Pitkin County

City of Aspen

Town of Basalt

Town of Snowmass Village

Aspen Fire

Roaring Fork Fire Rescue

Pitkin County Hazard Mitigation Plan

Assistance provided by:

WSP

April 2023

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APPENDICES

1 INTRODUCTION

1.1 EXECUTIVE SUMMARY

The following jurisdictions have prepared and adopted this 2023 update to the Pitkin County Hazard Mitigation Plan (HMP):

- Pitkin County
- City of Aspen
- Town of Basalt
- Town of Snowmass Village
- Aspen Fire Protection District
- Roaring Fork Fire Rescue Authority

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from disasters or hazardous events. Studies have found that hazard mitigation is extremely cost-effective, with every dollar spent on mitigation saving an average of $6 in avoided future losses. The Federal Emergency Management Agency (FEMA) requires that HMPs be updated every five years for the jurisdictions to be eligible for federal mitigation assistance. All sections of the 2017 Pitkin County HMP were reviewed and updated to address natural and human-caused hazards for the purpose of saving lives and reducing losses from future disasters or hazard events.

The 2023 Pitkin County HMP (also referred to as “Plan”) will serve as a blueprint for coordinating and implementing hazard mitigation policies, programs, and projects in Pitkin County. It provides a list of mitigation goals and related actions that may assist the participating jurisdictions in reducing risk and preventing loss from future hazard events. The impacts of hazards can often be lessened or even avoided if appropriate actions are taken before events occur. By reducing exposure to known hazard risks, communities will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events.

The goals of the 2023 Pitkin County HMP are:

1. **Reduce the potential for impacts on human life and safety, property loss and damage to critical facilities and the natural environment by natural and human-caused hazards.**

2. **Increase the public's awareness of our hazard vulnerabilities and promote hazard mitigation activities by residents.**

3. **Increase Pitkin County’s resiliency to hazards by integrating mitigation into all planning initiatives, to enable faster recovery from disasters.**

4. **Recognizing the common issues and mutual goals of hazard mitigation and climate adaptation, promote collaborative planning and identify opportunities to dovetail actions that reduce risks from both natural hazards and climate warming.**

5. **Promote equity by ensuring vulnerable populations and under-served communities are included in mitigation planning and activities.**

This Plan was also developed to maintain Pitkin County’s and participating jurisdictions’ eligibility for federal disaster assistance, specifically the FEMA Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Building Resilient Infrastructure and Communities (BRIC) grant program, as well as the Rehabilitation of High Hazard Potential Dam (HHPD) grant program.

Chapter 1 Introduction contains this Executive Summary along with background information on the plan.

Chapter 2 Planning Process describes the process followed to update the Plan. A broad range of public and private stakeholders, including agencies, local businesses, nonprofits, and other interested parties were invited to participate. Public input was sought throughout the planning process including online surveys and public review of the draft Plan.

Chapter 3 Community Profile describes the planning area, consisting of Pitkin County and the participating jurisdictions listed above, with updated information on demographics, social vulnerability, and changes in development. It includes an assessment of programs and policies currently in place across the County to reduce hazard impacts or that could be used to implement hazard mitigation activities and identifies opportunities to enhance those capabilities.

Chapter 4 Risk Assessment identifies the natural and human-caused hazards of greatest concern to the County and describes the risk from those hazards. The information generated through the risk assessment helps communities to prioritize and focus their efforts on those hazards of greatest concern and those assets or areas facing the greatest risk(s). The best available information on the impacts of changing weather conditions was taken into account for each hazard. The hazards profiled in the 2023 Plan are listed in Table 1-1.

Table 1-1 Hazard Risk Summary

HAZARD	PITKIN COUNTY	ASPEN	BASALT	SNOWMASS VILLAGE	ASPEN FIRE	ROARING FORK FIRE
Avalanche	Medium	Low	Low	Medium	Medium	Medium
Contagious Disease	Medium	Medium	Medium	Medium	Medium	Medium
Cyber-Attack	High	High	High	High	Medium	Medium
Dam Inundation	Low	Low	Medium	Low	Low	Low
Drought	High	High	High	High	High	High
Flooding	Medium	High	High	Medium	Medium	Medium
Geologic Hazards	High	High	Medium	High	Medium	High
Ice Jam Release	Medium	Medium	Medium	Low	Medium	Medium
Lightning	Low	Low	Low	Low	Low	Low
Wildfire	High	High	High	High	High	High
Winter Storm	High	Medium	Medium	Medium	High	High

Chapter 5 Mitigation Strategy describes what the County and jurisdictions will do to reduce their vulnerability to the hazards identified in Chapter 4. It presents the goals and objectives of the mitigation program and details a broad range of targeted mitigation actions to reduce losses from hazard events. The plan update identified 54 mitigation actions for implementation by individual planning partners.

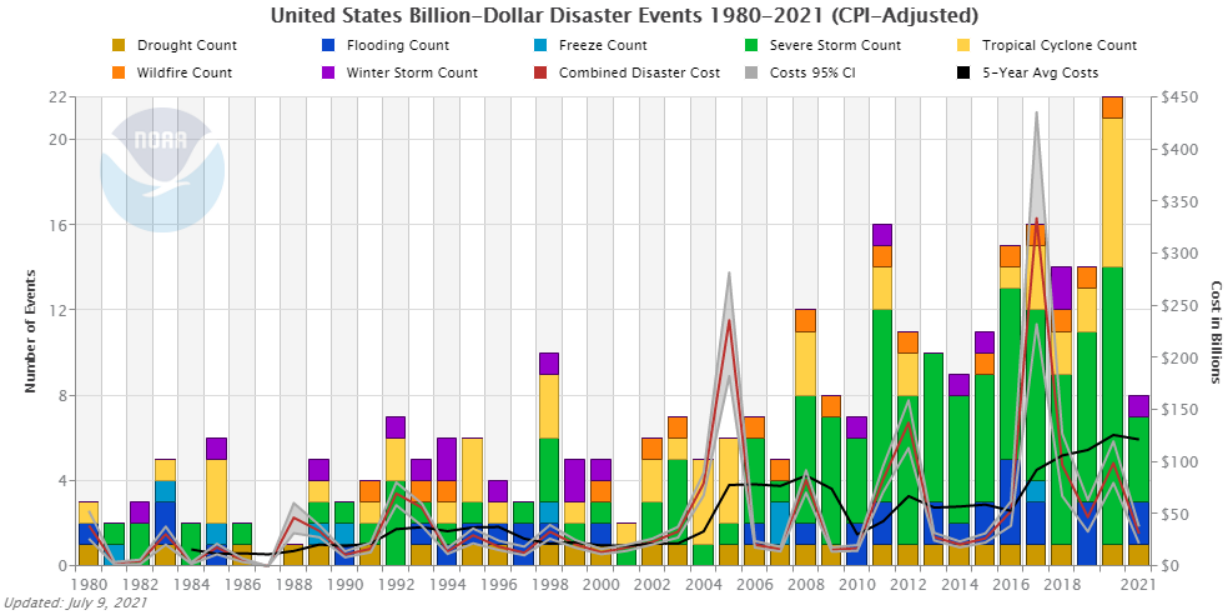
Chapter 6 Plan Implementation and Maintenance details how the Plan will be implemented, monitored, evaluated, and updated, as well as how the mitigation program will be integrated into other planning mechanisms.

It is important that local decision-makers stay involved in mitigation planning to provide new ideas and insight for future updates to the Pitkin County HMP. As a long-term goal, the HMP and the mitigation strategies identified within will be fully integrated into daily decisions and routines of local government. This will continue to require dedication and hard work, and to this end, this Plan update continues efforts to further strengthen the resiliency of Pitkin County.

1.2 Background and Scope

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." Each year in the U.S., disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. Additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars, making the costs of disasters several times higher than calculated amounts. Figure 1-1 shows the number and type of natural disasters in the U.S. that have done more than one billion dollars in damage, showing how the frequency and cost of major disasters have risen over the past several decades.

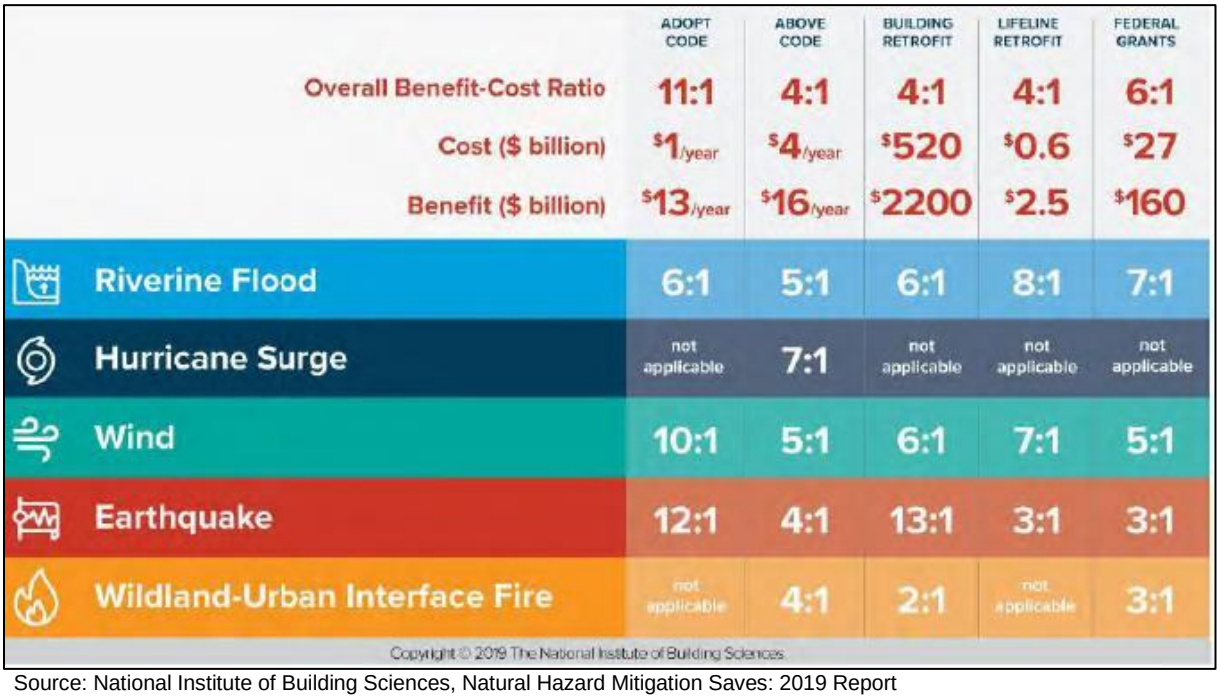
Figure 1-1 Billion-Dollar Disasters in the U.S., 1980-2021



Source: National Oceanic and Atmospheric Administration (NOAA)

However, some types of hazards are predictable, and much of the damage caused by these events can be mitigated through the use of various zoning, construction and permitting vehicles and other preventative actions. Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves communities an average of $6 in avoided future losses in addition to saving lives and preventing injuries, as illustrated in Figure 1-2

Figure 1-2 Financial Benefits of Hazard Mitigation



Source: National Institute of Building Sciences, Natural Hazard Mitigation Saves: 2019 Report

This Plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390, also known as the DMA) and its implementing regulations, which establish the requirements local HMPs must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

This Plan builds on years of mitigation planning in Pitkin County dating back to 2005. The Plan was last updated in 2018 and has been completely updated for 2023. Proactive mitigation planning will help reduce the cost of disaster response and recovery to the community and its property owners by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruption. The Pitkin County planning area is committed to reducing future disaster impacts and maintaining eligibility for federal funding.

2 PLANNING PROCESS

DMA Requirement §201.6(b) and §201.6(c)(1):

An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and

Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

2.1 2023 PLAN UPDATE PROCESS

This updated version of the Pitkin County Hazard Mitigation Plan (HMP) is the fourth revision of a plan originally prepared as a regional document in cooperation with Eagle County (2005) and subsequently updated in 2011-2012 and again in 2018 as a plan for Pitkin County and its local partners exclusively. This updated plan builds on previous versions, incorporating current hazard research, studies, and information about natural and human-caused hazards.

The project to update the Pitkin County Hazard Mitigation Plan (HMP) was managed by the Pitkin County Emergency Manager and funded by a combination of federal grant funds and local matching funds provided through in-kind contributions. A planning consultant, WSP Earth & Environment, was contracted to conduct research, facilitate data collection, incorporate best available current data into revisions. The updated HMP complies with FEMA guidance for Local Hazard Mitigation Plans in the DMA of 2000 and FEMA's 2013 Local Hazard Mitigation Planning Handbook.

2.1.1 What's New in the Plan Update

This HMP update involved a comprehensive review and update of each section of the 2018 plan and includes an assessment of the progress in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. The planning process provided an opportunity to review jurisdictional priorities related to hazard significance and mitigation action, and revisions were made where applicable to the plan. Only the information and data still valid from the 2018 plan was carried forward as applicable into this HMP update.

During the 2023 update process, the Hazard Mitigation Planning Committee (HMPC) updated each section of the previously approved plan to include new information and improve the organization and formatting of the plan's contents. The HMPC analyzed each section using FEMA's local plan update guidance to ensure that the plan meets all requirements. The Risk Assessment in Chapter 4 was substantially revised to incorporate recent events and reflect recent development trends with an updated GIS-based risk assessment. Information within has been updated throughout the plan where appropriate. The mitigation strategy in Chapter 5 has been updated to reflect current priorities and mitigation actions moving forward from the 2018 plan.

2.2 LOCAL GOVERNMENT PARTICIPATION

Pitkin County's HMP is a multi-jurisdictional plan that geographically covers everything within Pitkin County, as described further in Chapter 3. All jurisdictions that participated in the 2018 Plan participated again in the 2023 Plan, with the exception that Basalt Fire and Snowmass-Wildcat Fire Protection District merged to form the Roaring Fork Fire Rescue Authority. The following jurisdictions with the authority to regulate development participated in the planning process and are seeking FEMA approval of this plan:

- Pitkin County
- City of Aspen
- Town of Snowmass Village
- Town of Basalt
- Aspen Fire Protection District
- Roaring Fork Fire Rescue Authority

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC
- Detail areas within the planning area where the risk differs from that facing the entire area
- Identify specific projects to be eligible for funding
- Have the governing board formally adopt the plan

Updates to this plan were guided by a Planning Team composed of representatives of each participating jurisdiction, possessing a wide variety of technical expertise and community knowledge, including public safety, public works, community development, emergency management, environmental health, floodplain management, and utilities services. The Pitkin County HMPC formed over the course of three planning meetings and through responses to surveys and requests for information. For the Pitkin County Hazard Mitigation Plan's HMPC, participation was defined as:

- Attending and participating in the HMPC meetings
- Providing available data requested of the HMPC
- Reviewing and providing comments on the plan drafts
- Identify mitigation projects specific to jurisdiction for all profiled hazards & provide status
- Assist with and participate in the public input process
- Coordinate formal adoption

2.3 PLANNING PROCESS

Pitkin County and WSP worked together to establish the planning process for Pitkin County's plan update using the DMA planning requirements and FEMA's associated guidance. The original FEMA planning guidance is structured around a four-phase process:

- Organize Resources,
- Assess Risks,
- Develop the Mitigation Plan, and
- Implement the Plan and Monitor Progress.

FEMA's March 2013 Local Mitigation Planning Handbook recommends a nine-step process within the original four-phase process. Into this four-phase process, WSP integrated a more detailed 10-step planning process used for FEMA's Community Rating System (CRS) and FMA programs. Thus, the modified 10-step process used for this plan meets the funding eligibility requirements of the HMA grants (including HMGP, BRIC grant, HHPD grant, and FMA grant), CRS, and the flood control projects authorized by the U.S. Army Corps of Engineers (USACE). Table 2-1 summarizes the four-phase DMA process, the detailed CRS planning steps and work plan used to develop the plan and the nine handbook planning tasks from FEMA's 2013 Local Mitigation Planning Handbook. The sections that follow describe each planning step in more detail.

Table 2-1 Mitigation Planning Process Used to Update the Plan

FEMA'S 4-PHASE DMA PROCESS	MODIFIED 10-STEP CRS PROCESS	FEMA LOCAL MITIGATION PLANNING HANDBOOK TASKS
1) Organize Resources		
201.6(c)(1)	1) Organize the Planning Effort	1: Determine the planning area and resources
201.6(b)(1)	2) Involve the Public	2: Build the Planning Team - 44 CFR 201.6 (C)(1)
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies	3: Create an outreach strategy - 44 CFR 201.6(b)(1)
		4: Review community capabilities - 44 CFR 201.6 (b)(2)&(3)
2) Assess Risks		
201.6(c)(2)(i)	4) Identify the Hazards	5: Conduct a risk assessment - 44 CFR 201.6 (C)(2)(i) 44 CFR, 201.6(C)(2)(ii)&(iii)
201.6(c)(2)(ii)	5) Assess the Risks	
3) Develop the Mitigation Plan		
201.6(c)(3)(i)	6) Set Goals	

FEMA'S 4-PHASE DMA PROCESS	MODIFIED 10-STEP CRS PROCESS	FEMA LOCAL MITIGATION PLANNING HANDBOOK TASKS
201.6(c)(3)(ii)	7) Review Possible Activities	6: Develop a mitigation strategy - 44 CFR 201.6(c)(3)(i); 44 CFR 201(c)(3)(ii) and 44 CFR 201.6(c)(3)(iii)
201.6(c)(3)(iii)	8) Draft an Action Plan	
4) Implement the Plan and Monitor Progress		
201.6(c)(5)	9) Adopt the Plan	7: Review and adopt the plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan	8: Keep the plan current
		9: Create a safe and resilient community - 44 CFR 201.6(c)(4)

2.3.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

WSP worked with the Pitkin County Office of Emergency Management (OEM) to establish the framework and organization for the update of this Plan. WSP and OEM identified the key County, municipal, and other local government, and initial stakeholder representatives. Invitations were emailed to invite them to participate as a member of the HMPC and to attend a kickoff meeting. Representatives from the following County, municipal, and special district agencies participated on the HMPC and the development of the plan:

Table 2-2 Pitkin County Hazard Mitigation Planning Team

PITKIN COUNTY HAZARD MITIGATION COUNTY PLANNING TEAM	
Pitkin County	
Administration/County Manager's Office	Pitkin County Sheriff's Office (PCSO)
Community Relations Department	Pitkin County Emergency Management
Community Development Office	Animal Safety Department (PCSO)
Public Works Department	Human Services Department
Engineering and Road & Bridge Dept.	Environmental Health Department
Land Use Engineering/Floodplain Mgmt.	Regional Emergency Dispatch Center
Long-Range Planning	Solid Waste Center
GIS Department	Aspen/Pitkin County Airport
City of Aspen	
City Manager's Office	Aspen Police Department
Climate Action/Canary Initiative	Environmental Health & Sustainability
Community Development	Human Resources/Risk Management
Stormwater/Flood and Mudflows	Utilities
Town of Snowmass Village	
Town Manager's Office	Snowmass Village Police Department
Public Works Department	
Town of Basalt	
Community Development	Basalt Police Department
Public Works Department	
Aspen Fire Protection District	
Roaring Fork Fire Rescue Authority	
Stakeholders	
American Red Cross	Crystal River Valley Community
Aspen Valley Hospital	Community of Lenado
Aspen Community Health	Colorado Mountain College
Aspen Ambulance District	Aspen Skiing Company
Aspen School District	Roaring Fork Transportation Authority
Roaring Fork Conservancy	Holy Cross Energy
Colorado State Division of Fire Prevention	Colorado Division of Water Resources, Dam Safety

PITKIN COUNTY HAZARD MITIGATION COUNTY PLANNING TEAM	
U.S Forest Service	Bureau of Land Management
National Weather Service	

A list of specific HMPC representatives is included in Appendix B. Other local, state, federal, and private stakeholders invited to participate in the HMPC are discussed below under planning Step 3.

During the plan update process, the HMPC communicated with a combination of virtual meetings, phone conversations, and email correspondence. Three planning meetings with the HMPC were held during the plan's development between April and September 2023. The meeting schedule and topics are listed in the following table. The kickoff meeting was held virtually, but the remaining meetings were conducted in person. The sign-in sheets and agendas for each of the meetings are included in Appendix C.

Table 2-3 Schedule of Meetings

HMPC MEETING	MEETING TOPIC	LOCATION	MEETING DATE
1	Kickoff Meeting	Virtual via Microsoft Teams	April 5, 2022
2	Risk Assessment Update	In-person at Roaring Fork Fire Rescue Station in Basalt, CO	June 28, 2022
3	Mitigation Strategy Update	In-person at Roaring Fork Fire Rescue in Basalt, CO	September 27, 2022

HMPC Meeting #1 – Kickoff Meeting

During the kickoff meeting in April, WSP presented information on the scope and purpose of the plan, participation requirements of HMPC members, and the proposed project work plan and schedule via Microsoft Teams. Sixty-nine members of the HMPC and stakeholders were present. A plan for public involvement (Step 2) and coordination with other agencies and departments (Step 3) was discussed. WSP also introduced the hazard identification requirements and data, as well as reviewed the hazards included in the 2018 plan. The HMPC discussed past events and impacts and future probability for each of the hazards required by FEMA for consideration in a local hazard mitigation plan. Each jurisdiction provided updates through a data collection workbook created by WSP and mitigation action trackers or provided information directly to WSP for incorporation into the plan update.

