burned near the Blue Mesa Reservoir. Due to the age of the fire, additional information is not known.

- **Wiley Ridge Fire, June 2002** – The Wiley Ridge Fire was a lightning-caused wildfire that burned over 1,000 acres of forest and sagebrush. Approximately 200 people had to be evacuated during the event. The total cost to fight the fire was $150,000. The lower suppression cost was due to the sagebrush. The costs would have been much higher if the entire fire had occurred in a forest.

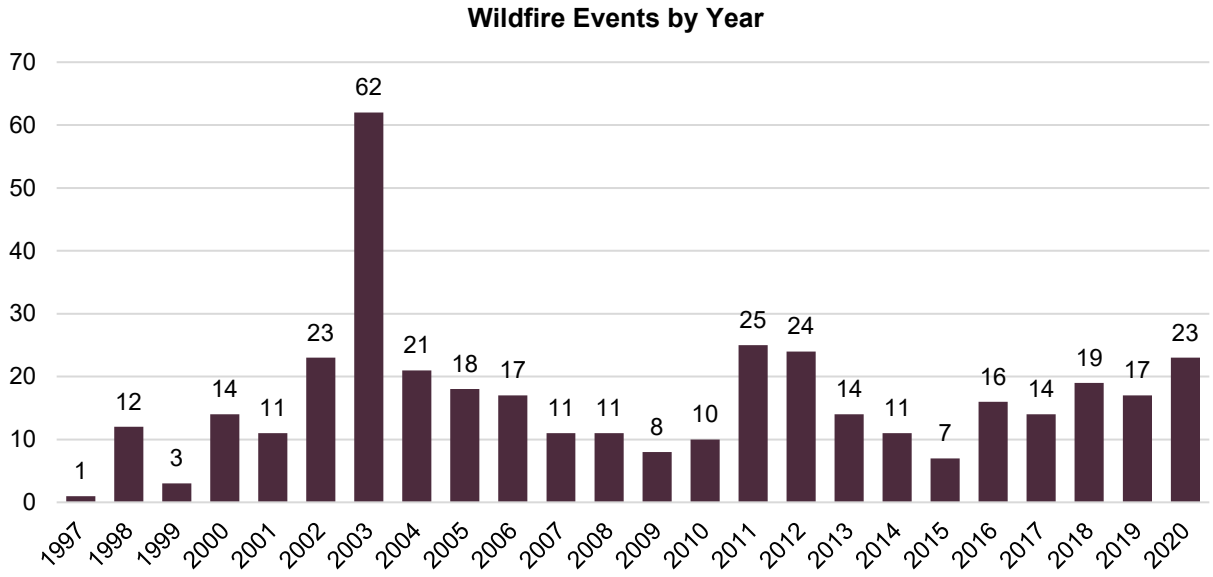
- **West Elk Fire, July 2008** – The West Elk Fire, located 18 miles west of Gunnison, was started by a lightning strike in early July. The fire was left to burn out due to its isolated location in the wilderness and steep terrain. The fire burned primarily in beetle-kill areas and covered 1,587 acres.

- **Lowline Fire, July 2023** – The 1,899-acre Lowline Fire started from a lightning strike approximately 10 miles north-northeast of Gunnison. The total cost of containment was estimated at $10,000,000. Evacuations of the surrounding area were conducted during the event.

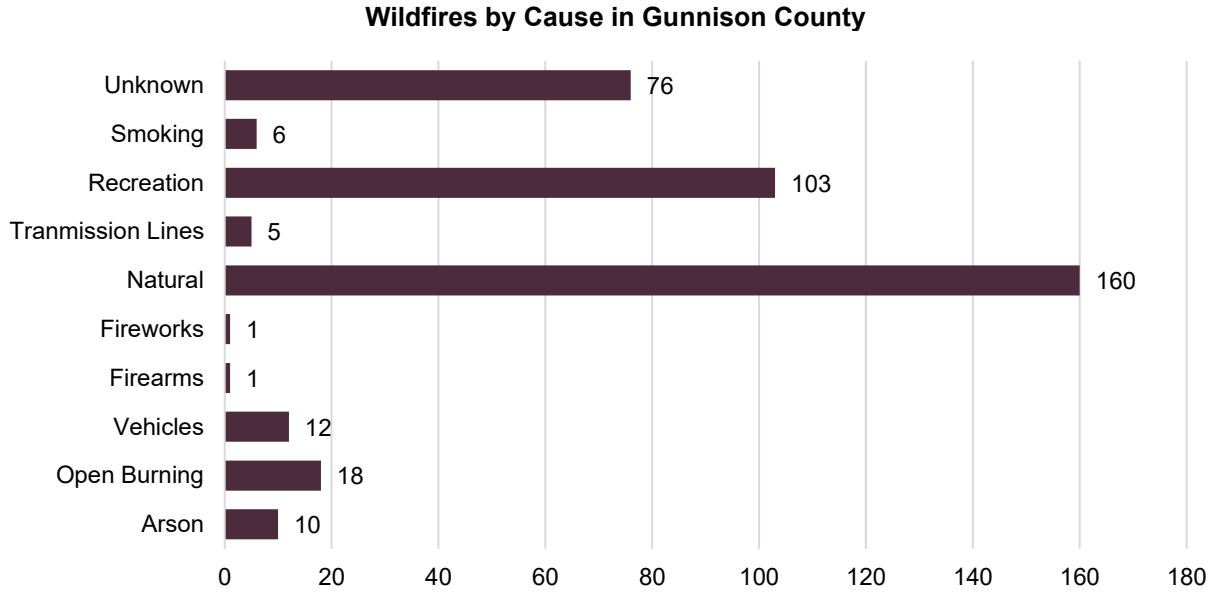
Low Line Fire

135 U.S. Forest Service. 2022. “Spatial Wildfire Occurrence Data for the United States, 1992-2020”. https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6.

The figures below show the number of reported wildfire events by year and their causes. Natural causes (i.e., lightning) are the most common cause.



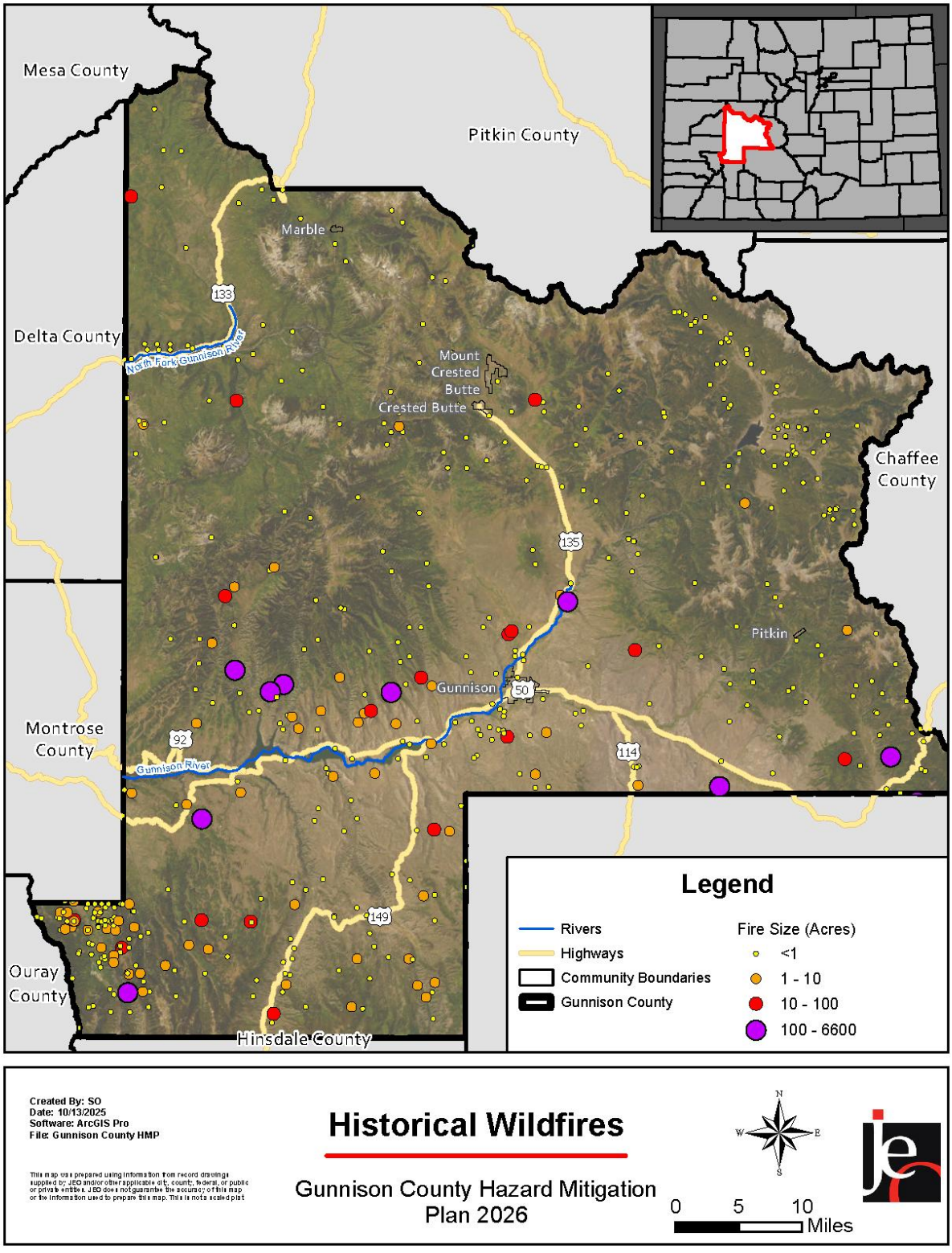
Source: U.S. Forest Service, 1997-2020[136]