HMPC Meeting # 2 – Risk Assessment Summary/Goals Development

The HMPC convened in June to review and discuss the results of the risk and vulnerability assessment update. Thirty members of the HMPC and stakeholders were present for the discussion. The group reviewed the public survey results and noted the differences between hazard ratings for the jurisdictions and the public's perception of risks to the various hazards. The HMPC went through each hazard together and discussed the results as well as shared any local insight to inform the Hazard Identification and Risk Assessment (HIRA) update. Additionally, climate adaptation requirements were presented for the plan update. Refer to the meeting summary in Appendix C for notes related to each hazard discussed and results from the post meeting survey.

HMPC Meeting #3 – Mitigation Strategy Development

The HMPC met again in September, with twenty-five HMPC members participating to discuss updating the mitigation action plan from 2018 and finalize the goals and objectives for this planning process. The HMPC provided an update on the progress of mitigation actions and discussed the criteria for mitigation action selection and prioritization using a worksheet provided by WSP (see Appendix C). The group also reviewed the public survey results for which mitigation actions the public believes should have the highest priority. During the meeting, an activity was facilitated by WSP where all members of the HMPC wrote a new mitigation action and then individuals would vote on their top three actions. The meeting ended with a review of the next steps and planning process schedule.

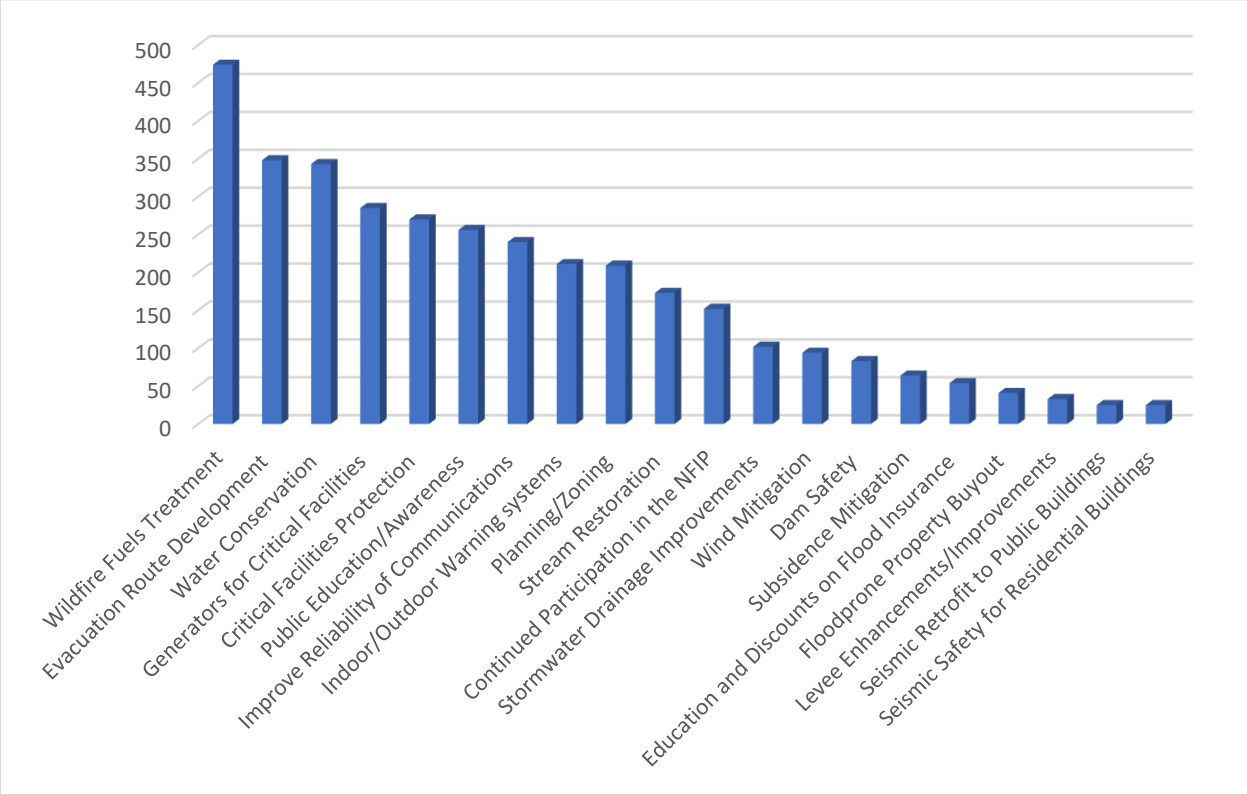
Planning Step 2: Involve the Public

At the kickoff meeting, the HMPC discussed options for soliciting public input on the mitigation plan and developed an outreach strategy by consensus. Public and stakeholder input was collected through an online survey from May 1-31, 2022. The survey was advertised by the County and participating jurisdictions through social media and their websites.

The survey provided an opportunity for public input during the planning process prior to finalization of the plan update. The public survey received responses from 523 individuals. Responses indicated that the public perceives the most significant hazards to be wildfire, drought, and winter storms.

Figure 2-1 below displays the results from Question 6, which asked respondents to consider potential mitigation actions and to indicate which types of actions should have the highest priority in the updated County Mitigation Strategy. As indicated by the survey excerpt below, the public feels the highest priority action items should include wildfire fuels treatment projects (474 responses), evacuation route development (348), water conservation (343), generators for critical facilities (285), and critical facilities protection (270). Full results of the public survey are provided in Appendix D. This information was discussed with the HMPC to use when evaluating hazard risks and considering mitigation actions.

Figure 2-1 Survey Responses on the Types of Mitigation Actions That Should Have the Highest Priority in Pitkin County



The public was also given an opportunity to review and comment on the completed draft plan in December 2022. The draft plan was made available on the County website, along with an online comment form. The plan was advertised by the County through social media and their websites. The public was given a two-week period to review and provide comments. No public comments were received on the draft plan.

Planning Step 3: Coordinate with Other Departments and Agencies

There are numerous organizations whose goals and interests' interface with hazard mitigation in Pitkin County. Coordination with these organizations and other community planning efforts is vital to the success

of this Plan update and implementation. The HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and power and communications organizations to participate in the process. An opportunity for neighboring communities, as well as local and regional agencies involved in hazard mitigation activities, was provided through invitations to meetings, or phone and email communication during the process; they were also given an opportunity to review and comment on the plan prior to finalization. The following agencies were reached out to during the planning process. Some were present at HMPC meetings (indicated by an asterisk) and/or supplied information to the HMPC that was used to inform the risk assessment. Neighboring jurisdictions were asked to comment on the plan prior to its finalization.

State and Federal Agencies

- Colorado Department of Natural Resources – Dam Safety
- Bureau of Land Management*
- Colorado Department of Homeland Security and Emergency Management*
- Colorado Department of Transportation
- Colorado State Patrol – Golden Incident and Resources Management*
- U.S. Forest Service*
- National Weather Service Grand Junction*
- U.S. Environmental Protection Agency – Response and Planning
- Colorado State University Extension
- Colorado Division of Fire Prevention & Control*
- Colorado Department of Natural Resources, Div. of Water Resources, District 5

Neighboring Jurisdictions

- Eagle County
- Garfield County
- Gunnison County
- Lake County
- Mesa County

Special Districts/Private Businesses/Community Organizations

- American Red Cross
- Aspen Ambulance District
- Aspen Community Health
- Aspen Fire Protection District
- Aspen School District
- Aspen Skiing Company
- Aspen Valley Hospital*
- Holy Cross Energy
- Roaring Fork Conservancy*
- Roaring Fork Transportation Authority
- Colorado Mountain College

Integration with Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this Plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability from natural hazards. Pitkin County uses a variety of comprehensive planning mechanisms, such as master plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. Table 2-4 below provides a summary of the key existing plans, studies, and reports that were reviewed during the update process. Information on how they informed the update are noted where applicable.

Table 2-4 Summary of Key Plans, Studies, and Reports

PLAN, STUDY, REPORT NAME	HOW PLAN, STUDY OR REPORT INFORMED THE HMPC`
Pitkin County CWPP (2014)	Reviewed information on past wildfires and wildfire risk to inform the risk assessment for Pitkin County.
Upper Snowmass Creek Caucus CWPP (2018)	Reviewed information on past wildfires and wildfire risk to inform the risk assessment for Snowmass Village.
Carbondale-Basalt CWPP (2010)	Reviewed information on past wildfires and wildfire risk to inform the risk assessment for the Town of Basalt.
Pitkin County Comprehensive Plan	Informed the Community Profile and capability assessments for the County.
Pitkin County Annual Comprehensive Report	Informed the Community Profile and capability assessments for the County.
2012 Aspen Area Community Plan	Informed the Community Profile and capability assessments for the City of Aspen.
Snowmass Village Comprehensive Plan 2018	Informed the Community Profile and capability assessments for the Town of Snowmass Village.
Pitkin County Wildland Fire Operating Plan (2022)	Reviewed what existing policies and procedures exist for wildfire protection and inform mitigation actions.
Colorado State Hazard Mitigation Plan (2018 Update)	Reviewed information on past hazard events and hazard risk information to inform the risk assessment Reviewed State goals and objectives.
Colorado Drought Mitigation and Response Plan (2018 Update)	Reviewed information on pasts droughts and their impacts on the planning area. Incorporated information into the risk assessment.
Colorado Flood Mitigation Plan (2018 Update)	Reviewed information on past flood events and risk analysis for the planning area to inform the risk assessment.
Updated Flood Insurance Study Draft (2020) for Pitkin County and Incorporated Areas	Provided updated flood risk data for specific hazard areas located within the County and allowed the County to meet the minimum NFIP and CWCB regulations.
U.S. Department of Agriculture (USDA) Risk Management Agency Crop Indemnity Reports (2007-2020)	Provided data related to crop losses due to drought and hail.

2.3.2 Phase 2: Assess Risk

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

Chapter 4 Risk Assessment is the result of a comprehensive effort to identify and document all the hazards that have, or could, impact the planning area. This section was updated to reflect recent hazard events and current assets within the county and jurisdictions. Where data permitted, GIS were used to display, analyze, and quantify hazards and vulnerabilities. The HMPC conducted a capability assessment update to review and document the planning area's current capabilities to mitigate risk and vulnerability from natural hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC can assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. All hazards from the 2018 plan were kept in the 2023 update, and three new hazards were added: cyber-attack, contagious disease, and ice jam release. A more detailed description of the risk assessment process and the results are included in Chapter 4. The capability assessment is included in Chapter 3 Community Profile and Capability Assessment. In addition to input from the Planning Team, a variety of state, federal, nonprofit and university sources were consulted to collect data required for the update of this plan, as listed above under Planning Step 3: Coordinate with Other Departments and Agencies.

2.3.3 Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

WSP facilitated a brainstorming and discussion session with the HMPC during their second meeting to update the goals and objectives from the 2018 plan. During the third HMPC meeting, WSP facilitated a discussion session with the HMPC around a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This included a review of progress on each action identified in the 2018 plan. WSP then facilitated an activity where individuals of the HMPC created new mitigation actions and voted on those they considered to be the highest priority. This process and its results are described in greater detail in Chapter 5.

Planning Step 8: Draft and Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in planning steps 6 and 7, WSP produced a complete first draft of the plan. This complete draft was shared electronically for HMPC review and comment. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. WSP integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Division of Homeland Security and Emergency Management (DHSEM) and FEMA Region VIII to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction.

2.3.4 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

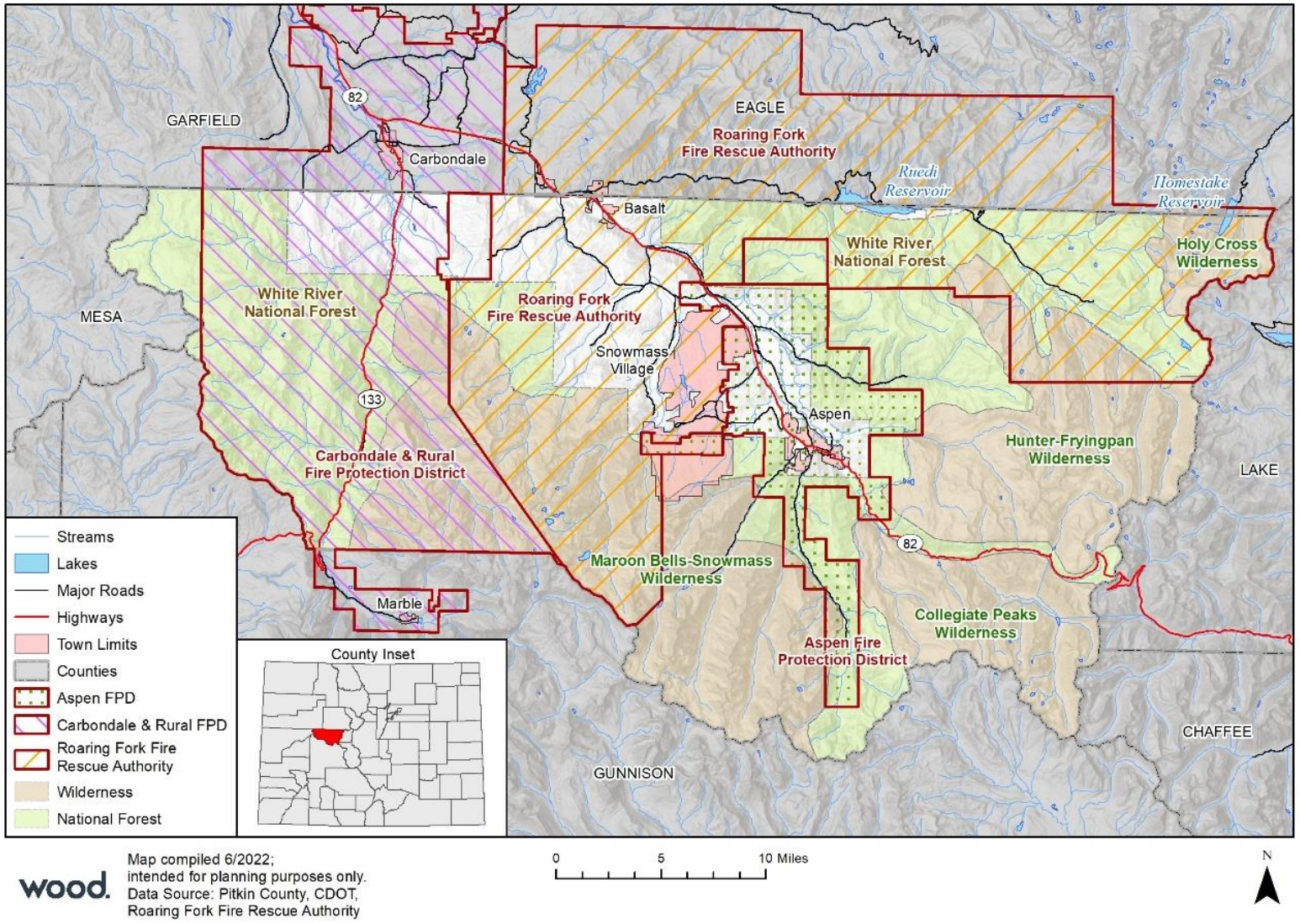
The updated plan will be officially implemented upon formal adoption by the Pitkin County Board of Commissioners and the governing bodies of the other participating jurisdictions, tentatively scheduled for early 2023, following conditional approval by FEMA Region VIII.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time. A discussion on the progress with implementation is included in Chapter 5.2. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 6, which also includes a strategy for continued public involvement.

3 COMMUNITY PROFILE

Figure 3-1 Map of Pitkin County



Pitkin County is located in the high country of west-central Colorado and is dominated by national forest land, several large mountain ranges, and many of the state's highest mountain peaks. Located approximately 200 miles southwest of Denver, Pitkin County is the 24th largest county in the state out of 64 counties, covering approximately 975 square miles (626,832 acres).

Most of the land area in Pitkin County is publicly owned. The U.S. Forest Service/White River National Forest is the largest landowner in the county with 494,709 acres (79% of the county), followed by the Bureau of Land Management which owns 27,522 acres (4.4%), and the Colorado Division of Wildlife (800 acres or less than 1%). The total land area in the county that is privately held is 95,473 acres (15.3%).

Pitkin County includes the City of Aspen, the Town of Snowmass Village, portions of the Town of Basalt, and the unincorporated communities of Woody Creek, Old Snowmass, Meredith, Thomasville, and Redstone. Other rural residential areas include Brush Creek Village, Aspen Village and Castle/Maroon Creek, Crystal River Valley and Lenado. Ghost towns within the county include Ashcroft and Independence. The majority of private lands and homes are located along the Roaring Fork River corridor -- the primary river valley in Pitkin County -- and in the Crystal River Valley. The other significant river drainages in the County are the Frying Pan River, Snowmass Creek, Woody Creek, Castle Creek, Conundrum Creek and East Sopris Creek.

3.1 History

Before the arrival of the first non-native settlers from Europe in the mid-nineteenth century and well before the height of silver mining in the early 1880s, the Ute Indians hunted, fished, and gathered wild foods in the valleys of the Roaring Fork, Fryingpan, and other rivers and streams of current-day Pitkin County. The Ute Indians referred to the area as "Shining Mountains." In 1879, the first silver miners arrived in the Roaring Fork Valley followed by ranchers running sheep and cattle and entrepreneurs that established commerce to support the new industries.

In 1880, the small settlement known as Ute City was renamed Aspen and the town was incorporated the next year. By 1891, Aspen surpassed Leadville as the nation's largest single silver-producing mining district and the town's population grew to 12,000. In 1894, one of the largest nuggets of native silver ever found (2,350 pounds) was mined at the Smuggler Mine near Aspen. However, the Sherman Silver Act had been repealed in 1893, which led to the demonetization of silver. After the silver bust, Aspen's population declined to 700 and the economy languished until rebounding in the 1940s when Aspen was reborn as a ski town. Today, the City of Aspen is the 53rd largest city in the state and a world-renowned winter and summer resort.

In 1882, demand for charcoal from smelters in Aspen resulted in the construction of seven kilns near the confluence of the Roaring Fork and Fryingpan Rivers. Five years later in 1887, the Town of Aspen Junction was formed across the Fryingpan River from the kilns. In 1895 Aspen Junction was renamed Basalt for the basaltic rock formation of Basalt Mountain, north of the town. The Town of Basalt was officially incorporated during the summer of 1901. The Fryingpan Kilns at Arbany Park, the best-preserved regional examples of the early-industry facilities, were designated as a Local Historic Landmark in 1893.

Situated high in the Brush Creek Valley, the area that would become Snowmass Village was settled by ranching families in 1910. Inspired by the success of the Aspen ski area during the late 1950s, a real estate developer bought ranches at the base of Baldy and Burnt Mountains and opened the Snowmass Ski Area in 1967. The Snowmass Ski Area is home to the second-largest ski mountain in Colorado and has the most vertical feet of terrain in the United States and over 150 miles of ski trails. The Town of Snowmass Village was incorporated in 1977 and today maintains over 35 miles of hiking and biking trails with beautiful mountain vistas.

3.2 Climate

The high-altitude climate of Pitkin County is characterized by low humidity, abundant sunshine, and annual precipitation totals that vary widely from high peaks to lower valleys. Summer weather is warm and generally dry with temperatures occasionally reaching 90˚F during the day. Brief afternoon thunderstorms are

common during the summer months, with accompanying lightning strikes and locally heavy rainfall. Overnight low temperatures in the summer can dip below 50˚F, again with high variability depending on elevation. During the winter, sunny days and clear blue skies often give way to severe winter weather conditions and significant snowfall accumulations. Communities in the Roaring Fork Valley experience relatively temperate daytime high temperatures in winter that average around 35˚F, while temperatures drop dramatically at night with overnight low temperatures that average in single digits.