Source: U.S. Forest Service, 1997-2020[137]

136 U.S. Forest Service. 2022. "Spatial Wildfire Occurrence Data for the United States, 1997-2020". https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6.
137 U.S. Forest Service. 2022. "Spatial Wildfire Occurrence Data for the United States, 1997-2020". https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6.

Historical Wildfire Occurrences



Average Annual Losses

The average damage and crop loss per event estimate was determined using records from the NCEI database for Gunnison County since 1996. This does not include losses from displacement, functional downtime, economic loss, injury, or loss of life. Over 24 years, the U.S. Forest Service reported 392 wildfires in Gunnison County that burned 6,356 acres, causing $5,000 in crop damage and $12,065,000 in property damage. Two injuries and no fatalities were reported from these events.

Damage from wildfires extends beyond the loss of buildings, recreation areas, timber, forage, wildlife habitat, and scenic views. Secondary effects of wildfires, including erosion, landslides, the introduction of invasive species, and changes in water quality, all increase due to exposure of bare ground and the loss of vegetative cover following a wildfire and can often be more disastrous than the fire itself in long-term recovery efforts.

Wildfire Loss Estimation

Hazard Type	Number of Events[1]	Events Per Year[1]	Average Acres Per Fire[1]	Total Property Loss[2]	Average Property Loss[2]	Total Crop Loss[2]	Average Annual Crop Loss[2]
Wildfire	392	16.3	16.2	$12,065,000	$416,034	$5,000	$17

Source: 1 U.S. Forest Service (1997-2020)[138], 2 NCEI (1996-May 2025)[139]

Historical Probability & Future Likelihood

The figure on the pages below shows the burn probability for Gunnison County. Burn probability is the annual probability of any location to burn due to wildfire. Areas with the highest probability of burning include most of the county outside of the valley. Many areas have limited access and are considered high-risk. Marble, Pitkin, Crested Butte, and Mt. Crested Butte are in high-intensity areas and have a negative composite wildfire risk compared to more remote locations.

Given the historical record of wildfire events (at least one fire event reported each year) for this plan, the historical probability of wildfire occurrence is 100 percent. With the anticipated impacts of climate change and future development, the future likelihood of wildfire is very likely.

Historical Probability & Future Likelihood – Wildfire

Historical Probability	Climate Change Impact	Future Development Impact	Future Likelihood
100%	Increase in Frequency & Severity	Increase in Exposure	**Very Likely**

<u>Climate Change</u>

Current climate trends are expected to increase the frequency and severity of wildfires across Colorado. Periods of drought can occur throughout the year, while elevated heat conditions during the summer months significantly increase the potential for and magnitude of wildfires. During severe drought and dry conditions, large wildfires can spread more easily. Additionally, Colorado's wildfire season is projected to increase by several weeks.

138 U.S. Forest Service. 2022. "Spatial Wildfire Occurrence Data for the United States, 1997-2020". https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6.
139 National Centers for Environmental Information. May 2025. "Storm Events Database". https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=8%2CCOLORADO.

A specific tool developed and utilized in the State of Colorado is the Future Avoided Cost Explorer, which assesses costs associated with wildfire.[140] This tool provides an in-depth look at the potential economic impacts of flooding across specific sectors of the Colorado economy. The following table and figures show the effects expected from wildfire under the current climate and projected "Moderate" and "More Severe Climate" scenarios, with anticipated growth in Gunnison County.

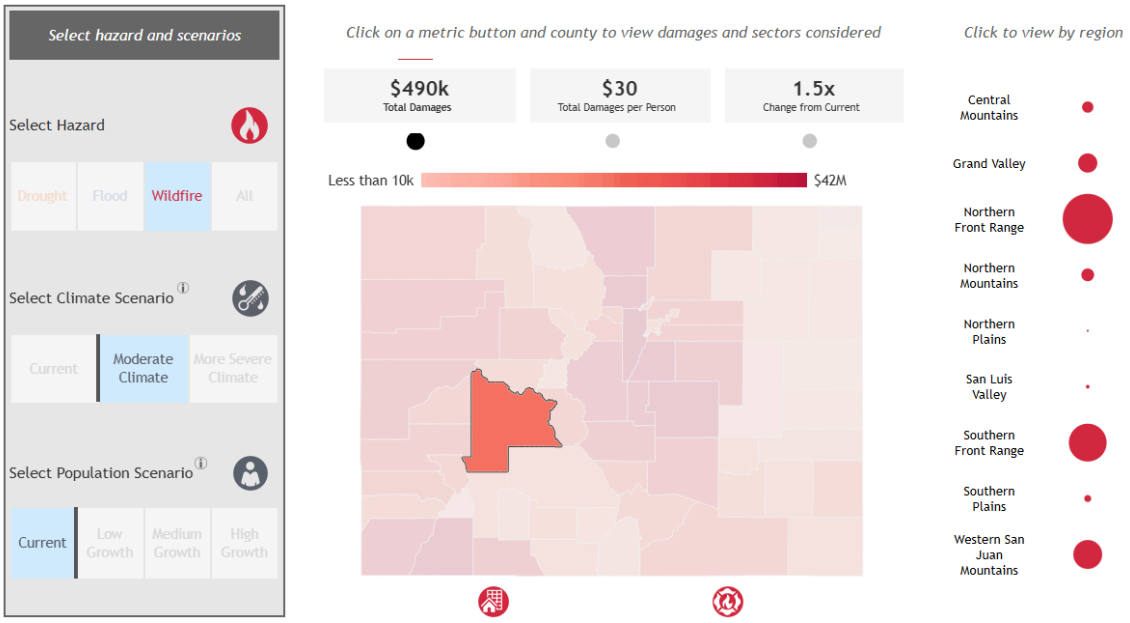
Based on the Future Avoided Cost Explorer assessments, it is likely that Gunnison County will experience worsening wildfire impacts from climate change. At the current growth rate and only moderate climate impacts, Gunnison County may experience up to $490,000 in total damage annually. Damages may vary across sectors and regions, such as bridges, buildings, cattle, crops, and fire suppression activities.

Future Avoided Cost Explorer Anticipated Damages for Wildfire Matrix

Population Scenario	Climate Scenario		
	Current Climate	Moderate Climate	More Severe Climate
Current Growth Rate	$320,000 $20 per person	$490,000 $30 per person	$500,000 $30 per person
Low Growth Rate	$320,000 $20 per person	$500,000 $30 per person	$500,000 $30 per person
Medium Growth Rate	$320,000 $20 per person	$500,000 $20 per person	$600,000 $30 per person
High Growth Rate	$320,000 $10 per person	$500,000 $20 per person	$600,000 $20 per person

Source: Colorado Water Conservation Board Future Avoided Cost Explorer[141]