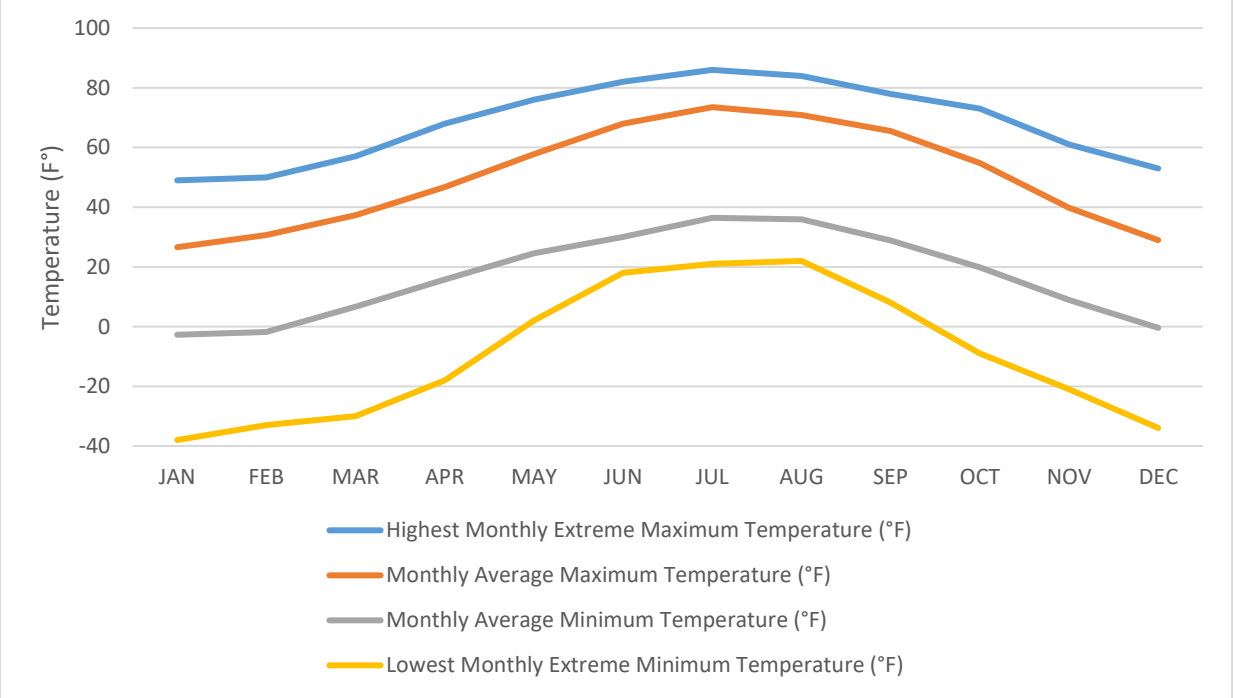
The High Plains Regional Climate Center and Colorado Climate Center report data from the Aspen 1SW weather station in Pitkin County. Table 3-1 contains temperature summaries for the station. The Western Regional Climate Center also reports data from the Pitkin weather station in Pitkin County. Figure 3-2 graphs the daily temperature averages and extremes from 1963 through 1986 for the Pitkin weather station.

Table 3-1 Pitkin County Temperature Summary Aspen 1SW Station

Period Of Record	1980-2022
Winter Average Minimum Temperature	9.0°F
Winter Mean Temperature	24.0ºF
Summer Average Maximum Temperature	76.0°F
Summer Mean Temperature	60.0ºF
Maximum Temperature	91°F; July 7, 1989
Minimum Temperature	-25°F; February 7, 1989
Average Annual Number of Days >90°F	0.0
Average Annual Number of Days <32°F	211.9

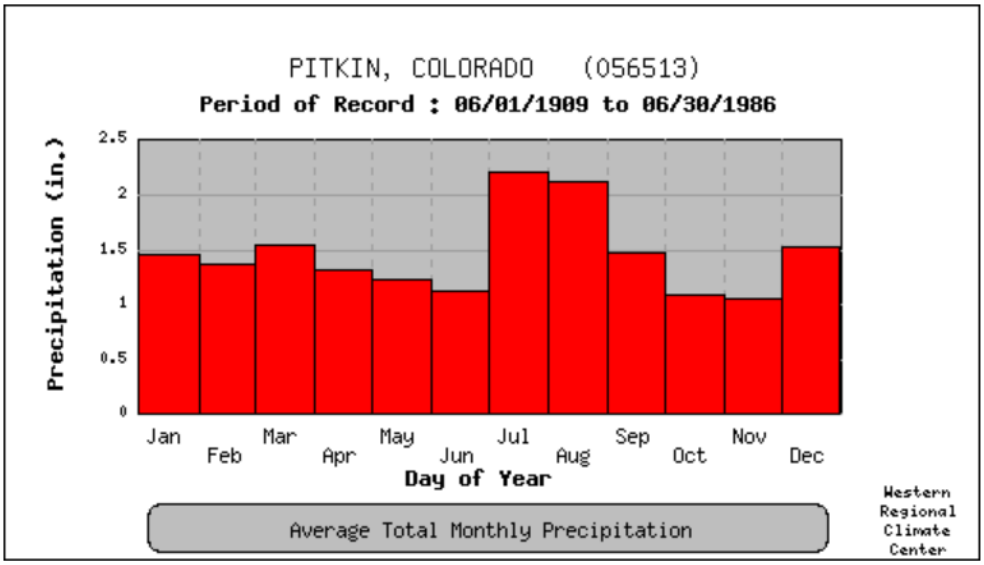
Note: Winter: December, January, February; Summer: June, July, August
Source: High Plains Regional Climate Center (https://hprcc.unl.edu/stationtool/index.php); Colorado Climate Center (https://climate.colostate.edu/)

Figure 3-2 Pitkin Station Monthly Temperature Data (1963-1986)



Precipitation is highest during July and August. The average annual precipitation is 16.92 inches of rain and 114.2 inches of snowfall. Severe thunderstorms occur mostly in the summer. Based on information from NOAA, Colorado receives an average of 520,833 cloud-to-ground lightning strikes per year. Figure 3-3 shows the average monthly precipitation of rainfall in Pitkin County.

Figure 3-3 Average Monthly Rainfall Precipitation for Pitkin County (1909-1986)



3.3 GEOGRAPHY

Pitkin County is dominated by several large mountain ranges. The Elk Mountains form the western and southern sides of Pitkin County and the Continental Divide forms the eastern boundary along the crest of the Sawatch Range. The Fryingpan River is dammed to form the Ruedi Reservoir and the Roaring Fork River flows northwest from the high peaks. The Crystal River is on the western side of the county. The elevations in the county range from 6,250 feet along the Crystal River south of Carbondale to over 14,000 feet on a number of peaks in the Maroon Bells/Snowmass Wilderness Area.

Most of the land area within Pitkin County consists of high elevation forests and alpine environments, with the lower valleys dominated by irrigated farmlands and urban/suburban developments. In between the high elevation forests and alpine habitats and the lower farmlands are pinion/juniper woodlands, oakbrush stands, aspen forests, lodgepole pine forests, and much of the rural population. The majority of the population and most privately-owned lands in Pitkin County are located on the valley floor.

3.4 DEMOGRAPHICS

Information on population levels and other demographic information helps to make informed decisions about future planning. Population directly relates to land needs for housing, industry, stores, public facilities and services, and transportation. Population changes are useful socioeconomic indicators, as a growing population generally indicates a growing economy, and a decreasing population signifies economic decline.

The U.S. Census Bureau American Community Survey (ACS) estimated the Pitkin County population at 17,767 as of 2021. Table 3-2 shows planning area population data from 2000 through 2020. The total Pitkin County population increased 4.8% from 2000 to 2020, slightly lower than the United States population increase of 5.8% during the same time frame.

Table 3-2 Population of Pitkin County, Aspen, Basalt, and Snowmass Village from 2000 - 2020

JURISDICTION	2010	2012	2014	2016	2018	2020
Pitkin County	17,148	17,154	17,292	17,712	17,975	17,976
Town of Aspen	6,403	6,607	6,700	6,788	7,234	7,721
Town of Basalt	3,674	3,954	3,891	3,783	3,955	3,941
Town of Snowmass Village	2,590	2,766	2,852	2,883	2,824	2,786
Unincorporated Pitkin County	6,740	6,205	6,290	6,345	6,290	6,200

Source: U.S. Census Bureau, 2020 ACS 5-Year Estimates.

With about 37% of the county's population, Aspen is the most populous town in Pitkin County. However, as of 2020 about 35% of the residents of the County live in unincorporated areas, down from 39% in 2010.

Select U.S. Census ACS 2020 Five-Year Estimates demographic and social characteristics for Pitkin County are shown in Table 3-3.

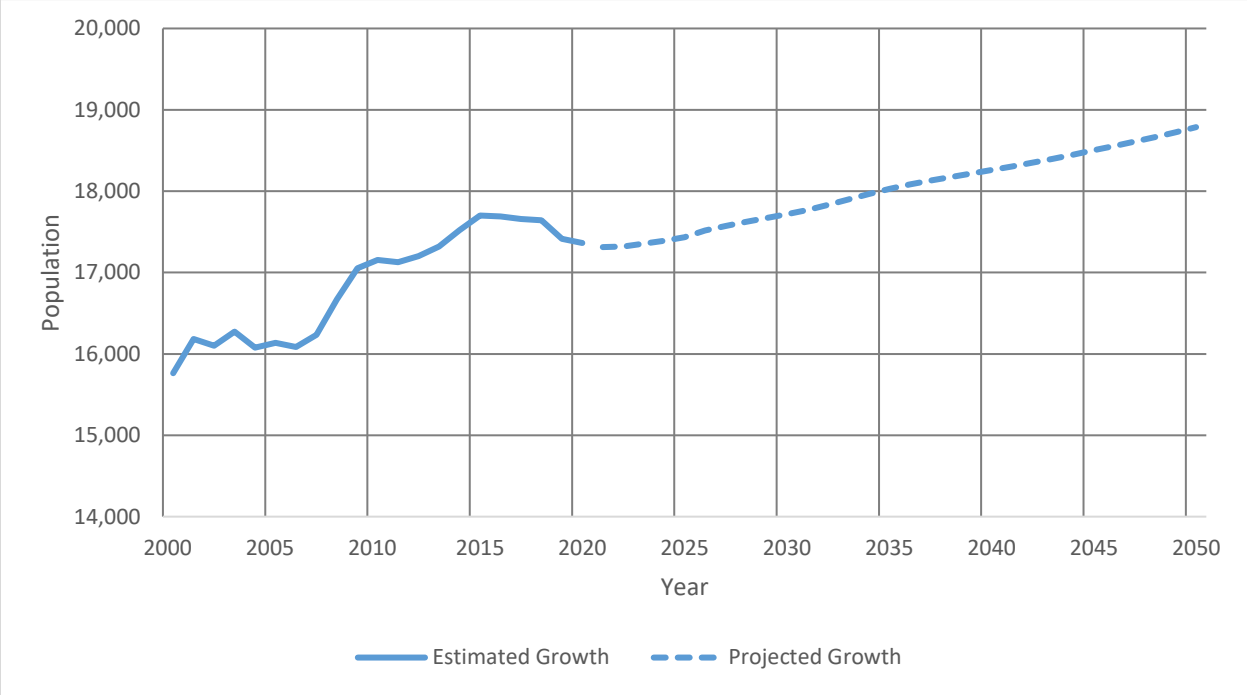
Table 3-3 Demographic and Social Characteristics of Pitkin County

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Gender/Age (% of Population)				
Male	52.90%	52.10%	51.40%	48.50%
Female	47.10%ewq	47.90%	48.60%	51.50%
Under 5 Years	5.40%	3.20%	5.70%	8.40%
65 years and over	18.70%	15.20%	21.80%	25.70%
Race/Ethnicity (% of Population)				
White	90.40%	88.90%	93.90%	96.90%
American Indian/Alaska Native	0.10%	0.20%	0.80%	0.00%
Asian/Pacific Islander	2.30%	4.90%	0.50%	0.00%
Black or African American	0.50%	1.00%	0.30%	0.50%
Two Or More Races	3.20%	3.40%	2.60%	0.00%
Hispanic Or Latino (Of Any Race)	10.30%	7.70%	9.40%	14.40%
Education (% of Total Population 25+ Years)				
High School Graduate Or Higher	96.40%	97.10%	96.20%	100.00%

*Population/Residents here refer to the civilian non-institutionalized population.
Source: U.S. Census Bureau, 2020 ACS 5-Year Estimates.

Figure 3-4 shows 5-year population changes in Pitkin County from 2000 to 2020, as well as forecasted growth through the year 2050 according to the Colorado State Demography Office. Pitkin County is expected to grow to almost 19,000 residents by 2050.

Figure 3-5 Pitkin County Population and Forecasted Growth, 2000 to 2050



Source: State Demography Office 2021

3.5 Social Vulnerability

Local vulnerability to disasters depends on more than the relationship between a place and its exposure to hazards. Social and economic factors – including race, age, income, renter status, or institutionalized living– directly affect a community's ability to prepare for, respond to, and recover from hazards and disasters. The concept of social vulnerability helps explain why communities often experience a hazard event differently, even when they experience the same amount of physical impacts or property loss.

The term vulnerability should be used to describe the communities at an increased risk from a risk or hazard, such as high vulnerability due to wildfires or floods based upon geography, topography, hydrology, or weather. Referencing people themselves directly with the term vulnerability causes individual community members to be seen with a deficit lens, leaving the impression that the vulnerability is a result of the lack of responsibility and/or adequate planning of the individual. Instead, vulnerability only occurs when the system that the individual is part of fails to provide equitable accessibility to resources or services, known as access and functional needs, for the individual to survive, respond to, and recover from an event. Barriers that may be exacerbated by certain social and economic factors – including race, age, income, renter status, or institutionalized living – directly affect a community's ability to prepare for, respond to, and recover from hazards and disasters.

This social vulnerability assessment is designed to improve local decision making, hazard prioritization, and emergency management activities. By incorporating social vulnerability into the risk assessments of individual hazards, local communities can identify more vulnerable areas and tailor their mitigation actions to accommodate all members of their community, including the most sensitive groups.

The Centers for Disease Control and Prevention (CDC) has developed a social vulnerability index (SVI) as a way to measure the resilience of communities when confronted by external stresses such as natural or human-caused disasters or disease outbreaks. The SVI is broken down at the census-tract level and provides insight into particularly vulnerable populations to assist emergency planners and public health officials identify communities more likely to require additional support before, during, and after a hazardous

event. The SVI index looks at 15 factors, which are aggregated into four main themes: socioeconomic status, household composition & disability, minority status & language, and housing & transportation. Table 3-4 shows countywide estimates for those four themes and 15 factors, along with relative rankings showing how Pitkin County compares to other counties in Colorado and nationally. The rankings show that compared to other counties in Colorado, Pitkin County's social vulnerability is low (i.e. less socially vulnerable than most counties and most of the state's population).

Table 3-4 Pitkin County Social Vulnerability Characteristics

THEME	VARIABLE	COUNTYWIDE ESTIMATE	RANK COMPARED TO COLORADO COUNTIES	VULNERABILITY
Socioeconomic Status			**10%**	**Low**
	Below Poverty	7.2%	14%	Low
	Unemployment	4.3%	43%	Below Average
	Per Capita Income	$56,180	0%	Low
	No High School Diploma (25+)	3.7%	16%	Low
Household Composition and Disability			**19%**	**Low**
	Age 65 and Older	17.2%	48%	Below Average
	Age 17 and Younger	17.2%	13%	Low
	Disability Estimate	3.8%	0%	Low
	Single-Parent Household	8.1%	73%	Above Average
Minority Status and Language			**22%**	**Low**
	Minority	14.5%	25%	Below Average
	Speaking English "Less than well"	0.8%	22%	Low
Housing and Transportation			**29%**	**Below Average**
	Multi-unit (10+) Structures	25.6%	95%	High
	Mobile Homes	4.2%	22%	Low
	Units with More People than Rooms	1.4%	17%	Low
	Households without Vehicles	5.5%	79%	High
	Group Quarters	0.7%	21%	Low
Overall Social Vulnerability			**16%**	**Low**

Source: U.S. Centers for Disease Control and Prevention, *https://www.atsdr.cdc.gov/placeandhealth/svi/index.html*

The data shows that Pitkin County's social vulnerability is low overall compared to the State of Colorado. The County has relatively high levels of vulnerability in the following categories:

- Multi-unit housing (defined as more than ten units per structure), which can be more difficult to evacuate during emergencies.
- Percentage of households without a vehicle, which makes accessing resources and evacuating difficult.
- Percentage of single-parent households, who may be disproportionately burdened in a disaster as all caretaker responsibility will fall on one parent.

It should be noted that even though the County may have relatively few people in a category compared to other counties, there are still people in that category who may be disproportionately impacted by disasters and may need extra consideration or assistance.

Another social vulnerability not captured in the CDC data is the lack of broadband service in certain areas of the County. The lack of broadband services, or in some cases high speed internet services, can make it challenging to inform people in these areas of emergency situations or community outreach related to hazards in general.

3.5.1 Age Distribution

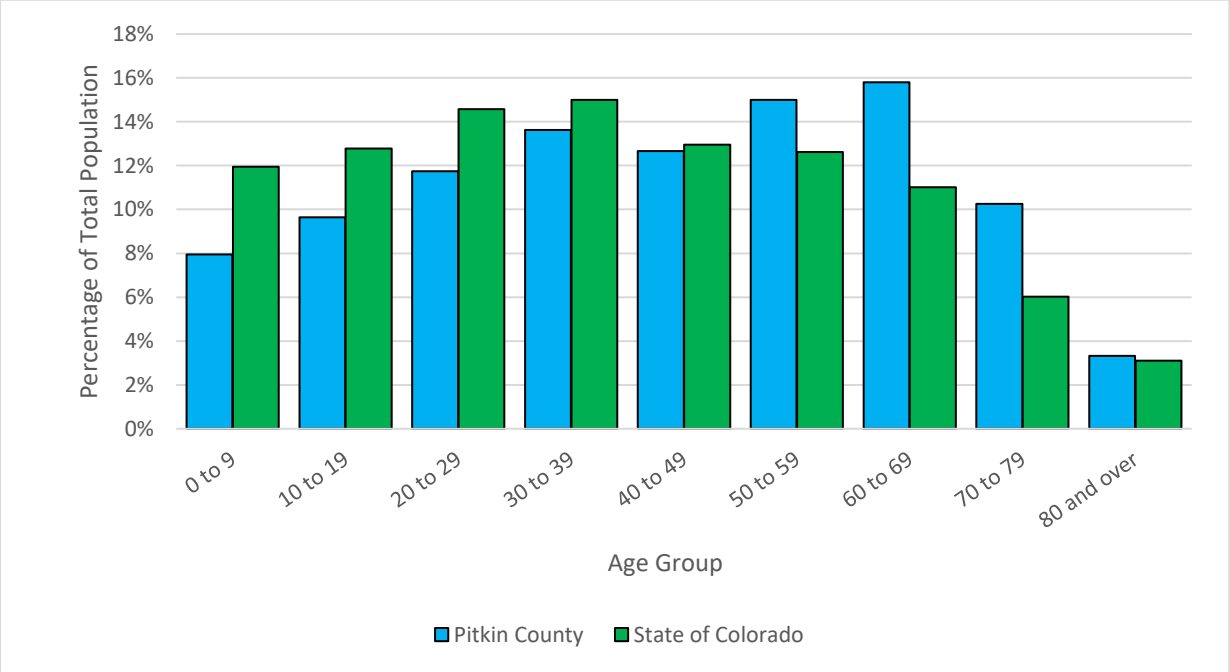
As discussed above, as a group the elderly are more likely to lack the physical and economic resources necessary for response to hazard events and are more likely to suffer health-related consequences making

recovery slower. They are more likely to be vision, hearing, or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, the elderly are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. Elderly residents living in their own homes may have more difficulty evacuating and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific planning attention for the elderly is an important consideration given the current aging of the national population. Based on 2020 U.S. Census data estimates, 18.7% of the planning area's population is 65 or older and 48.8% of those 65 or older have some form of disability.

Children under 17 are also particularly vulnerable to disaster events because of their young age and dependence on others for basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards. According to the 2020 U.S. Census data estimates, 16.4% of the planning area is under the age of 18, and 4.5% of Pitkin County families have children under 18 and are below the poverty line.

The overall age distribution for the planning area is illustrated in Figure 3-6.

Figure 3-6 Pitkin County Age Distribution – 2020



3.5.2 Disabled Populations

The 2020 U.S. Census ACS estimates indicated that there are over 40 million non-institutionalized Americans living with disabilities. This equates to about 12.6% of the total civilian non-institutionalized population. People with disabilities are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of the population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs. According to the 2020 ACS 5-Year Estimates, 7.2% of the population in the planning area lives with some form of disability.

3.5.3 Ethnic Population

Research shows that racial and ethnic minority groups are often less likely to be involved in pre-disaster planning and experience higher mortality rates during a disaster event. Post-disaster recovery can be less effective for ethnic populations and is often characterized by cultural insensitivity. Since higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability. In Pitkin County, 14.0% of individuals speak a language other than English at home, compared to 16.9% of the statewide population and 21.5% of the population country wide. According to the U.S. Census, the ethnic composition of the planning area is predominantly white, at about 90.4%. The largest minority population is Hispanic or Latino at 10.3%.