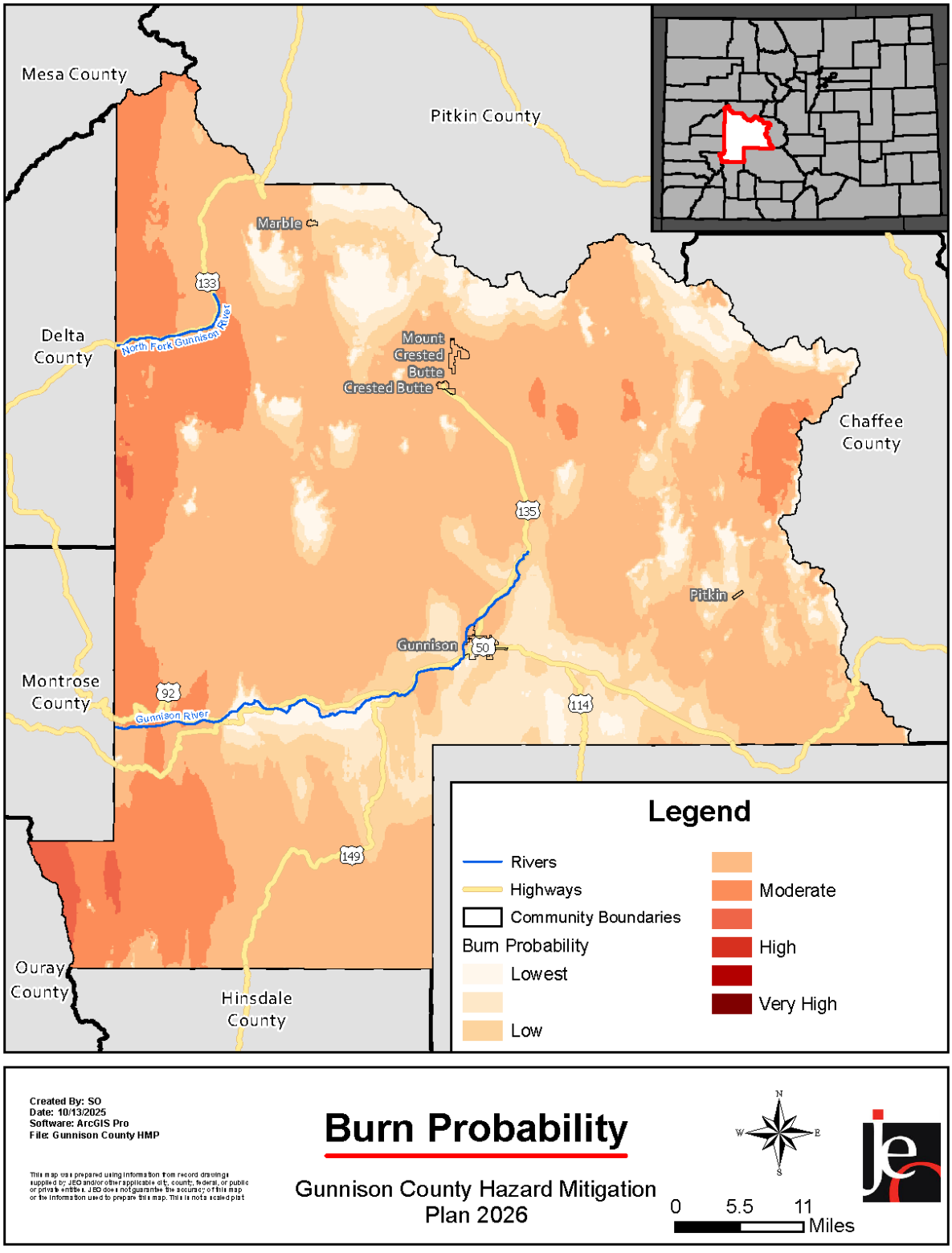
Future Avoided Cost Explorer Wildfire Analysis Example



Source: Colorado Water Conservation Board Future Avoided Cost Explorer[142]

140 Colorado Water Conservation Board. October 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.
141 Colorado Water Conservation Board. October 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.
142 Colorado Water Conservation Board. October 2025. "Future Avoided Cost Explorer: Colorado Hazards." https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e.

Gunnison County Burn Probability



Future Development

New developments can substantially increase wildfire risk, making the entire county susceptible. During a wildfire, growth increases the resources needed to protect development from burning and increases firefighting costs. Any new developments in the county should assess their wildfire risk and practice fire mitigation principles to reduce potential losses.

Gunnison County's land use regulations include a section for development in areas subject to wildfire hazards. These regulations ensure that development avoids wildfire hazard areas whenever possible. When avoidance is impossible, it provides standards to reduce or minimize the potential threats from wildfire. As part of the regulations, development in all wildfire hazard areas must comply with the 2021 International Wildland Urban Interface Code adopted by the Gunnison County Board of County Commissioners in 2022.

County Vulnerabilities

Although wildfires are a natural part of forested ecosystems, they pose a threat to people and property in Gunnison County. Wildfires can cause evacuations, injuries, and loss of life. Additionally, wildfires can cause severe damage to buildings and infrastructure in the county. Damage to homes and businesses can affect residents' livelihoods. A major wildfire can also affect visitors to the county in the summer months when tourism is high. Additionally, smoke from wildfires can harm human health. Wildfire smoke is a contributor to particulate matter, which is dangerous because it becomes lodged deep in the lungs and can enter the bloodstream, triggering asthma attacks, heart attacks, strokes, and, in some cases, lung cancer. Gunnison County can be affected by smoke from fires outside its boundaries, as experienced with recent fires. Challenges arise from forests managed by multiple agencies and the county's varied terrain.

Due to Gunnison County's topography, many neighborhoods have limited ingress and egress, with only one way in and one way out. This can hinder evacuation efforts and first responders. Early notification and warning are paramount in these neighborhoods to ensure everyone can be safely evacuated. The Town of Marble is a significant concern due to limited ingress and egress and high fuel loads. The county does not have an evacuation plan or small area evacuation plans. On a larger scale, wildfires can impact major transportation routes, causing stranded travelers. Housing-stranded travelers can become a problem, especially during high-visitor seasons.

Impacts on water supplies and infrastructure can linger for months or even years after a wildfire. Watersheds downstream of burned areas can experience water quality impacts, reduced reservoir capacity, damage to water-delivery and transportation infrastructure, degradation of aquatic habitat, and an increased risk of flooding. Waterways can also become polluted from burned building materials, plastics, sediment, fire retardants, and many other chemicals that get burned or spread during suppression. This can tax local water systems, which may not be able to treat these pollutants.

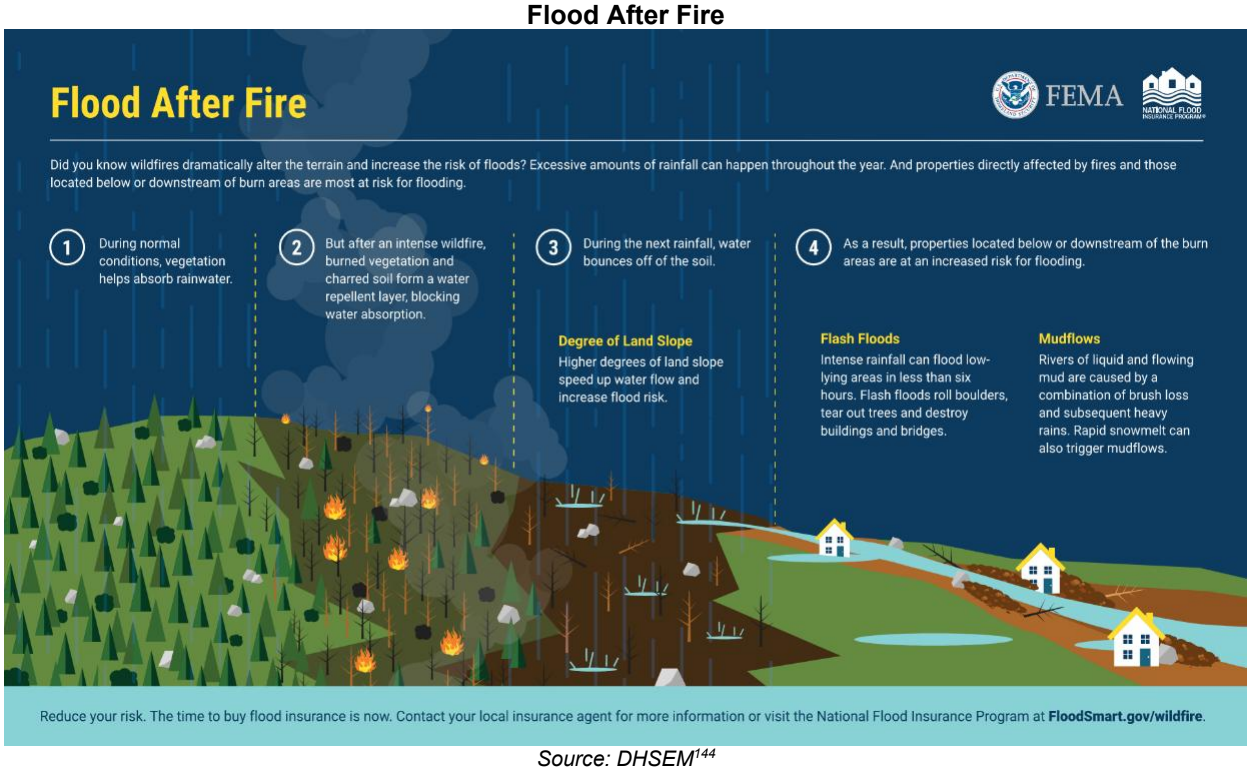
The impacts of insects on the health of trees in Gunnison County have been an ongoing concern. In 2023, the Western Balsam Bark Beetle, Western Spruce Budworm, Mountain Pine Beetle, Spruce Beetle, and Douglas-Fir Beetle were all detected in the county.[143] These insects can leave behind stands of dead trees, which may increase wildfire fuel throughout the county.