3.6 Economy

Select 2020 economic characteristics estimated for Pitkin County by the U.S. Census Bureau are shown in Table 3-5.

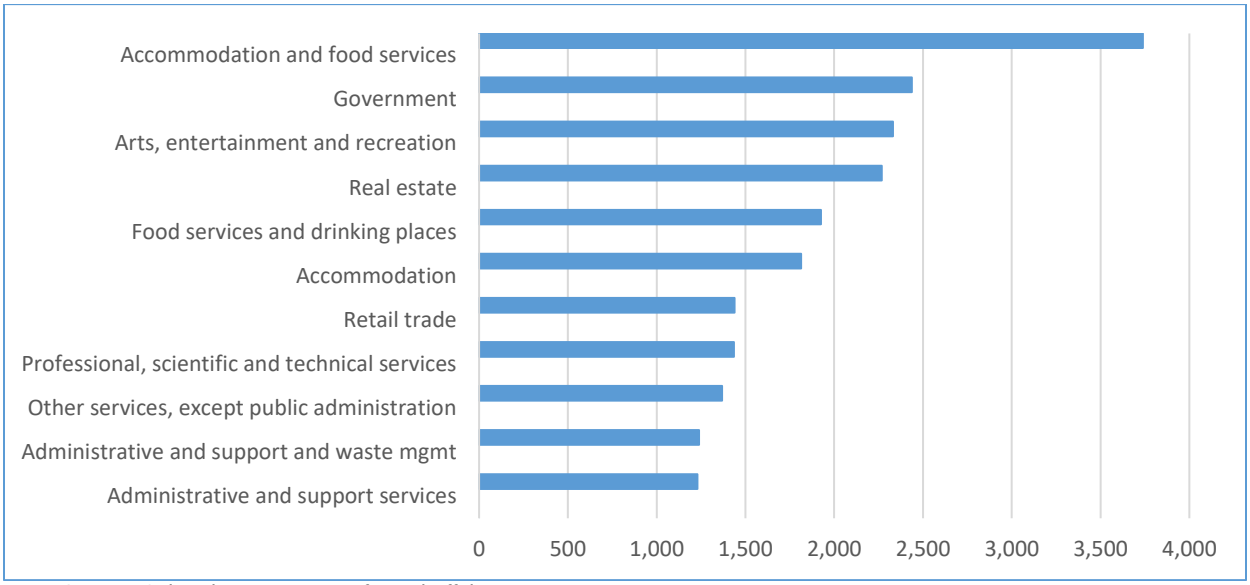
Table 3-5 Pitkin County Economic Characteristics

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF SNOWMASS VILLAGE	TOWN OF BASALT
Families Living Below Poverty Level	1.6%	1.6%	0.0%	2.8%
Percent of Individuals Living Below Poverty Level	5.7%	4.4%	0.5%	5.0%
Median Home Value	$599,000	$558,000	$642,400	$790,400
Median Annual Household Income	$82,455	$77,669	$76,777	$100,551
Per Capita Income	$61,261	$71,707	$55,882	$55,060
Population 16+ Years old in Labor Force	78.7%	78.9%	83.8%	80.5%
Employment Rate	76.0%	77.8%	83.8%	77.8%

3.6.1 Occupations and Industry

Tourism accounts for more than half of the base industry employment in Pitkin County. As with other mountain resort communities, the largest industries by employment are accommodation and food services (19.0%), arts, entertainment, and recreation (11.8%), and real estate (11.5%), as well as government (12.4%). Based on the 2020 U.S. Census Annual Business Survey, the total number of business establishments located in Pitkin County was 1,669 and the total number of employees was 18,401. Figure 3-7 shows the distribution of industry types in Pitkin County, based on share of total employment.

Figure 3-7 Percent of Total Employment by Industry in Pitkin County



Source: Colorado Department of Local Affairs.

According to the State Demography Office, total employment in Pitkin County was estimated to be 20,367 in 2015, down about 1,600 jobs from the county's 2008 employment peak of 21,937. The employment drop that occurred in 2015 was due to reclassification of temporary-help workers to surrounding counties. Two-thirds of the industries in Pitkin County employ fewer people than prior to the recession. Average weekly wages in the county increased by 18% between 2010 and 2015, compared to the state which increased by 13%. Between 2015 and 2030, the total number of jobs in Pitkin County is projected to increase from 23,541 to 26,189, an increase of 11.25%.

In addition to direct impacts and damages to critical facilities, major disasters can result in large amounts of debris, business interruptions, increased emergency response times and costs, loss of income for businesses and residents, increased demands for health services, and the need to replace roads, bridges and public buildings. After a disaster, economic recovery is the highest recovery priority, next to public health and safety.

The table below lists the top ten employers in Pitkin County by number of employees for calendar year 2021. The total number of workers for these ten employers represent 57% of total employment in Pitkin County.

Table 3-6 Top Employers in Pitkin County in 2021

EMPLOYER	NUMBER OF EMPLOYEES
Aspen Skiing Company	3800
St. Regis Aspen	325
City of Aspen	313
Westin Snowmass Wildwood Resort	300
Roaring Fork Transit	295
Aspen Valley Hospital	292
Pitkin County	255
Aspen School District	241
Viceroy Snowmass Resort	223
Ritz Carlton	142

Source: Pitkin County, Colorado Comprehensive Annual Financial Report; Year Ended December 31, 2021

3.7 Housing

In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from disasters to some extent. This means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy more inadequately built and improperly maintained housing. Mobile or modular homes, for example, are more susceptible to damage in earthquakes and floods than other types of housing. Mobile homes represent 2.4% of the total housing stock in Pitkin County.

Table 3-7 shows select housing characteristics from the 2020 American Community Survey (ACS).

Table 3-7 Pitkin County Selected Housing Characteristics

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Total Housing Units	13,861	6,300	2,354	3,313
Occupied Housing Units	7,424	3,372	1,428	1,783
Homeowner Vacancy Rate	0.9%	1.4%	1.8%	0.0%
Rental Vacancy Rate	24.0%	19.6%	5.3%	51.1%
Owner Occupied	67.4%	56.5%	62.3%	66.2%
Renter Occupied	32.6%	43.5%	37.7%	33.8
Average # of Persons per Household	2.4	2.3	2.2	2.6
Rental Households Paying 35%+ of Income on Housing	27.9%	35.1%	33.0%	41.2%

The table below shows the rate of growth in housing units for Pitkin County, Aspen, Basalt, and Snowmass Village between 2015-2020. Both Basalt and Snowmass Village experienced large increases in the number of housing units during the period, with small increases in Pitkin County as a whole and Aspen.

Table 3-8 Growth in Housing Units in Pitkin County, 2015-2020

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT*	TOWN OF SNOWMASS VILLAGE
2015	13,027	5,961	1,865	2,698
2020	13,861	6,300	2,354	3,313
Percent Change	6.4%	5.69%	26.2%	22.8%

Source: Department of Local Affairs, State Demography Office, www.dola.colorado.gov/dlg/demog
U.S. Census Bureau, 2020 ACS 5-Year Estimates.
* Basalt housing figures include both portions of Town in Pitkin County and Eagle County

3.8 Future Trends in Development

As shown in Figure 3-5 above, Pitkin County is projected to maintain moderate population growth in the coming years. The municipal planning partners have adopted plans that govern land use decision and policy making in their jurisdictions. Decisions on land use will be governed by these programs. This plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in the planning area.

It is the goal that all municipal planning partners will incorporate this HMP update in their comprehensive plans (if applicable) by reference. This will help ensure that future development trends can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

3.9 GOVERNMENT

With the county seat in Aspen, Pitkin County was established in 1881 and became a home-rule county in 1978, giving local elected officials the authority of self- government under the State Constitution, Colorado Revised Statutes, and the Home Rule Charter for Pitkin County. A five-member Board of County Commissioners is the decision-making body for the County. Each Commissioner is elected at large from one of five districts and serves a four-year term. The Board of County Commissioners appoints a county manager and county attorney, as well as a variety of citizen boards, such as the Planning and Zoning Commission, Open Space and Trails Board, and the Financial Advisory Board.

The City of Aspen, the Town of Basalt, and the Town of Snowmass Village are all home-rule municipalities. All three municipalities have council- mayor-manager forms of government. The city/town manager oversees each municipality's day-to-day operations on behalf of the elected mayor and council members. All powers are vested in the councils, which enact local legislation, adopt budgets, and determine policies. Aspen and Snowmass Village have five-member councils (including the mayor), while Basalt has a seven-member council (including the mayor).

Pitkin County Emergency Management is responsible for county-level planning and coordination of local disaster services, including preparedness, response, mitigation, and recovery from natural and human-caused emergencies and disasters. Public safety agencies at all participating jurisdictions are responsible for planning and coordination for their jurisdictions. To enhance planning and coordination, the Pitkin County Public Safety Council (PSC) identifies problems and facilitates solutions in matters concerning public safety in the communities during preparedness, response, and recovery activities.

3.9.1 Pitkin County

The Pitkin County government is made up of the following offices and departments:

- Administration
- Airport
- Animal Safety
- Assessor
- Attorney
- Board of Commissioners
- Broadband
- Caucuses
- Clerk and Recorder
- Community Relations County Manager
- Coroner
- Community Development
- Elections
- Emergency Dispatch
- Emergency Management
- Engineering / Road & Bridge
- Environmental Health
- Facilities Management
- Finance
- Fleet Services
- GIS / Mapping
- Human Services
- Healthy Rivers Board
- Human Resources & Risk Management
- Information Technology
- Jail
- Land Management
- Landfill
- Library
- Motor Vehicle Resources
- Open Space & Trails
- Public Health
- Public Works
- Purchasing / Procurement
- Recycling
- Sheriff
- Treasurer / Public Trustee
- Telecommunications
- Use Tax

3.9.2 City of Aspen

The City of Aspen is the most populous municipality and the county seat of Pitkin. At the time of the U.S. Census Bureau's 2020 ACS 5-Year Estimate, Aspen had 7,721 residents, an increase of 3.9% over the previous year. It is a home-rule municipality with a council-manager government. The council is comprised of four elected officials and a mayor, while the manager is appointed by the city council. The local government includes the following departments:

- Aspen Pitkin County Housing Authority
- Asset Management
- Attorney
- City Manager
- Clerk
- Climate Action
- Community Development
- Communications
- Electric
- Engineering
- Environmental Health & Sustainability
- Finance
- Forestry
- GIS / Mapping
- Golf
- Grants
- Human Resources
- Kids First
- Municipal Court
- Natural Resources
- Open Space
- Parking
- Parks & Recreation
- Police
- Purchasing
- Red Brick Center for the Arts
- Special Events
- Strategy and Innovation Office
- Street
- Transportation
- Utilities
- Utilities Billing
- Water
- Wheeler Opera House

3.9.3 Town of Basalt

The Town of Basalt encompasses 1.9 square miles spread across Eagle and Pitkin counties. At the time of the U.S. Census Bureau's 2020 ACS 5-Year Estimate, Basalt had 3,941 residents, an increase of 2.4% over the previous year. According to the Basalt Chamber of Commerce, only 31.1% of the population are Colorado natives. As such, second homeowners and visitors are large contributors to the town's economy. Basalt is a council-manager municipality served by a five-member elected town council, an elected mayor, and a town manager who is hired by a panel comprised of the council members, town residents, and other town mayors. Basalt's local government is made up of the following offices and departments:

- Administration
- Building
- Planning
- Police
- Public Works
- Recreation
- Pool
- Water
- Basalt & Rural Fire Protection District
- Basalt Sanitation District
- Mid Valley Metropolitan District

In 2003, the Town of Basalt established an Emergency Management Committee (BEMC) to ensure early warnings, shelter, and emergency preparedness are planned for. BEMC works in cooperation with the Public Safety Councils in Pitkin, Eagle, and Garfield counties. These organizations work through an Incident Command System (ICS) in the event of a flood, wildfire, hazardous materials incident, gas/electric/propane emergency, shootings, or other serious regional emergencies. BEMC cooperates with all these entities to ensure that residents receive notification and detailed, informed instructions in case of an emergency.

3.9.4 Town of Snowmass Village

The Town of Snowmass Village spans 28.9 square miles and at the time of the U.S. Census Bureau's 2020 ACS 5-Year Estimate had a population of 2,786, a 0.1% increase over the previous year. Snowmass Village is well-known for the Snowmass Ski Area, the largest of the four ski areas that comprise the Aspen-Snowmass winter resort area. The Town is served by an elected four-member town council, an elected mayor, and a town manager who is hired by the council. The local government includes the following offices and departments:

- Animal Services
- Community Development
- Finance
- GIS & Mapping
- Housing
- Human Resources
- Parks, Recreation & Trails
- Police Department
- Public Works
- Tourism: Marketing, Group Sales, & Events
- Town Clerk
- Town Manager's Office
- Transportation & Parking

3.9.5 Aspen Fire Protection District

The Aspen Fire Protection District spans 87 square miles, encompassing the entirety of Aspen, as well as several unincorporated areas in Pitkin County, including Woody Creek, Brush Creek, and Starwood. The district provides 24-hour emergency response to a wide variety of critical situations, including structural, wildland, and urban interface fires, explosions, hazardous materials incidents, medical emergencies, accidents, and auto extrication. Personnel are trained in swift-water rescue, as well as ice, low-angle rope, trench, and confined-space rescue. The fire department has the capability to respond to emergency medical needs, including basic life support.

The department also manages fire prevention and emergency preparedness programs, including fire inspections, hazardous process permitting, burn permits, fire code enforcement, community education, and business emergency planning in accordance with Colorado laws. Each year the Aspen Fire Protection District spends over 4,000 hours completing hands-on training activities, which build important practical skills and provide each firefighter with the abilities needed to respond to all types of emergency situations quickly and correctly.

3.9.6 Roaring Fork Fire Rescue Authority

The Roaring Fork Fire Rescue Authority (RFFRA) was formed in 2018 by joining Basalt Fire and the Snowmass Wildcat Fire Protection District. RFFRA's service area is over 500 square miles, serviced out of five fire stations by 70 firefighters and medics.

RFFRA provides emergency and non-emergency services throughout Basalt and Snowmass Village and the surrounding areas. This includes 24-hour emergency response to a wide variety of critical situations. Operational capabilities include, but are not limited to, medical emergencies, wildland fires, structure fires, hazardous materials response, auto extrication, trench rescue, low-angle rope rescue, confined-space rescue, swift-water rescue, ice rescue, fire suppression, and aircraft incidents. In addition, RFFRA has adopted valley-wide medical protocols which are a series of treatment modalities for specific illnesses and injuries that ensures consistent care throughout the service area. Currently the call volume is approximately 2300 calls per year of which 80 percent are medical.

RFFRA also operates active fire prevention and emergency preparedness programs which provides for fire inspections, hazardous process permitting, burn permits, fire code enforcement and community education. Each year the Roaring Fork Fire Rescue Authority spends over 4,000 hours completing hands-on training activities, which build important practical skills and provide each firefighter and first responder with the abilities needed to quickly and correctly respond to all types of emergency situations.

RFFRA is comprised of an Executive Team (one Chief, one Human Resources Director and one Finance Director), the Administration Division, the Operations Division, and the Prevention Division.

3.9.7 Carbondale & Rural Fire Protection District

The Carbondale and Rural Fire Protection District (CRFPD) protects the life and property of approximately 16,000 residents and 20,000 commuters in a 300-square-mile area of central Colorado. This response area includes the towns of Carbondale, Colorado in Garfield County, Redstone in Pitkin County and Marble in Gunnison County.

Founded in 1953, CRFPD has 26 career personnel and 35 volunteer personnel who respond from five fire stations to provide fire and medical services to the community. The department has 21 apparatus including

one ladder truck, one aerial engine, six engines, five water tenders, two wildland fire units, two rescue units and four medic units.

With a strong emphasis on community and customer service, the fire district relentlessly pursues its vision to provide the best quality emergency and prevention services to the community.

A full service, "all-hazards" organization, CRFPD provides fire prevention/inspection services, fire suppression (structural, wildland, and vehicle), advanced life support emergency medical services (paramedic ambulance transportation), public and risk reduction education, hazardous materials response, and technical rescue (high angle and swift-water rescue) services.

The Carbondale and Rural Fire Protection District is not seeking approval as a participating jurisdiction in this plan. They are included here for information purposes only.

3.10 Capability Assessment

The Planning Team performed an inventory and analysis of existing authorities and capabilities called a "capability assessment." A capability assessment creates an inventory of an agency's mission, programs, and policies, and evaluates its capacity to carry them out.

3.10.1 Legal and Regulatory Capabilities

Table 3-9 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Pitkin and the participating jurisdictions.

Table 3-9 Pitkin County Regulatory Mitigation Capabilities Matrix

REGULATORY MITIGATION CAPABILITY	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Comprehensive or Master Plan	Yes	Yes	Yes	Yes
Zoning Ordinance	Yes	Yes	Yes	Yes
Subdivision Ordinance	Yes	Yes	Yes	No
Growth Management Ordinance	Yes	Yes	No	No
Floodplain Ordinance	Yes	Yes	Yes	Yes
Floodplain Management Plan	Yes	Yes	Yes	Yes
Other Special Purpose Ordinance or Plan (Steep Slope, Wildfire)	Yes	Yes	Yes	Yes
Building Code	Yes, 2015	Yes, 2015	Yes, 2015	Yes, 2015
Fire Department ISO Rating	3/9/10	4	4	4
Erosion/Sediment Control Program	Yes	Yes	Yes	Yes
Stormwater Management Program	No	Yes	Yes	Yes
Site Plan Review Requirements	Yes	Yes	Yes	Yes
Capital Improvements Plan	Yes	Yes	Yes	Yes
Economic Development Plan	No	Yes	Yes	No
Local Emergency Operations Plan	Yes	Yes*	Yes*	Yes*
Flood Insurance Study or Other Engineering Study for Streams	Yes	Yes	Yes	Yes
Elevation Certificates	Yes	Yes	Yes	Yes
National Flood Insurance Program	Yes	Yes	Yes	Yes
Flood Insurance Rate Maps (FIRMs)	Yes	Yes	Yes	Yes
Community Rating System Participant	Yes (Rating: 8)	No	No	No
BCEGS Ratings (1-10)	No	No	No	No
Community Wildfire Protection Plan	Yes (2014)	Yes**	Yes**	Yes**
Other	Mudflow ordinance/plan			

* City and Towns are signatories to county-level Emergency Operations Plan (EOP)

** City and Towns are signatories to county- and local-level CWPPs

The political jurisdictions within Pitkin County enforce a range of regulations that support mitigation goals and principles by restricting development in areas prone to natural hazards, including stringent floodplain policies and regulations. Pitkin County participates in the NFIP's CRS program, with a class rating of 8, thereby providing a 10% discount on flood insurance policies for properties in Special Flood Hazard Areas.

Applicants for new construction or redevelopment in Pitkin County must complete a Wildfire Hazard Analysis, including a wildfire hazard assessment for the property based on fuels, slope, aspect, and access. Permitted construction is required to include supplemental fuels mitigation (thinning) and homes within high-hazard areas have more stringent building materials and construction requirements.

Pitkin County's Land Use and Subdivision regulations related to natural hazard mitigation include grading and filling standards, standards for development on unstable slopes, floodplain regulations, maintenance of historical flow/runoff patterns, limits on development where geologic hazards exist, and standards for development in wildfire hazard areas.

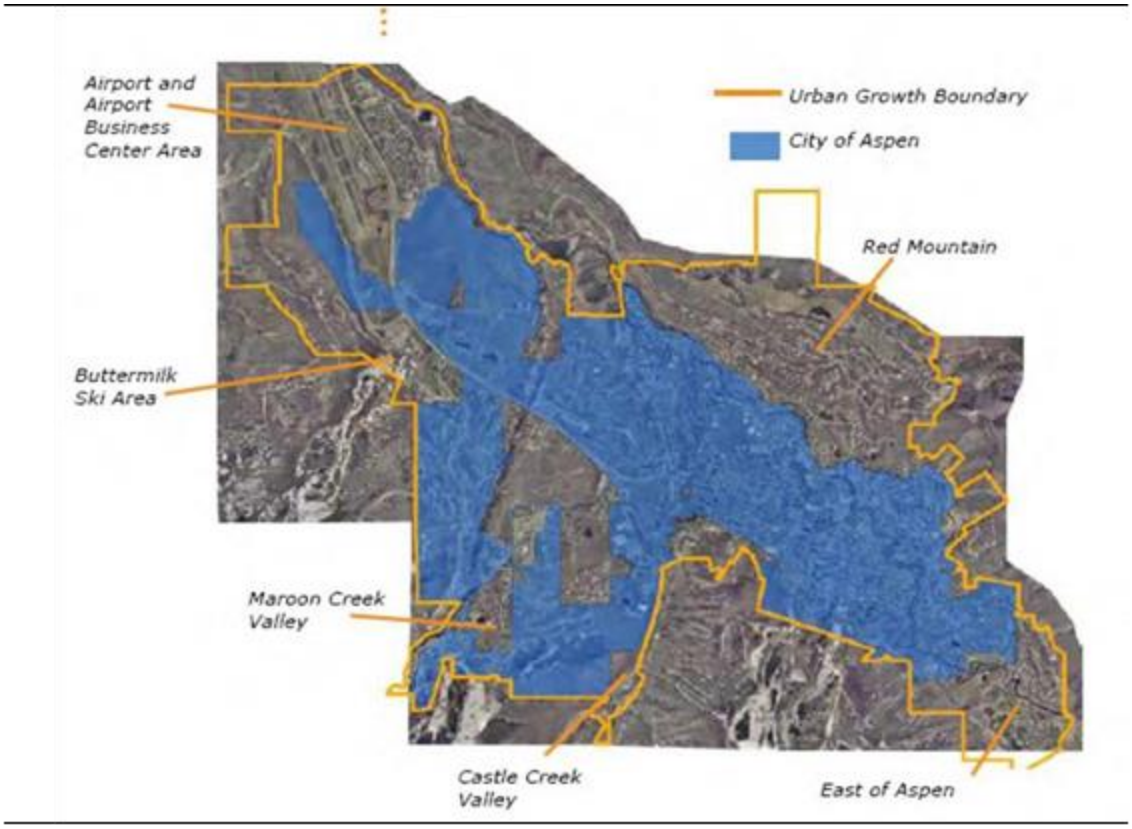
In 2000, the City of Aspen and Pitkin County jointly adopted an Urban Growth Boundary (UGB) which identifies the land surrounding the City as either appropriate for urban development (within the UGB) or inappropriate for urban development (outside the UGB). By limiting urban sprawl, the UGB deters urban development patterns in rural areas that are more susceptible to risks from natural hazards, such as land within the wildland urban interface.

Complementing the UGB is Pitkin County's Transfer of Development Rights (TDR) program, originally adopted to encourage the relocation of development from the backcountry to areas closer to existing services and infrastructure, but since expanded to encourage the protection of environmentally sensitive areas and to discourage development in environmentally hazardous areas.

The City of Aspen's Land Use Code requires "heightened review" of proposed development in environmentally sensitive areas, including areas subject to flooding and geologic hazards, and in Specially Planned Areas (SPAs) in order to evaluate suitability considering the potential for mudflow, rockfall, avalanche and flood hazards. The Planned Unit Development (PUD) section of the Land Use Code limits the density of development on steep slopes with the goal of reducing wildfire, mudslide, and avalanche hazards. The subdivision section restricts the location of subdivisions on land unsuitable for development because of flood or geologic hazards.

The City of Aspen's Urban Runoff Management Plan contains the floodplain ordinance and regulations and outlines the inspection and permitting process followed by the City of Aspen Engineering Department. The plan requires that all new development occurring within the identified mudflow plain perform a mudflow analysis. Additionally, the plan requires that all new and substantially changed critical facilities be located outside of the 500-year floodplain and requires a mudflow analysis for development on slopes of 15% or greater or for sites in the mudflow plain.

Figure 3-8 City of Aspen/Pitkin County Urban Growth Boundary



The Land Use and Subdivision regulations in the Town of Snowmass Village limit development in identified wildfire hazard areas and requires implementation of mitigation measures related to structural design, access, water supply, appropriate vegetation, and maintenance. The regulations also include storm drainage standards intended to preserve the integrity of existing and natural runoff patterns and limit flooding, erosion, and pollution. The regulations restrict development in geologic hazard areas where slopes are excessively steep (greater than 30%), unstable or hazardous. The floodplain section of the regulations requires all proposed development to be located outside of the limits of the 100-year floodplain.

The Town of Basalt's Land Use and Subdivision regulations also specifically address natural hazards, including discouraging development on slopes that exceed 30% and in areas prone to subsidence, unstable soils, rockfall hazards and flooding. The regulations specify floodplain development restrictions and describe recommended mitigation techniques, including elevation, floodproofing, slope stabilization, catchment walls, diversion structures and structural reinforcement. Subdivision preliminary plat requirements include an engineering analysis and drainage plan that addresses potential flood and mudflow risks. Basalt also has specific regulations for the Reach II and Southside floodplains that require new development to prove that it does not increase the base flood elevation.

The Roaring Fork Watershed Plan (March 2011) provides a set of regional guidelines that address natural hazard mitigation in the river corridor. The watershed plan was developed to protect and restore riparian areas, ensure adequate stream setbacks, and increase awareness of the importance of riparian areas. Plan objectives include: (1) ensuring coordination of local land use actions to mitigate watershed impacts, (2) reducing the negative impacts of drought and floods, and (3) preserving and enhancing native riparian and instream flora and fauna.

The City of Aspen has emerged as a leader in climate action in the U.S. and around the world. In an effort to reduce the threat of climate change, Aspen's City Council adopted the City of Aspen's Canary Action Plan in 2007, which commits to reducing community emissions 30% by 2020 and 80% by 2050, below 2004

levels. A testament to Aspen's commitment to sustainability performance is the achievement of 100% renewable energy in 2015. The City of Aspen electric utility uses 46% hydroelectric, 53% wind power, and 1% landfill gas (2015 figures). Pitkin County, the City of Aspen, and the Town of Basalt have all adopted new Climate Action Plans and the Town of Basalt has also adopted the 2015 ICC building energy code.

National Flood Insurance Program

Pitkin County, the City of Aspen, and the Towns of Basalt and Snowmass Village all participate in the National Flood Insurance Program (NFIP) and are currently in good standing. There are a total of 365 policies and there have been 27 total claims by the NFIP participating jurisdictions. There are no Repetitive Loss properties or Severe Repetitive Loss properties in Pitkin County.

Table 3-10 NFIP Community Participation

COMMUNITY	INITIAL FHBM	INITIAL FIRM	REGULAR ENTRY DATE	CURRENT EFFECTIVE MAP DATE
Pitkin County	10/25/1977	06/04/1987	06/04/1987	08/15/2019
City of Aspen	02/15/1974	12/04/1985	12/04/1985	08/15/2019
Town of Basalt	06/28/1974	03/18/1980	03/18/1980	12/04/2007
Town of Snowmass Village	06/04/1987	06/04/1987	06/04/1987	08/15/2019

Source: FEMA Community Information System. Letter of Map Revision (LOMR) completed for southside Basalt in November 2016.

Table 3-11 NFIP Policies and Claims as of November 30, 2022

COMMUNITY	POLICIES IN FORCE	INSURANCE COVERAGE	TOTAL PREMIUM	TOTAL CLAIMS	TOTAL PAYMENTS
Pitkin County	115	$35,128,700	$109,168	18	$45,990
City of Aspen	127	$34,955,700	$90,022	8	$152,972
Town of Basalt	104	$32,607,900	$108,721	6	$88,658
Town of Snowmass Village	12	$4,310,000	$5,921	2	$5,717
TOTALS	358	$107,002,300	$313,832	34	$293,337

Source: FEMA Community Information System

In addition to participating in the NFIP, Pitkin County participates in the Community Rating System (CRS). CRS is a voluntary program for NFIP participating communities focused on reducing flood damages to insurable property and encouraging a comprehensive approach to floodplain management. The CRS provides incentives in the form of insurance premium discounts to communities that go above and beyond the minimum floodplain management requirements and develop extra measures to reduce flood risk. There are 10 CRS classes from Class 10 which provides no premium discount up to Class 1 which offers the largest premium discount. Pitkin County currently holds a Class 8 CRS rating, which provides a 10% discount on flood insurance rates, saving policyholders approximately $9,289 per year.

Aspen's Climate Action Plan (2018-2020)

The City of Aspen maintains a Climate Action Plan, which includes recommendations relevant to mitigating the impact of hazards profiled in this plan. These recommendations are listed below. The City remains committed to implementing these recommendations; see mitigation action A-6 on page 5-15.

- Establish a collective of local governments, large consumers, and utilities to drive a regional clean energy transition.
- Implement and expand Advanced Metering Infrastructure (AMI).
- Support distributed energy storage to address the intermittency of wind and solar.
- Encourage regional solar development through supportive land use policies.
- Streamline and incentivize rooftop solar installation process.
- Incentivize both community- and utility-owned renewable generation.
- Advance climate and energy policy to the benefit of the community.

- Integrate space and water heating equipment standards into building codes.
- Facilitate education and accreditation for contractors, architects, and property managers.
- Implement sleep mode technology for second homes when unoccupied.
- Encourage and require energy efficiency upgrades for rental units.
- Require high efficiency air conditioning systems as AC use becomes more prevalent.
- Support commercial energy benchmarking and incremental EE improvements through policy.
- Provide incentives for new and remodeled buildings to build above code.
- Limit GHG emissions from future development through the use of controlled growth and coordinated land use in and around the Urban Growth Boundary.
- Delay the need for air conditioning via building design and management.
- Establish new program to bring existing buildings to meet current energy codes.
- Retrofit government buildings, offices, and facilities (including affordable housing units and complexes) to comply with current energy code.
- Adapt utility rates as necessary to incentivize and balance current and future priorities.
- Collaborate with employers to subsidize transit and mobility options for employees.
- Expand bike and walk options between population and work centers to primary transit stops.
- Support and expand mobility options for the first and last mile and/or full trips.
- Increase the ratio of electric vehicles in all fleets in the community.
- Further develop bicycle infrastructure.
- Support increased and targeted service during peak times on transit routes.
- Use parking policies and prices to disincentivize single-occupancy vehicle travel.
- Support and research regional road pricing.
- Advance transportation and clean fuels policy to the benefit of the community.
- Use codes and regulations to increase composting rates.
- Create a system for moving construction and demolition (C&D) waste to markets.
- Adopt and enforce requirements for C&D waste diversion.
- Provide increased opportunities for deconstructed building materials to be salvaged and reused.
- Create incentives for recycling and disincentives for contaminating recycling loads.
- Align city, county and regional waste policies and codes.
- Investigate haulers' routes and look for opportunities to optimize route efficiency.
- Encourage the use of cleaner vehicles for local waste haulers.
- Engage in waste and waste-diversion policy to the benefit of the community.
- Support the use of electric vehicles or other clean fuel vehicles for ground support vehicles.
- Upgrade airfield lighting with LED lighting.
- Encourage taxi and airport shuttles to achieve high fuel economy or clean-fuels standards.
- Promote and incentivize the use of aviation biofuels in aircraft servicing local airport.
- Encourage and support new terminal or Airport building to be net-zero.
- Encourage rental car companies to have EV options. Pursue EVs becoming a certain percentage of the rental fleet.
- Provide transit service directly to and from Airport and/or wayfinding from terminal to existing transit.
- Advance relevant policy to the benefit of the community.

Town Of Basalt Roaring Fork River Stewardship Master Plan (2002)

The Town Of Basalt adopted a stewardship master plan for the Roaring Fork River, which includes recommendations relevant to mitigating the impact of hazards profiled in this plan. These recommendations are listed below, grouped by section of the river. The Town remains committed to implementing these recommendations; see mitigation action B-3 on page 5-17.

<u>South Side</u>

- Establish easement for emergency flood/drainage channel.
- Maintain zero-rise criteria for new construction.
- Carry out Upper Bypass Bridge improvements as noted on page X-3.
- Identify location for routing flood flows over/under Highway 82.

- Protect Wastewater Treatment Plant from flood flows.
- Reinforce existing levee to meet FEMA standards after stabilizing North Channel.

Upper Basalt Bypass Bridge Highway 82

- Permanent Solution - Reconstruct bridge to provide clear span, without support structures in river channel.
- Interim Bridge Mitigation - Enclose/sheath piers and cap pier ends.

Fisherman's Park To Emma Bridge

- Maintain river corridor width of approximately 300' or more through this corridor.
- Manage to allow for some natural shifting of channel back and forth across corridor.
- Remove cobble levee on west side of channel.
- Improve fish habitat by stabilizing riverbed and providing in-river structures that will promote feeding, natural reproduction and cover.
- Research viability of grade control structures and other options for this reach to stabilize channel, protect riverbanks and improve recreational opportunities and natural habitat.
- Develop and implement a long-term plan for structural bank stabilization on east bank of river to protect Two Rivers Road. Incorporate natural & bioengineering elements into structures.
- Reestablish oxbow channel for riparian enhancement.
- Survey existing mature riparian vegetation and develop maintenance plans.

Emma Bridge

- Prioritize downstream improvements to assure that reconstruction of Emma Bridge does not create new or more severe impacts downstream.
- Redesign and rebuild bridge to widen span and provide safe abutments - possibly relocate to serve other redeveloped properties.
- Reconstruct channel to promote stability.
- Stabilize bank as necessary to control bank erosion.

Emma Bridge To Midland Bridge

- Acquire confluence area for the public open space.
- Develop plan for relocating residences in mobile home park to hazard-free area.
- Redevelop Roaring Fork MHP to provide public park area within floodplain – include public gathering, passive use and river access opportunities in park area.
- Provide commercial/residential opportunities in RFMHP area outside of floodplain.
- Remove jersey-barrier levee.
- Install bank stabilization structures as necessary to stabilize channel.
- Investigate potential for kayak course in this area.

Midland Avenue To Pan & Fork Mobile Home Park

- Redevelop Pan & Fork MHP to provide commercial/river access opportunities.

Riparian And Natural Habitat

- Preserve natural habitat on Basalt Commercial Park riverfront parcel.
- Re-establish oxbow upstream of Emma Bridge to enhance wildlife habitat.
- Acquire confluence property for interpretive area.
- Acquire riverfront parcel on Levinson property for public park/open space.
- Rehabilitate pond to function as a regional detention and water quality pond.
- Restore and enhance wetlands and riparian vegetation.
- Preserve the riverfront parcel just west of the skateboard park, for passive park and natural habitat.
- Restore and enhance Spring Creek area to support trout spawning and enhanced fishing conditions.

3.10.2 Administrative and Technical Mitigation Capabilities

Table 3-12 identifies the County personnel responsible for activities related to mitigation and loss prevention in Pitkin County and its jurisdictions.

Table 3-12 Pitkin County Administrative and Technical Mitigation Capabilities Matrix

ADMINISTRATIVE AND TECHNICAL RESOURCES	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Planner/engineer with knowledge of land development/land management practices	Yes	Yes	Yes	Yes
Engineer/professional trained in construction practices related to buildings and/or infrastructure	Yes	Yes	Yes	Yes
Personnel skilled in GIS	Yes	Yes	Yes	Yes
HAZUS Analysis	Yes	Yes	Yes	Yes
Full-Time Building Official	Yes	Yes	Yes	Yes
Floodplain Administrator	Yes	Yes	Yes	Yes
Emergency Manager	Yes	No	No	No
Grant Writer	Yes	Yes	Yes	Yes
Warning Systems/Services	Yes	Yes	Yes	Yes
Resiliency Planner	Yes*	No	No	Yes
Transportation Planner	Yes	Yes	No	Yes
GIS Date Resources (Hazard Areas, Facilities, Etc.)	Yes	Yes	Yes	Yes

* Focused on climate resiliency

3.10.3 Financial Capabilities

Table 3-13 identifies financial tools or resources that Pitkin County and its jurisdictions have used to help fund mitigation activities.

Table 3-13 Pitkin County Financial Mitigation Capabilities Matrix

FINANCIAL RESOURCES	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Community Development Block Grants	No	No	Yes	No
Capital Improvements Project Funding	Yes	Yes	Yes	Yes
Authority to Levy Taxes for Specific Purposes	Yes	Yes	Yes	Yes
Fees for Water, Sewer, Gas or Electric Services	NA	Yes	Yes	Yes
Impact Fees for New Development	Yes	Yes	Yes	Yes
Incur Debt Through General Obligation Bonds	Yes	Yes	Yes	Yes
Incur Debt through Special Tax Bonds	No	Yes	Yes	Yes
Withhold Spending in Hazard-Prone Areas	NA	NA	No	No

Note: Yes indicates the jurisdiction has used that resource to fund mitigation.
No indicates the jurisdiction has not used the resource to fund mitigation but could do so in the future.
NA indicates the funding mechanism is not available to the jurisdiction

3.10.4 Education and Outreach Capabilities

Table 3-14 lists additional education and outreach capabilities that Pitkin County and its jurisdictions utilize to implement hazard mitigation activities.

Table 3-14 Pitkin County Education and Outreach Capabilities

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Past or ongoing public education that address mitigation	Yes	Yes	Yes	Yes
Local citizen groups that communicate hazard risks	Yes	Yes	Yes	Yes
Firewise	No*	No	No	No
StormReady	Yes	No	No	No

* Crystal River Country Estates south of Carbondale is a Firewise community

Specific education & outreach programs include:

- Pitkin County OEM does extensive wildfire outreach every summer, as well as outreach for high water danger and burn restrictions as needed. This information is sent out through multiple community groups so they can amplify the distribution.
- Cooperative fire "ready set go" education with regional Public Safety Council.
- Several Master Plan Updates include recommendations for individual and neighborhood responsibility for preparedness for natural hazard events. They also support responsible water use.
- Some of the active neighborhood Caucuses have participated in Caucus-wide Firewise efforts to prepare for wildfire events. Some have also discussed evacuation plans on a neighborhood scale.
- Basalt 2020 Wildfire Mitigation Ordinance Outreach.
- The Roaring Fork Valley Wildfire Collaborative.
- Quarterly meetings of the Basalt Emergency Management Committee, Pitkin County Public Safety Council, and annual Community Police Academy's and National Night Out events.
- In an ongoing effort to promote defensible spacing and Firewise community standards, Aspen Fire, Roaring Fork Fire, and Pitkin County partner with local homeowners' associations to complete annual wildfire mitigation projects, including right-of-way tree removal, public chipping programs, and removal of fuels.

3.10.5 Fire Protection District Capabilities

The capabilities in the preceding sections focused primarily on the county and its incorporated municipalities. The participating fire protection districts – Aspen Fire Protection District and Roaring Fork Fire Rescue Authority – also have a variety of capabilities to conduct mitigation activities.

Principle among those capabilities are the Community Wildfire Protection Pans (CWPPs). The following CWPPs have been developed in Pitkin County:

- 2014 Pitkin County CWPP
- 2004 Conundrum Area CWPP
- 2013 SHIELD-O Terrace Subdivision CWPP
- 2018 Upper Snowmass Creek Caucus CWPP

Other mitigation capabilities include:

- Education and outreach programs as described in Section 3.10.4;
- Establishment of the Roaring Fork Wildfire Council and participation in the Roaring Fork Valley Wildfire Collaborative;
- Development of Annual Operating Plans and participation in the Pitkin County Emergency Fire Fund;
- Maintenance of mutual aid agreements with local partners and intergovernmental agreements with state and federal government agencies; and
- Enhanced mapping and site-specific risk assessment programs.
- Fire prevention and emergency preparedness programs, including fire inspections, hazardous process permitting, burn permits, fire code enforcement, community education, and business emergency planning in accordance with Colorado laws.

In addition to these capabilities developed within the fire service and wildland fire communities, many of the authorities supporting the mission of the FPDs can be found in county, city and town land use regulations, building codes, and other local government authorities for managing growth and ensuring safe development.

The FPDs enforce wildland fire prevention and are responsible for all wildland fire suppression activities on private and state lands within their fire districts, with support from the Colorado Division of Fire Prevention and Control and the Pitkin County Sheriff. While the Sheriff has ultimate authority over all fires on state and

private lands in the county, FPD's typically handle routine wildfire suppression within their districts and rely on the Sheriff to summon additional assistance as needed.

FPD personnel are trained to fight structural fires, urban interface fires, and wildland fires in the backcountry. The FPDs also manage fire prevention and emergency preparedness programs, including fire inspections, hazardous process permitting, burn permits, fire code enforcement, community education, and business emergency planning in accordance with Colorado laws. In an ongoing effort to promote defensible spacing and Firewise community standards, FPDs partner with local homeowners' associations to complete annual wildfire mitigation projects, including right-of-way tree removal, public chipping programs, and removal of fuels.

3.10.6 State and Regional Partnerships

Colorado Division of Homeland Security and Emergency Management

The Colorado Division of Homeland Security and Emergency Management, part of the Department of Public Safety, is comprised of three offices:

- Office of Emergency Management,
- Office of Grants Management, and
- Office of Prevention and Security/Colorado Information Analysis Center.

Division of Homeland Security and Emergency Management's (DHSEM) mission is: "To lead and support Colorado's effort to prevent, protect, mitigate, respond to and recover from all hazards events." The Division vision is: "A prepared, safe and resilient Colorado."

Colorado Division of Fire Prevention & Control

The Colorado Division of Fire Prevention and Control (DFPC) was created in July 2012 as an effort to consolidate state fire functions. The vision of DFPC is "To be the Nation's premier state fire organization by acting with foresight, providing bold leadership, enhancing our partnerships, and exemplifying the highest level of professionalism in fire prevention and protection, while building a safe and supportive work environment for our employees."