Wildfires also increase the risk of other hazards, compounding damage and straining resources. DHSEM has provided additional information detailing the relationship between wildfire and

143 Colorado State Forest Service. 2023. "2023 Report on the Health of Colorado's Forests". https://csfs.colostate.edu/forest-management/forest-health-report-2023/insects-and-diseases/.

flooding/debris flow events. Wildfires remove vegetation and harden soil, reducing infiltration during heavy rain events. Subsequent severe storms that bring heavy precipitation can then escalate into flash flooding and landslides, dealing additional damage to jurisdictions.

Flood After Fire



Source: DHSEM[144]

There has been much work in the county to reduce vegetative fuels. Since 2000, nearly 403,000 acres in the county have undergone fuel management activities. These include canopy treatment, reforestation, prescribed fire, and surface treatment by the U.S. Forest Service, Bureau of Land Management, Colorado State Forest Service, and others.[145] Current and future projects can be found in the Gunnison County CWPP.

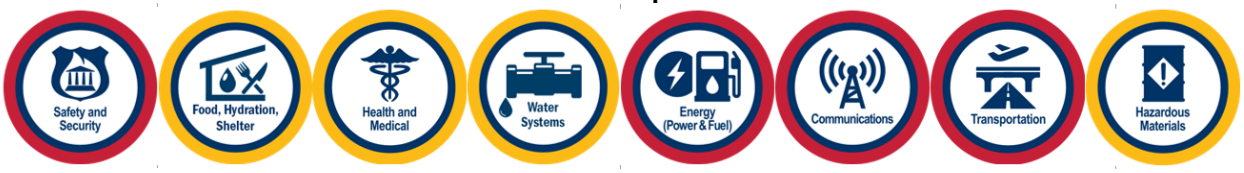
144 DHSEM. 2025. "Flood After Fire Overview". https://mars.colorado.gov/recovery/flood-after-fire.
145 Gunnison County. 2025. "Appendix B Vegetation Management History". https://www.gunnisoncounty.org/DocumentCenter/View/16286/Appendix-B---Vegetation-Management-History.

County Wildfire Vulnerabilities

Sector	Vulnerability
People	-Risk of injury or death for residents and firefighting personnel -Displacement of people and loss of homes -Increased health impacts on people with breathing difficulties
Economic	-Damages to buildings and property can cause significant losses to business owners -Loss of businesses -Loss of tourism
Built Environment	-Building and property damages -Transportation routes may be blocked by fire, impacting evacuation efforts
Community Lifelines	-Damage to power lines and utility structures -Contamination of water supplies -Potential loss of firefighting equipment and resources -Risk of damage to buildings
Recreation	-Hikers and other recreationists in remote areas -Loss of access to recreational areas -Loss of viewsheds

Community Lifeline Potential Impacts

Wildfire Impacts



Level of Concern for Wildfire

The table below lists the wildfire level of concern rating for each participating jurisdiction as determined by the local planning teams.

Participant Levels of Concern – Wildfire

Participant	Level of Concern (Low, Moderate, High)
Gunnison County	High
City of Gunnison	Moderate
Town of Crested Butte	High
Town of Mt. Crested Butte	High
Crested Butte Fire Protection District (Stakeholder)	Moderate
Gunnison County Fire Protection District	Moderate
Mt. Crested Butte Water & Sanitation District	Moderate