Colorado Water Conservation Board

The Colorado Water Conservation Board (CWCB) is an agency of the State of Colorado. The CWCB Flood Protection Program is directed to review and approve statewide floodplain studies and designations prior to adoption by local governments. The CWCB is also responsible for the coordination of the NFIP in Colorado and for providing assistance to local communities in meeting NFIP requirements. This includes CWCB prepared or partnered local floodplain studies.

Colorado Geological Survey

The Colorado Geological Survey (CGS) is a non-regulatory state government agency within the Colorado School of Mines. The mission of CGS is to help reduce the impact of geologic hazards on the citizens of Colorado, to promote responsible economic development of mineral and energy resources, provide geologic insight into water resources, provide avalanche safety training and forecasting, and to provide geologic advice and information to a variety of constituencies.

Colorado State Forest Service

The mission of the Colorado State Forest Service is to provide for the stewardship of forest resources and to reduce related risks to life, property, and the environment for the benefit of present and future generations. Its fire preparedness and response strategic priority is to provide leadership in wildland fire protection for state and private lands in Colorado and reduce wildfire-related loss of life, property, and critical resources.

Colorado Parks & Wildlife

Colorado Parks & Wildlife (CPW) is a nationally recognized leader in conservation, outdoor recreation, and wildlife management. The agency manages 41 state parks, all of Colorado's wildlife, more than 350 state wildlife areas and a host of recreational programs. CPW issues hunting and fishing licenses, conducts research to improve wildlife management activities, protects high priority wildlife habitat through acquisitions and partnerships, provides technical assistance to private and other public landowners concerning wildlife and habitat management and develops programs to understand, protect and recover threatened and endangered species.

3.10.7 Opportunities for Capability Enhancement

The 2023 HMP update provided the County and participating jurisdictions an opportunity to review and update the capabilities currently in place to mitigate hazards. This also provided an opportunity to identify where capabilities could be improved or enhanced. Opportunities identified by HMPC members include:

- Additional partnerships with area agencies to further develop hazard mitigation programs. Potential additional actions include additional wildfire mitigation efforts, developing and improving infrastructure, revising and developing plans to reflect current risks and long-term planning.
- The jurisdictions will work to increase public awareness of potential hazards and mitigation actions they should take.
- The Town of Snowmass Village will be looking at the review and adoption of the 21 series codes in 2023. The Town of Basalt is currently exploring doing the same.

Another opportunity being considered to reduce flood losses is for Pitkin County to improve its CRS rating, or for other jurisdictions to join the CRS. Table 3-15 shows the potential annual savings to policyholders for each CRS Rating, along with the current ratings and savings for comparison. Improving a community's standing in the CRS program must be based on balancing those benefits against the staff time and jurisdictional commitments required to achieve and maintain certification, however; as summarized below the potential savings for each community could be in the tens of thousands of dollars.

Table 3-15 Potential Benefits of CRS Ratings By Jurisdiction

	PITKIN COUNTY	CITY OF ASPEN	TOWN OF BASALT	TOWN OF SNOWMASS VILLAGE
Class 9 Annual Savings	$5,403	$4,322	$5,088	$296
Class 8 Annual Savings	$9,289*	$7,650	$8,779	$334
Class 7 Annual Savings	$13,176	$10,976	$12,469	$372
Class 6 Annual Savings	$18,579	$15,300	$17,557	$668
Class 5 Annual Savings	$22,465	$18,628	$21,248	$706
Class 4 Annual Savings	$26,352	$21,956	$24,939	$744
Class 3 Annual Savings	$30,236	$25,285	$28,629	$782
Class 2 Annual Savings	$34,125	$28,613	$32,320	$820
Class 1 Annual Savings	$38,011	$31,941	$36,010	$858

Source: FEMA Community Information System

* Indicates Pitkin County's current savings based on a Class 8 rating

4 RISK ASSESSMENT

DMA Requirement §201.6(c)(2):

[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. The risk assessment shall include:

(i) A description of the type, 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.

(ii) 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. The plan should describe vulnerability in terms of:

(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

(B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

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

4.1 HAZARD IDENTIFICATION

This section of the Pitkin County Hazard Mitigation Plan (HMP) describes the local Hazard Identification and Risk Assessment (HIRA) summary undertaken by the County and participating jurisdictions. The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction's potential risk to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazardous events.

A key step to mitigate disaster losses is to develop a comprehensive understanding of the community's hazards, vulnerabilities, and risks. The following terms are used throughout the Plan to facilitate comparisons between communities.

- **Hazard:** Event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, other types of harm or loss. Hazard may be naturally occurring (flood, tornado, etc.) or human-caused (active threat, hazmat, etc.).
- **Vulnerability:** Degree of susceptibility to physical injury, harm, damage, or economic loss; depends on an asset's construction, contents, and economic value of its functions.
- **Risk:** The potential for damage, loss, or other impacts created by the interaction of hazards with vulnerabilities.

The risk assessment evaluates potential loss from hazards by assessing the vulnerability of the County's population, built environment, critical facilities, and other assets. Environmental and social impacts are also taken into consideration wherever possible. This risk assessment covers the entire geographical area of Pitkin County. Since this is a multi-jurisdictional plan, the Planning Team also evaluated how the hazards and risks vary from jurisdiction to jurisdiction.

The results of this risk assessment are summarized by jurisdiction in Table 4-1.

Table 4-1 Hazard Risk Summary

HAZARD	PITKIN COUNTY	ASPEN	BASALT	SNOWMASS VILLAGE	ASPEN FIRE	ROARING FORK FIRE
Avalanche	Medium	Low	Low	Medium	Medium	Medium
Contagious Disease	Medium	Medium	Medium	Medium	Medium	Medium
Cyber-Attack	High	High	High	High	Medium	Medium
Dam Inundation	Low	Low	Medium	Low	Low	Low
Drought	High	High	High	High	High	High
Flooding	Medium	High	High	Medium	Medium	Medium
Geologic Hazards	High	High	Medium	High	Medium	High
Ice Jam Release	Medium	Medium	Medium	Low	Medium	Medium
Lightning	Low	Low	Low	Low	Low	Low
Wildfire	High	High	High	High	High	High
Winter Storm	High	Medium	Medium	Medium	High	High

4.1.1 Disaster Declaration History for Pitkin County

Federal disaster declarations are granted when the magnitude and severity of impacts caused by an event surpass the ability of state and affected local governments to respond and recover. Most disaster assistance programs are supplemental and require a local cost-sharing match. When the response capacity of an affected jurisdiction is exhausted, a state disaster declaration may be issued, allowing for the provision of state assistance, usually for the purpose of covering the costs of state assets committed to response operations.

Should the severity of the disaster event surpass both the local and state government response capacity, a federal emergency or disaster declaration may be issued, allowing for the provision of federal disaster assistance. Generally, the federal government issues disaster declarations through the Federal Emergency Management Agency (FEMA). However, federal assistance may also come from the U.S. Department of Agriculture (USDA), the Small Business Association (SBA), or other government programs such as the Fire Management Assistance Grant Program (FMAG). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

USDA disaster declarations are the most common type of federal disaster assistance and is limited to low-interest loans to farmers and ranchers to help compensate for losses due to natural hazards, including drought, freezing, hail, and insect infestations. Table 4-2 lists the federal disaster declarations for which Pitkin County was a designated county.

Table 4-2 Federal Disaster Declaration History for Pitkin County, 1965-2022

YEAR	DISASTER EVENT TYPE	DECLARATION TYPE (NUMBER)
1977	Drought; emergency federal public assistance to repair/replace disaster-damaged facilities.	FEMA Emergency EM-3025
1984	Minor-to-moderate property damage in Basalt (flooding) and Aspen (mudslides).	FEMA Disaster DR-719
2002	Statewide federal drought designation (snowpack in Colorado on April 1 just 52% of normal).	USDA Disaster (Number N/A)

YEAR	DISASTER EVENT TYPE	DECLARATION TYPE (NUMBER)
2006	Federal drought designation for Pitkin County for losses due to heat, high winds, and drought.	USDA Disaster S2351
2012	Federal designation for Pitkin County for losses due to freezing conditions.	USDA Disaster S3307
2013	Federal designation for Pitkin County for losses due to drought.	USDA Disaster S3575
2013	Federal designation for Pitkin County for losses due to frost and freezing.	USDA Disaster S3583
2014	Federal designation for Pitkin County for losses due to frost and freezing.	USDA Disaster S3760
2018	Federal designation for Pitkin County for losses due to drought.	USDA Disaster S4304, S4326, S4329, S4336, S4352, S4386
2019	Federal designation for Pitkin County for losses due to drought.	USDA Disaster S4468, S4481
2020	Federal designation for Pitkin County for losses due to drought.	USDA Disaster S4648, S4722, S4755, S4770
2020	Federal designation for Pitkin County for losses due to frost/freeze.	USDA Disaster S4696
2020	COVID-19 Pandemic.	FEMA Emergency EM-3436 FEMA Disaster DR-4498
2021	Federal designation for Pitkin County for losses due to drought.	USDA Disaster S4917
2021	Federal designation for Pitkin County for losses due to frost/freeze.	USDA Disaster S5018

Source: Colorado Natural Hazards Mitigation Plan (2013); Colorado Drought Hazard Mitigation Plan (2013); FEMA, www.fema.gov/news/disasters.fema.

4.1.2 Identified Hazards of Concern

For this plan update, the Planning Team considered the full range of hazards that could impact the planning area and then listed hazards that present the greatest concern. The process incorporated review of state and local hazard planning documents, as well as information on the frequency, magnitude, and costs associated with hazards that have impacted or could impact the planning area. Anecdotal information regarding natural hazards and the perceived vulnerability of the planning area's assets to them was also used.

Historical data, catastrophic potential, relevance to the jurisdiction, and the probability and potential magnitude of future occurrences were all used to identify and prioritize the list of hazards most relevant to Pitkin County. Hazard data was obtained from various federal, state, and local sources such as FEMA, the Colorado Geological Survey (CGS), the Colorado Dam Safety Division, NOAA's National Center for Environmental Information (NCEI), the United States Geological Survey (USGS), and others. Local and national news reports were also used to research historic events. Together, these sources were examined to assess the significance of these hazards to the County. The hazards selected for inclusion in this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future.

The hazards profiled in the 2018 Pitkin County Plan were reviewed, and the Planning Team decided to keep all hazards from the 2018 Plan for 2023. Three new hazards were added for 2023: Contagious Disease, Cyber-Attack, and Ice Jam Release.

The Planning Team also reviewed the natural and human-caused hazards listed in the 2018 Colorado State Hazard Mitigation Plan (SHMP) but determined that none of the other hazards in that plan presented sufficient risk in Pitkin County to justify their inclusion.

The Planning Team also discussed how best to incorporate the impacts of climate change into the Plan and determined not to profile climate change as a separate hazard but rather to include a section on climate change impacts in each hazard profile.

Based on this review, this Plan addresses the following hazards of concern:

- Avalanche
- Contagious Disease
- Cyber-Attack
- Dam Inundation
- Drought
- Flooding
- Geologic Hazards: Landslides, Debris Flows, Mudflows and Rockfalls
- Ice Jam Release
- Lightning
- Wildfire
- Winter Storm

4.1.3 Risk Assessment Methodology

A risk ranking was performed for the hazards of concern listed above. This risk ranking assesses the probability of each hazard's occurrence as well as its likely impact on the people, property, and economy of the planning area. The risk ranking was conducted by the Planning Team based on the hazard risk assessment presented during the second Planning Team meeting, community survey results, and personal and professional experience with hazards in the planning area. The results are used in establishing mitigation priorities.

Hazard Profiles

Each hazard was profiled as follows:

- **Description:** General description of the hazard and associated problems, followed by details on the hazard specific to Pitkin County.
- **Past Events:** Overview history of the hazard's occurrences, compiled from multiple data sources, to include information provided by the Planning Team and the public. Significant incidents are profiled in greater detail and include scope, severity, and magnitude, and known impacts.
- **Location:** Discusses what parts of the County are most likely to be affected by the hazard.
- **Magnitude and Severity:** Summarizes the anticipated magnitude and severity of a hazard event based largely on previous occurrences and specific aspects of the planning area. Speed of onset and duration are also factored in.
- **Probability of Future Events:** Estimates the likelihood or probability of future occurrences of the hazard.
- **Climate Change Considerations:** Discusses how the projected impacts of climate change may affect the likelihood and severity of the hazard in the future.
- **Vulnerability Assessment:** Describes the likely impacts of the hazard on people, property, critical infrastructure, government services, the economy, and historical, cultural, and natural resources.
- **Development Trends:** Summarizes how projected trends in land use, and development have the potential to increase or decrease the impact of the hazard.
- **Differences by Jurisdiction:** Describes how the risk varies across the participating jurisdictions.
- **Risk Summary:** Summarizes key pieces of information for each hazard.

Vulnerability Assessment

With Pitkin County's hazards identified and profiled, the Hazard Mitigation Planning Committee (HMPC) conducted a vulnerability assessment to describe the impact that the significant hazards would have on the County. The vulnerability assessment quantifies, to the extent feasible, assets at risk to each identified hazard and estimates potential losses where possible. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

The vulnerability assessment was conducted based on the significance of the hazard utilizing best available data. This assessment is an attempt to quantify assets at risk, by jurisdiction where possible, to further define populations, buildings, and infrastructure at risk to natural hazards. The information presented is for planning level assessments only. Data to support the vulnerability assessment was collected and compiled from the following sources:

- Current County and municipal GIS data (hazards, base layers, critical facilities, and assessor's data),
- 2020 US Census, 2020 American Community Survey (ACS), and 2019 CO Department of Local Affairs (DOLA) data,

- 2022 Homeland Infrastructure Foundation-Level Data (HIFLD) data,
- Written descriptions of inventory and risks provided by participating jurisdictions,
- A refined flood loss estimation by jurisdiction with the use of geospatial analysis for both 1% and 0.2% annual chance flooding,
- Existing plans and studies, and applicable regulations, and
- Personal interviews with Planning Team members, hazard experts, and County and municipal staff.

The scope of the vulnerability assessment is to describe the risks to the County as a whole. The vulnerability assessment first describes the assets in Pitkin County, including the total exposure of people and property; critical facilities and infrastructure; natural, historic, and cultural resources; and economic assets. Development trends, including population growth and land status, are analyzed in relation to hazard-prone areas. Next, where data was available, hazards are evaluated in more detail and potential losses are estimated. Data from each jurisdiction was also evaluated and is integrated throughout this analysis. The methods to assess vulnerability presented here include an updated analysis from the 2018 Pitkin County Hazard Mitigation Plan. This includes a detailed risk assessment for all hazards based on advanced methods and updated hazard and inventory data. Thus this 2023 Plan should be considered the baseline for measuring changes in vulnerability during future updates, recognizing that vulnerability information should become more refined as data sources and methodologies improve over time.

Hazard Rankings

Hazards then were ranked based on the following factors:

- **Spatial Extent:** How much of the planning area is potentially at risk from the hazard?
  - **Extensive:** 50-100% of planning area.
  - **Significant:** 10-50% of planning area.
  - **Limited:** Less than 10% of planning area.
- **Potential Severity:** What are the likely impacts of the hazard?
  - **Catastrophic:** Multiple deaths, shutdown of facilities for 30 days or more, >50% of property is severely damaged.
  - **Critical:** Multiple severe injuries, shutdown of facilities for at least 2 weeks, >25% of property is severely damaged.
  - **Moderate:** Some injuries, shutdown of critical facilities for more than one week, >10% of property is severely damaged.
  - **Minor:** Minor injuries, minimal quality-of-life impact, interruption of facilities and services for 24 hours or less, less than 10% of property is severely damaged.
- **Frequency of Occurrence:** How often is the hazard likely to occur?
  - **Highly Likely:** Near 100% probability each year.
  - **Likely:** Between 10 and 100% probability per year or at least one chance in ten years.
  - **Occasional:** Between 1 and 10% probability per year or at least one chance in next 100 years.
  - **Unlikely:** Less than 1% probability in next 100 years.
- **Overall Significance:** Based on a combination of the previous three factors.
  - **High:** widespread potential impact.
  - **Medium:** moderate potential impact.
  - **Low:** minimal potential impact.

4.1.4 Climate Change

The 2023 Pitkin County Hazard Mitigation Plan update takes into account considerations of how changing climate conditions may impact the frequency, intensity, and distribution of specific hazards within the County. Because many impacts of climate induced hazards cross county boundaries, some of the discussion looks at impacts on a regional scale. Rather than identify and profile climate change as a standalone hazard in itself, this plan examines how climate change is expected to influence the severity, frequency, or impacts of the various individual hazards which are profiled, based on the best available

science. As climate science evolves, future mitigation plan updates may consider including climate change projections in the risk rankings and vulnerability assessments of the hazards included in the Plan.

Climate includes patterns of temperature, precipitation, humidity, wind, and seasons. Climate plays a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. “Climate change” refers to changes over a long period of time. It is generally perceived that climate change has had and will continue to have measurable impacts on the occurrence and severity of natural hazards around the world. Impacts include the following:

- Snow cover losses will continue, and declining snowpack will continue to affect snow-dependent water supplies and stream flow levels in Colorado and around the world.
- The risk of drought and the frequency, intensity, and duration of heat waves are expected to continue to increase, as are the frequency, size, and intensity of wildfires.
- More extreme precipitation events will continue to be likely, increasing the risk of flooding.
- The earth’s average temperature is expected to continue to increase.

In 2018, the US Global Change Research Program released the Fourth National Climate Assessment (NCA4), the authoritative and comprehensive report on climate change and its impacts in the United States. Not only did the report confirm that climate change continues to affect Americans in every region of the US, but the report also identifies increased heat, drought, insect outbreaks, wildfire, and flooding as key climate-related concerns for the southwest region of the US, which includes Colorado. The following is a summary of climate change impacts from the Fourth National Climate Assessment.

Recent warming in the southwest region is among the most rapid in the nation and is significantly greater than the global average, and the period since 1950 has been hotter than any comparable long period in at least 600 years. Summer temperatures across the state are expected to warm more than winter temperatures and projections suggest that typical summer months will be as warm as (or warmer than) the hottest 10% of summers that occurred between 1950 and 1999. Under the higher emissions scenario (RCP8.5) climate models predict an increase of 8.6°F in the southwest regional annual average temperature by 2100.

Projected increases in temperatures in the southwest region are also projected to increase probabilities of natural events such as wildfires, drought, and extreme precipitation. These temperature changes have great potential to directly affect public health through increased risk of heat stress and infrastructure through increased risk of disruptions of electric power generation. Water supplies are also vulnerable to impacts of higher temperatures. While water supplies generally change year-to-year due to variabilities in water use and precipitation, higher temperatures are projected to increase evapotranspiration, reducing the effectiveness of precipitation in replenishing surface water and soil moisture. This will have direct impacts on crop yields and productivity of key regional crops and livestock a major risk for the agricultural industry and food security nationwide.

The impacts of climate induced hazards already pose a threat to people and property in the southwest region of the United States, including Pitkin County. Vulnerable populations, in particular those who are low income, children, elderly, disabled and minorities will likely be impacted by the effects of climate induced hazards disproportionately than other populations (refer to Chapter 2 for more information on social vulnerability in the County). Together, these impacts represent a slow-onset disaster that is likely to manifest and change over time. Current projections predict even more rapid changes in the near future, which are likely to affect many of the natural hazards that Pitkin County has historically dealt with. According to HMPC the County is already experiencing some hazards with more frequency and intensity than in years past, such as drought, flooding, wildfire, and unusually warm temperatures.

Climate Change in Pitkin County, Colorado

The report Climate Change and Aspen (2014), prepared by the Aspen Global Change Institute, describes what living with natural hazards in the age of climate change will look like in Aspen and its neighboring communities in the Roaring Fork Valley of Pitkin County.

For Aspen, climate change will likely include longer summertime warm periods, earlier onset of spring snowmelt, more precipitation arriving as rain rather than snow, and longer dry periods with heavier precipitation events in between. These types of changes could exacerbate already risky wildfire conditions, place extra pressure on already stretched water providers and users, provide additional challenges to ski area operators and other winter and summer recreation providers, as well as result in other impacts to every sector important to the Aspen community.

Precipitation and snowfall in Pitkin County have been variable over the period 1940-2022, but as temperatures continue to rise, duration of snowpack and percent of precipitation falling as snow rather than rain may decline. Snowpack depth and duration of snow cover are closely linked to water availability, watershed functions and winter ecology. Related to this is the increase in forest beetle infestations, resulting in increased tree mortality that in turn increases the risk of wildfires.

Like many areas of Colorado, the winter tourism-based economy in Pitkin County relies on consistent winter storm fronts and adequate snowpack, but changes have already been observed in the timing of snow-producing storms and current climate trends have raised concerns about the possible impacts of a shortened winter sports season in the future, with corresponding economic impacts.

4.2 Community Assets

4.2.1 General Property

General property exposure to hazards is based on Pitkin's County's parcel data containing assessor information such as total number of parcels, improvement values, and parcel types by jurisdiction. Parcels with improvement values greater than $0, were used for analysis, along with eight exempt parcels with structures that were not valued. Non-developed or non-improved parcels were otherwise excluded for the purposes of conducting the vulnerability assessment.

Property counts and values are based on the latest County assessor's data from Pitkin County (as of January 2022), and Eagle County for the Town of Basalt (as of May 2022), which was provided in GIS formats. Improvement values and parcel type attributes were already joined to the parcel geometries in GIS which helps enable spatial analysis and mapping. Content values were estimated as a percentage of building value based on their property type, using FEMA estimated content replacement values. This includes 100% of the structure value for commercial and exempt structures, 50% for residential structures and 100% for vacant improved land. Improved and contents values were summed to obtain a total exposure value. Table 4-3 shows there are a total of 17,570 buildings with a combined value of $44 billion potentially at risk across the planning area (including the portion of Basalt that is in Eagle County).

For hazards with a geospatial component and where data was available, the parcel layer was overlaid with building footprints and compared to hazard layers to determine the parcels exposed to the hazards. The hazards that had enough geospatial data to conduct this parcel level hazard analysis were Avalanche, Dam Failure/Incidents, Flood, Geologic Hazards, and Wildfire.

Table 4-3 Pitkin County Total Exposure by Jurisdiction and Property Type

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Aspen	Agricultural	5	12	$84,990,300	$84,990,300	$169,980,600
	Commercial	904	989	$1,343,004,400	$1,343,004,400	$2,686,008,800
	Exempt	107	218	$334,091,900	$334,091,900	$668,183,800
	Mining	1	1	$13,500	$13,500	$27,000
	Mixed Use	28	65	$99,925,600	$99,925,600	$199,851,200
	Residential	5,239	5,480	$13,297,378,900	$6,648,689,450	$19,946,068,350
	Vacant	3	3	$804,800	$804,800	$1,609,600

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
	Total	6,287	6,768	$15,160,209,400	$8,511,519,950	$23,671,729,350
Basalt	Commercial	464	514	$293,129,900	$293,129,900	$586,259,800
	Exempt	54	57	$71,041,860	$71,041,860	$142,083,720
	Industrial	1	1	$1,152,100	$1,728,150	$2,880,250
	Mixed Use	13	13	$8,798,200	$8,798,200	$17,596,400
	Residential	1,709	1,831	$1,204,655,240	$602,327,620	$1,806,982,860
	Vacant	5	5	$4,323,970	$4,323,970	$8,647,950
	Total	2,246	2,421	$1,583,101,270	$981,349,700	$2,564,450,980
Snowmass Village	Agricultural	2	2	$8,683,900	$8,683,900	$17,367,800
	Commercial	82	98	$143,403,100	$143,403,100	$286,806,200
	Exempt	50	73	$42,320,500	$42,320,500	$84,641,000
	Mixed Use	4	4	$7,615,100	$7,615,100	$15,230,200
	Residential	2,792	3,338	$3,737,226,900	$1,868,613,450	$5,605,840,350
	Total	2,930	3,515	$3,939,249,500	$2,070,636,050	$6,009,885,550
Unincorporated	Agricultural	116	226	$179,881,900	$179,881,900	$359,763,800
	Commercial	88	159	$127,969,400	$127,969,400	$255,938,800
	Exempt	92	222	$233,848,000	$233,848,000	$467,696,000
	Mining	1	1	$26,100	$26,100	$52,200
	Mixed Use	49	75	$63,528,000	$63,528,000	$127,056,000
	Residential	3,385	4,178	$7,287,955,800	$3,643,977,900	$10,931,933,700
	Vacant	5	5	$186,400	$186,400	$372,800
	Total	3,736	4,866	$7,893,395,600	$4,249,417,700	$12,142,813,300
	Grand Total	15,199	17,570	$28,575,955,770	$15,812,923,400	$44,388,879,180

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, WSP GIS Analysis

4.2.2 People

Population estimates were calculated for hazards with a geospatial component and for which data was available for GIS-based parcel analysis. These were based on taking average household size data from the State Demographer's Office and comparing that to the total number of residential parcels. Average population per residential parcel was calculated as:

- Aspen: 1.97
- Basalt: 2.26
- Snowmass Village: 2.22
- Unincorporated County: 2.35

This value was then multiplied by the number of residential parcels that overlap with a hazard layer to get an estimate of the population exposed to that hazard. For more details on economic assets, development trends, and other population and demographic information refer to Chapter 2 Community Profile.

4.2.3 Critical Facilities and Infrastructure

A critical facility is one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA lifeline categories shown in Figure 4-1 are the US Department of Homeland Security's recommended way to standardize the classification of critical facilities and infrastructure which provide indispensable service, operation, or function to a community. A lifeline is

defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security.

Figure 4-1 Lifeline Categories

Source: FEMA

To develop a comprehensive list of critical facilities in the planning area, several data sources were compiled including GIS databases of critical facilities and infrastructure from the County, Roaring Fork Fire Rescue Authority, the Colorado Emergency Planning Commission, the National Bridge Inventory, and 2022 HIFLD data. This data was then reviewed and fact-checked by the Planning Team to ensure accuracy. The inventory of critical facilities identified in Pitkin County is summarized in Table 4-4, broken down by type of facility in Table 4-5, facility and mapped in Figure 4-2. Note that some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns.

Table 4-4 Critical Facility Summary by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	8	1	5	11	14	13	**25**
Energy	-	-	1	3	2	4	**4**
Food, Water, Shelter	1	1	2	2	2	3	**6**
Hazardous Material	3	-	-	15	10	1	**18**
Health and Medical	2	1	-	-	2	1	**3**
Safety and Security	12	8	5	20	28	18	**45**
Transportation	7	5	8	48	22	36	**68**
Total	**33**	**16**	**21**	**99**	**80**	**76**	**169**

Source: Pitkin County, CEPC, HIFLD, NBI, RFFR

Table 4-5 Critical Facility Breakdown by Jurisdiction and Type of Facility

JURISDICTION	LIFELINE	FACILITY TYPE	COUNT
Aspen	Communications	Cell Tower	8
	Food, Water, Shelter	Water Treatment	1
	Hazardous Material	RMP	1
		Tier II	2
	Health and Medical	EMS Station	1
		Hospital	1
	Safety and Security	Correctional Facility	1
		EOC	1
		Fire Station	1
		Government	7
		Police Station	2
	Transportation	Non-Scour Fair Condition Bridge	6
		Non-Scour Good Condition Bridge	1
		Total	**33**
Basalt	Communications	Cell Tower	1
	Food, Water, Shelter	Water Treatment	1
	Health and Medical	Public Health	1
	Safety and Security	Fire Station	1
		Government	3
		Police Station	1
		School	3
	Transportation	Non-Scour Good Condition Bridge	5
		Total	**16**
Snowmass Village	Communications	Cell Tower	5
	Energy	Transmission System	1
	Food, Water, Shelter	Water Treatment	2
	Safety and Security	Fire Station	1
		Government	3
		Police Station	1
	Transportation	Non-Scour Fair Condition Bridge	2
		Non-Scour Good Condition Bridge	6
		Total	**21**
Pitkin County	Communications	Cell Tower	11
	Energy	Generation System	2
		Transmission System	1
	Food, Water, Shelter	Water Treatment	2

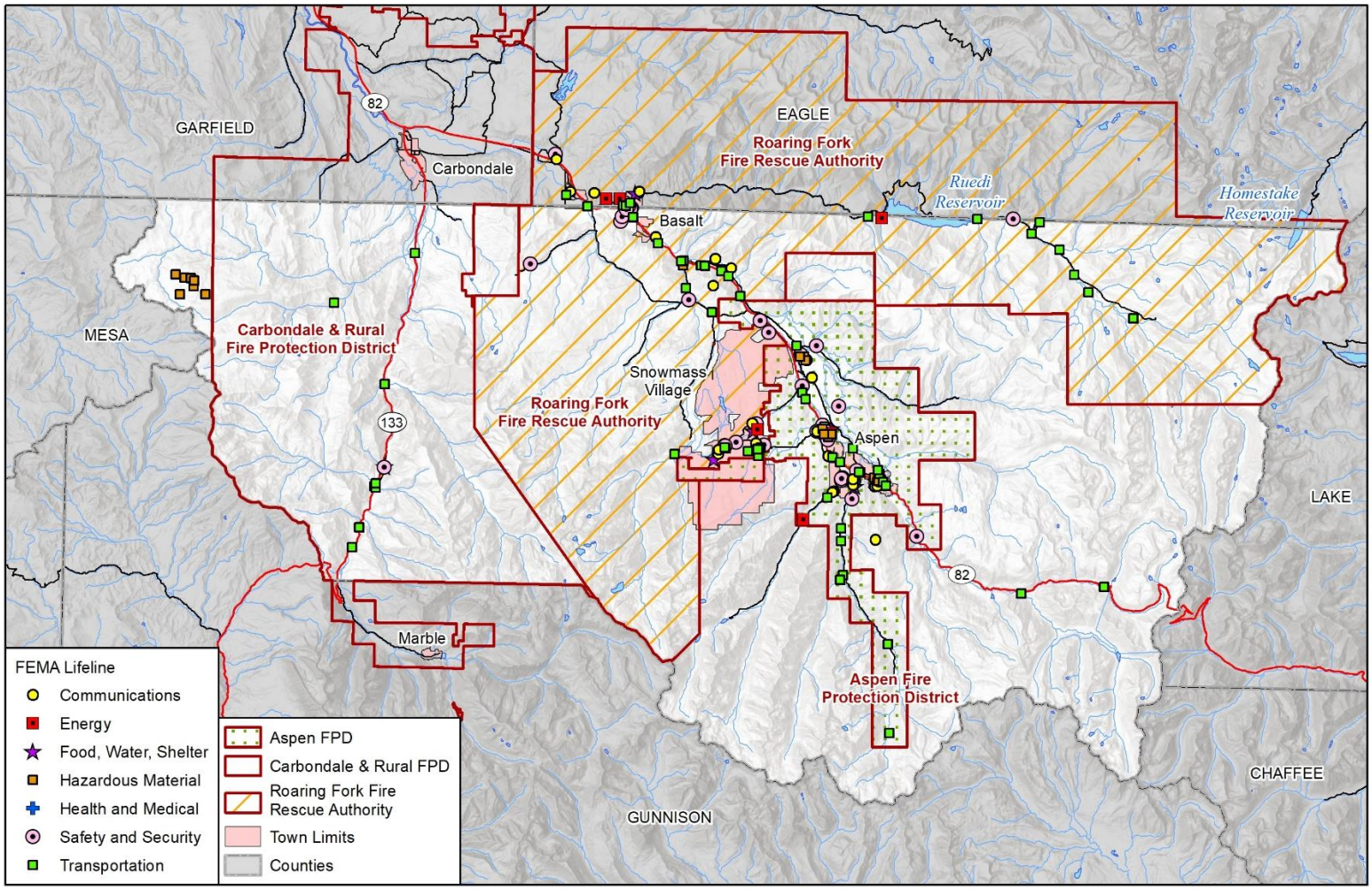
JURISDICTION	LIFELINE	FACILITY TYPE	COUNT
	Hazardous Material	Tier II	14
		TRI	1
	Safety and Security	Fire Station	8
		Government	4
		School	7
		Search and Rescue	1
	Transportation	Airport	1
		Bus Maintenance Facility	1
		Non-Scour Fair Condition Bridge	29
		Non-Scour Good Condition Bridge	16
		Non-Scour Poor Condition Bridge	1
		Total	**99**
Aspen Fire Protection District	Communications	Cell Tower	14
	Energy	Generation System	1
		Transmission System	1
	Food, Water, Shelter	Water Treatment	2
	Hazardous Material	RMP	1
		Tier II	8
		TRI	1
	Health and Medical	EMS Station	1
		Hospital	1
	Safety and Security	Correctional Facility	1
		EOC	1
		Fire Station	6
		Government	10
		Police Station	2
		School	7
		Search and Rescue	1
	Transportation	Airport	1
		Bus Maintenance Facility	1
		Non-Scour Fair Condition Bridge	14
		Non-Scour Good Condition Bridge	6
		Total	**80**
Roaring Fork Fire Rescue Authority	Communications	Cell Tower	13
	Energy	Generation System	1
		Transmission System	3
	Food, Water, Shelter	Water Treatment	3
	Hazardous Material	Tier II	1
	Health and Medical	Public Health	1
	Safety and Security	Fire Station	6
		Government	7
		Police Station	2
		School	3
	Transportation	Non-Scour Fair Condition Bridge	15
		Non-Scour Good Condition Bridge	21
		Total	**76**
		Grand Total	**325**

Source: Pitkin County, CEPC, HIFLD, NBI, RFFR

Specific information on facilities, names, and other key details by participating communities may be accessed by permission of the jurisdiction or infrastructure owner.

One major vulnerability of concern is the number of locations throughout the County with limited ingress/egress points. This has the potential to impact both evacuation and response if one of those points is impacted by a hazard. As an example, in the City of Aspen if one or both of the main Castle Creek bridges are damaged or unusable, there are no other bridges into the City that are rated for heavier vehicles such as many wildfire trucks.

Figure 4-2 Pitkin County Critical Facilities



Map compiled 6/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT, RFFR, CEPC, NBI, HIFLD

4.2.4 Historic, Cultural and Natural Resources

Pitkin County has a wealth of natural, historic, and cultural resources that are highly- valued community assets by residents and visitors alike. The protection of these types of resources is an important goal of hazard mitigation planning. Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters. Wetlands also improve water quality, limit erosion, and protect wildlife.

In the preparation of benefit-cost analyses for future mitigation projects, the need to protect natural, historic, and cultural resources can be used to leverage additional funding for projects that contribute to other community goals. Pitkin County and its local partners enjoy an abundance of natural resources, including legendary alpine terrain, wilderness, wetlands, and endangered species.

An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed. Endangered, threatened, and candidate species located in Pitkin County are listed in the table below.

Table 4-6 Rare Species in Pitkin County

COMMON NAME	SCIENTIFIC NAME	TYPE OF SPECIES	STATUS
Canada lynx	*Lynx canadensis*	Mammal	Threatened
Greenback cutthroat trout	*Oncorhynchus clarki stomias*	Fish	Threatened
Mexican spotted owl	*Strix occidentalis lucida*	Bird	Threatened
Uncompahgre fritillary butterfly	*Boloria acrocnema*	Insect	Endangered
Ute ladies'-tresses orchid	*Spiranthes diluvialis*	Flowering Plant	Threatened
Yellow-billed cuckoo	*Coccyzus americanus*	Bird	Threatened

Source: U.S. Fish and Wildlife Service

National and state historic inventories were reviewed to identify historic and cultural assets in Pitkin County. The National Register of Historic Places is the nation's official list of cultural resources worthy of preservation. The Colorado State Register of Historic Properties is a listing of the state's significant cultural resources worthy of preservation for the future education and enjoyment of Colorado's residents and visitors. The tables below list the properties in Pitkin County that are on the Colorado State Register of Historic Properties and the National Register of Historic Places.

Table 4-7 Historic Aspen Properties and Districts on National Register

PROPERTY	LOCATION	YEAR LISTED
Armory Hall/Fraternal Hall	130 S. Galena St.	1975
Aspen Community Church	200 N. Aspen St.	1975
Boat Tow	700 S. Aspen St.	1990
Bowles-Cooley House	201 W. Francis St.	1987
Matthew Callahan Log Cabin	205 S. 3rd St.	1987
Collins Block-Aspen Lumber & Supply	204 S. Mill St.	1987
Dixon-Markle House	135 E. Cooper Ave.	1987
D.E. Frantz House	333 W. Bleeker St.	1987
Samuel L. Hallett House	432 W. Francis St.	1987
Holden Mining & Smelting Company	1000 W. Hwy. 82	1990
Hotel Jerome	330 E. Main St.	1986
Hyman-Brand Building	203 S. Galena St.	1985

PROPERTY	LOCATION	YEAR LISTED
Thomas Hynes House	303 E. Main St.	1987
La Fave Block	405 S. Hunter St.	1987
New Brick/The Brick Saloon/Red Onion	420 E. Cooper Ave.	1987
Riede's City Bakery	413 E. Hyman Ave.	1987
Judge Shaw House/Newberry House	206 Lake Ave.	1987
Sheely Bridge	Mill St. Park	1985
Shilling-Lamb House	525 N. 2nd St.	1987
Smith-Elisha House	320 W. Main St.	1989
Smuggler Mine	Smuggler Mountain	1987
Ute Cemetery	Ute Ave.	2002
Davis Waite House	234 W. Francis St.	1987
Henry Webber House/Pioneer Park	442 W. Bleeker St.	1987
Wheeler Opera House	330 E. Hyman Ave.	1972
Wheeler-Stallard House	620 W. Bleeker St.	1975

Source: Directory of Colorado State Register Properties

Table 4-8 Historic Pitkin County Properties and Districts on National Register

PROPERTY	LOCATION	YEAR LISTED
Ashcroft	White River National Forest	1975
Independence/Independence Mill Site	Independence/Hwy. 82	1973
Maroon Creek Bridge	Hwy. 82/Aspen Vicinity	1985
Osgood Castle/Cleveholm	Redstone Vicinity	1971
Osgood Gamekeeper's Lodge	18679 Hwy. 133	1989
Osgood-Kuhnhausen House	642 Redstone Blvd.	1983
Pitkin County Courthouse	506 E. Main St. (Aspen)	1975
Redstone Coke Ovens Historic District	Redstone Vicinity	1990
Redstone Historic District	Redstone	1989
Redstone Inn	82 Redstone Blvd.	1980

Source: Directory of Colorado State Register Properties

According to the National Environmental Policy Act (NEPA), any property over 50 years of age is considered an historic resource and is potentially eligible for the National Register. As a result, alterations to listed properties must be evaluated under the guidelines set forth by NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

4.3 AVALANCHE

AVALANCHE	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Significant	Moderate	Highly Likely	**Medium**
Aspen	Limited	Minor	Likely	**Low**
Basalt	Limited	Minor	Likely	**Low**
Snowmass Village	Significant	Minor	Likely	**Medium**
Aspen Fire	Significant	Moderate	Likely	**Medium**
Roaring Fork Fire	Significant	Moderate	Likely	**Medium**

4.3.1 Description

An avalanche is a mass of snow, ice, and/or debris flowing and sliding rapidly down a steep slope. Avalanches can occur whenever a sufficient depth of snow is deposited on slopes steeper than approximately 20 degrees, with the most dangerous coming from slopes in the 35 to 40-degree range. Avalanche-prone areas can generally be identified with some accuracy, since they typically follow the same paths year after year, leaving scarring on the paths. However, unusual weather conditions can produce new paths or cause avalanches to extend beyond their normal paths.

In the spring, warming of the snowpack occurs from below (from the warmer ground) and above (from warm air, rain, and other sources). Warming can be enhanced near rocks or trees that transfer heat to the snowpack. The effects of a snowpack becoming weak may be enhanced in steeper terrain where the snowpack is shallow, and over smooth rock faces that may focus meltwater and produce "glide cracks." Such slopes may fail during conditions that encourage melt.

Wind can affect the transfer of heat into the snowpack and associated melt rates of near-surface snow. During moderate to strong winds, the moistening near-surface air in contact with the snow is constantly mixed with drier air above through turbulence. As a result, the air is continually drying out, which enhances evaporation from the snow surface rather than melt. Heat loss from the snow necessary to drive the evaporation process cools off near-surface snow and results in substantially less melt than otherwise might occur, even if temperatures are well above freezing.

When the snow surface becomes uneven in spring, air flow favors evaporation at the peaks, while calmer air in the valleys favors condensation there. Once the snow surface is wet, its ability to reflect solar energy drops dramatically; this becomes a self-perpetuating process, so that the valleys deepen (favoring calmer air and more heat transfer), while more evaporation occurs near the peaks, increasing the differential between peaks and valleys. However, a warm wet storm can quickly flatten the peaks as their larger surface area exposed to warm air, rain or condensation hastens their melt over the sheltered valleys.

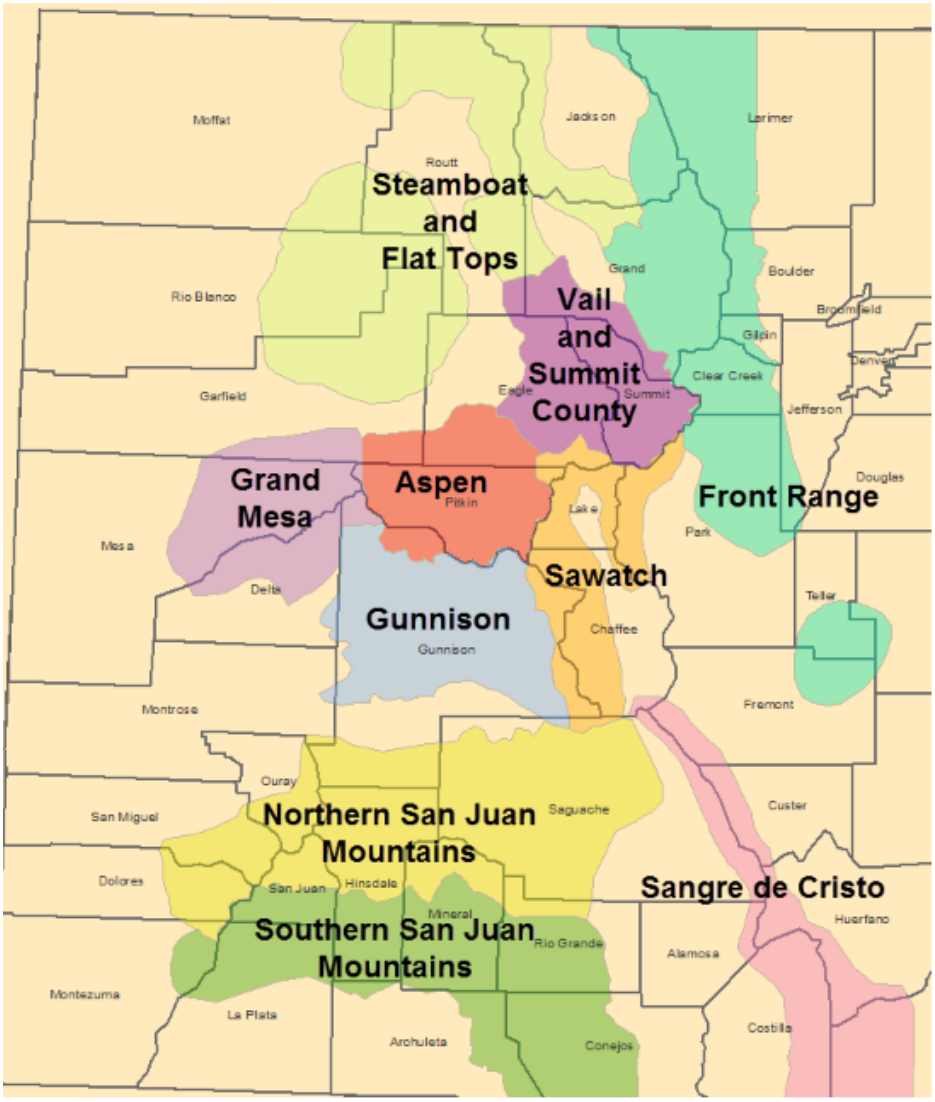
Avalanche hazards occur predominantly in the mountainous regions of Colorado above 8,000 feet. The majority of avalanches occur during and shortly after winter storms, during the winter and spring months between November and April. The most avalanche-prone months are, in order, February, March, and January. Avalanches caused by thaw occur most often in April. The avalanche danger increases with major snowstorms and periods of thaw. About 2,300 avalanches are reported to the Colorado Avalanche Information Center (CAIC) in an average winter. More than 80 percent of these occur during or just after large snowstorms. Avalanche paths consist of a starting zone, a track, and a runout zone.

The CAIC provides avalanche information and education, and promotes research for the protection of life, property, and the enhancement of the state's economy. Avalanche forecasts were first issued by the Colorado Avalanche Warning Center in 1973. The program was originally part of a federal research program but has been a part of the Colorado State government since 1983 and is now a program within the Colorado Department of Natural Resources (DNR). The program is a partnership between the DNR, Colorado Department of Transportation (CDOT), and the Friends of the CAIC, a 501(c)3 group.

The CAIC forecasts backcountry avalanche and mountain weather conditions for 10 Zones in the mountains of Colorado as illustrated in Figure 4-3 below; Pitkin County is located within the Aspen Zone. The CAIC

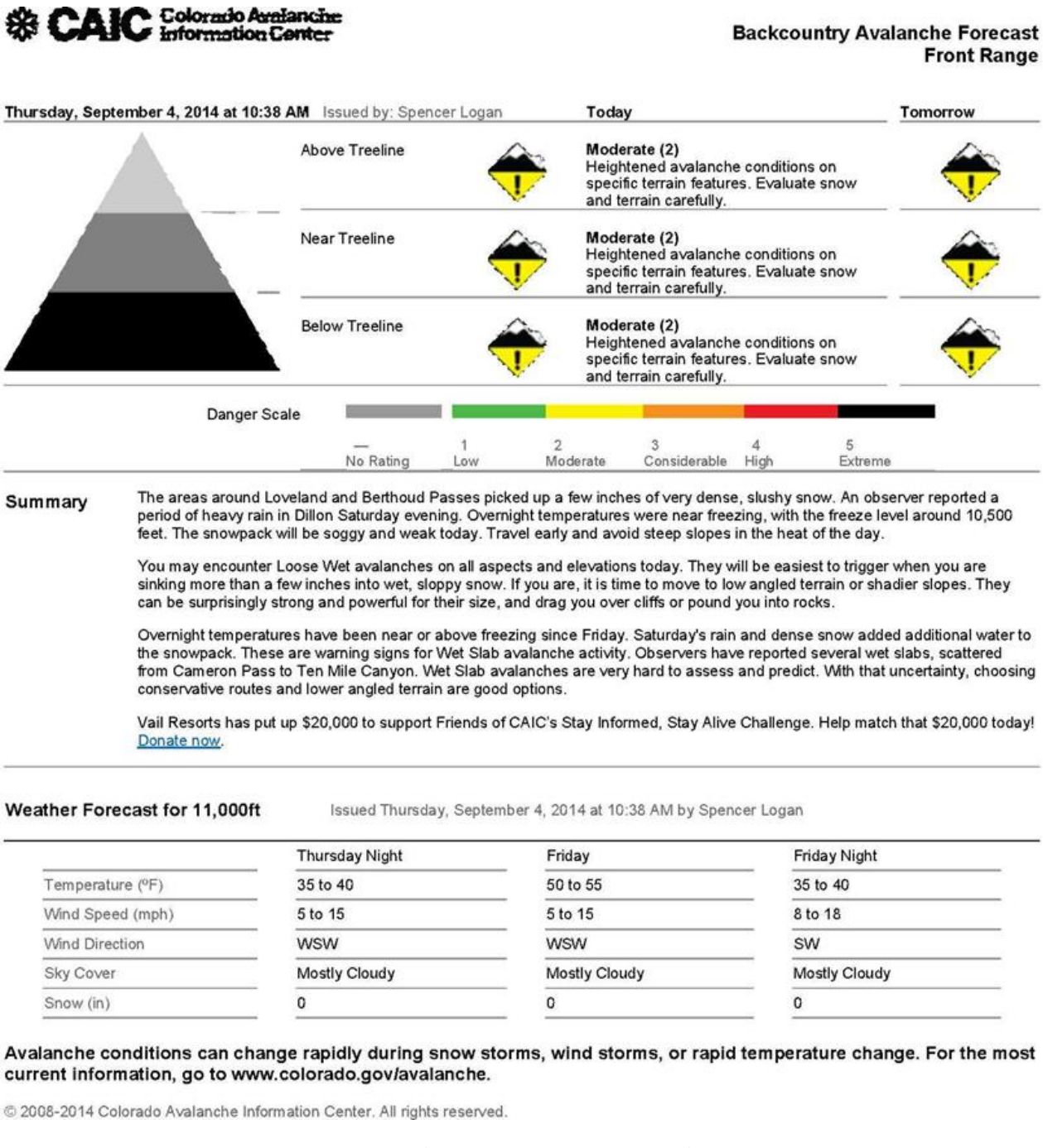
issues watches and warnings by zone to communicate avalanche danger levels to those recreating in backcountry areas. An example of this forecast for the Front Range area is shown in Figure 4-4.

Figure 4-3 Colorado Avalanche Zones



Source: CAIC

Figure 4-4 Sample Front Range Avalanche Danger Forecast



CAIC Colorado Avalanche Information Center

Backcountry Avalanche Forecast
Front Range

Thursday, September 4, 2014 at 10:38 AM Issued by: Spencer Logan

	Today	Tomorrow
Above Treeline	**Moderate (2)** Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully.	
Near Treeline	**Moderate (2)** Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully.	
Below Treeline	**Moderate (2)** Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully.	

Danger Scale

— No Rating | 1 Low | 2 Moderate | 3 Considerable | 4 High | 5 Extreme

Summary

The areas around Loveland and Berthoud Passes picked up a few inches of very dense, slushy snow. An observer reported a period of heavy rain in Dillon Saturday evening. Overnight temperatures were near freezing, with the freeze level around 10,500 feet. The snowpack will be soggy and weak today. Travel early and avoid steep slopes in the heat of the day.

You may encounter Loose Wet avalanches on all aspects and elevations today. They will be easiest to trigger when you are sinking more than a few inches into wet, sloppy snow. If you are, it is time to move to low angled terrain or shadier slopes. They can be surprisingly strong and powerful for their size, and drag you over cliffs or pound you into rocks.

Overnight temperatures have been near or above freezing since Friday. Saturday's rain and dense snow added additional water to the snowpack. These are warning signs for Wet Slab avalanche activity. Observers have reported several wet slabs, scattered from Cameron Pass to Ten Mile Canyon. Wet Slab avalanches are very hard to assess and predict. With that uncertainty, choosing conservative routes and lower angled terrain are good options.

Vail Resorts has put up $20,000 to support Friends of CAIC's Stay Informed, Stay Alive Challenge. Help match that $20,000 today! Donate now.

Weather Forecast for 11,000ft Issued Thursday, September 4, 2014 at 10:38 AM by Spencer Logan

	Thursday Night	Friday	Friday Night
Temperature (°F)	35 to 40	50 to 55	35 to 40
Wind Speed (mph)	5 to 15	5 to 15	8 to 18
Wind Direction	WSW	WSW	SW
Sky Cover	Mostly Cloudy	Mostly Cloudy	Mostly Cloudy
Snow (in)	0	0	0

Avalanche conditions can change rapidly during snow storms, wind storms, or rapid temperature change. For the most current information, go to www.colorado.gov/avalanche.

Source: CAIC Website (http://avalanche.state.co.us/forecasts/backcountry-avalanche/front- range/)

4.3.2 Past Events

The CAIC has documented 17 fatal avalanches in Pitkin County between the winter of 1997-98 and the winter of 2020-21, resulting in 19 fatalities, as shown in the table below.

Table 4-9 Pitkin County Avalanche Fatalities, 1997-98 to 2020-21

DATE	LOCATION	DESCRIPTION
March 1998	Aspen Mountain	1 out-of-bounds skier caught, partially buried, and killed.
January 1999	Aspen Highlands	2 out-of-area skiers caught; one buried and killed.
January 2000	Aspen Mountain	1 backcountry skier caught on backside of Aspen Mtn., buried, and killed.
March 2000	Aspen Highlands	2 out-of-area skiers caught, buried and killed.
February 2002	Aspen Highlands	1 skier caught, buried, and killed.
March 2002	Aspen Mountain	1 out-of-area skier caught, buried, and killed.
March 2005	Five Fingers Bowl (Aspen)	1 backcountry skier caught, buried, and killed.
December 2006	Rayburn Area (Snowmass Ski Area)	1 skier caught, buried, and killed.
December 2008	Aspen Backcountry	1 skier caught, buried, and killed.
February 2011	E. Snowmass Creek Valley/Sand's Chute	1 skier caught, buried, and killed.
April 2011	Highlands Ridge, Desolation Row (Aspen Zone)	1 skier caught, buried, and killed.
January 2012	Burnt Mtn. (near Snowmass Ski Area)	2 out-of-area skiers caught, 1 buried and killed.
December 2012	Snowmass Ski Area	1 ski patroller caught, swept over cliff, and killed.
January 2013	Raspberry Creek, near Marble	1 skier caught, buried, and killed
February 2015	Ophir Gulch (near Aspen Mtn.)	1 skier caught, buried, and killed.
April 2018	Maroon Bowl, west of Aspen Highlands	2 side country riders caught, 1 killed
February 2019	Pearl Pass Rd, Brush Creek Drainage	2 backcountry tourers caught, buried, and killed

Source: Colorado Avalanche Information Center

Figure 4-5 below shows avalanche paths identified within Pitkin County. Significant areas of the County are susceptible to avalanches as shown in Figure 4-6.

Figure 4-5 Pitkin County Avalanche Paths

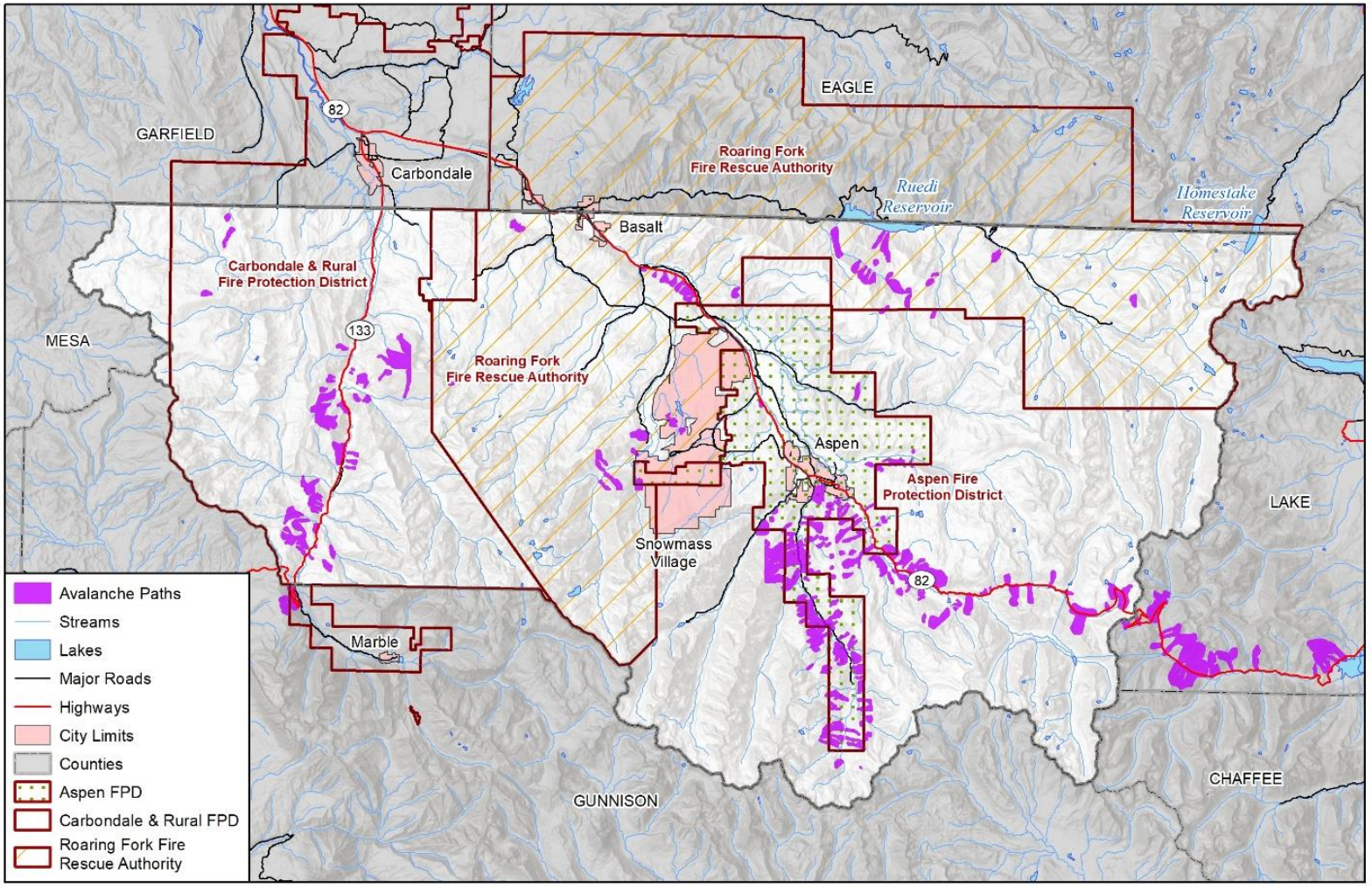
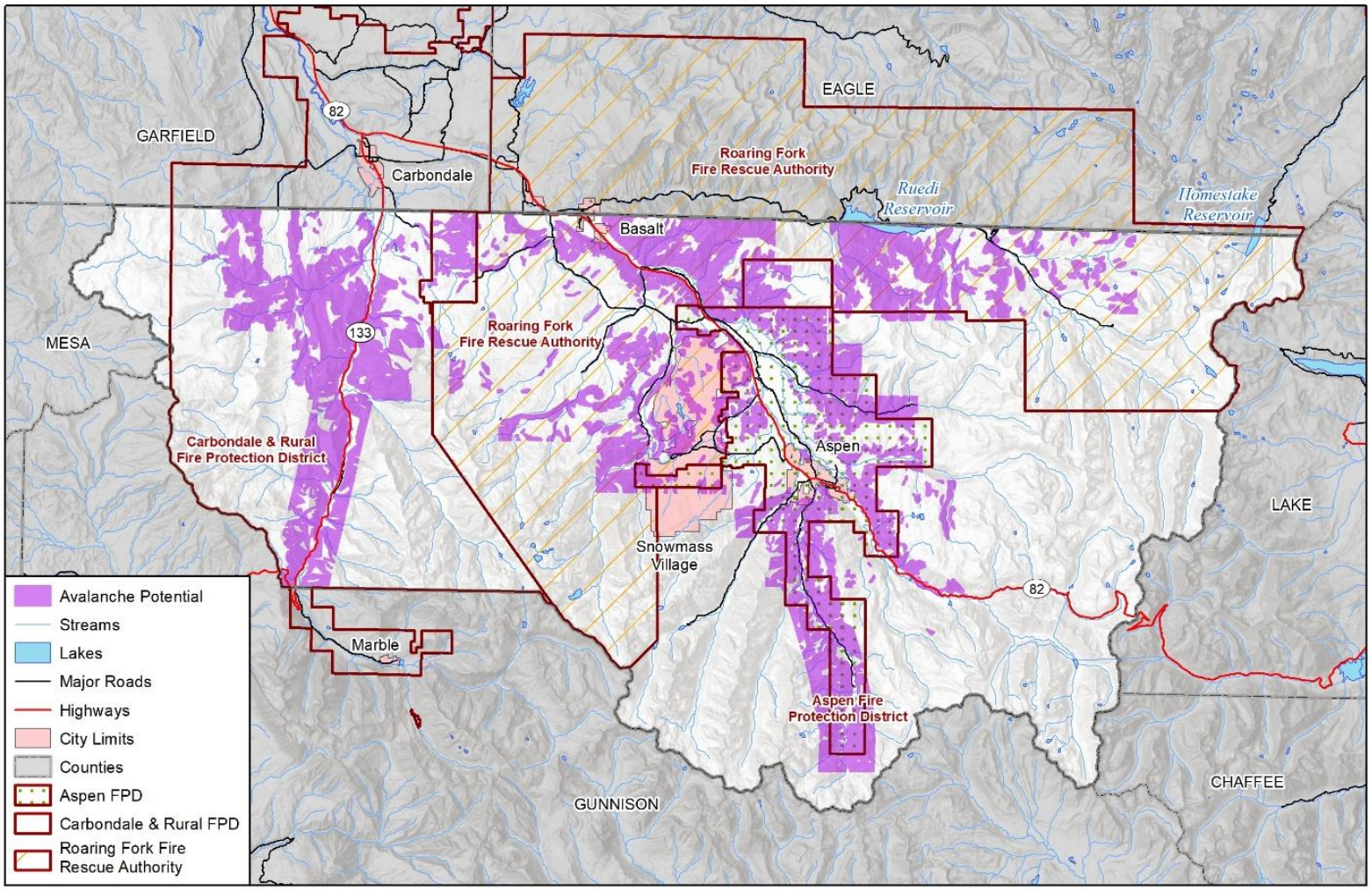


Figure 4-6 Pitkin County Avalanche Potential



4.3.3 Location

As noted previously, avalanche-prone areas can be determined with some accuracy, since under normal circumstances avalanches tend to run down the same paths year after year. The CAIC and the CGS have mapped areas with the most potential for avalanche activity. These areas are shown above in Figure 4-6.

The Aspen and Independence Pass areas of Pitkin County are considered especially susceptible to avalanche activity. The Aspen Highlands ski area has seen a number of previous occurrences. Small avalanches and sloughs frequently cover parts of the roadways along Castle Creek Rd., Little Annie Rd., and Fryingpan Rd.

4.3.4 Magnitude and Severity

Avalanches can reach speeds of up to 200 miles per hour and can exert forces great enough to destroy structures and uproot or snap off large trees. A number of weather and terrain factors determine avalanche severity and danger:

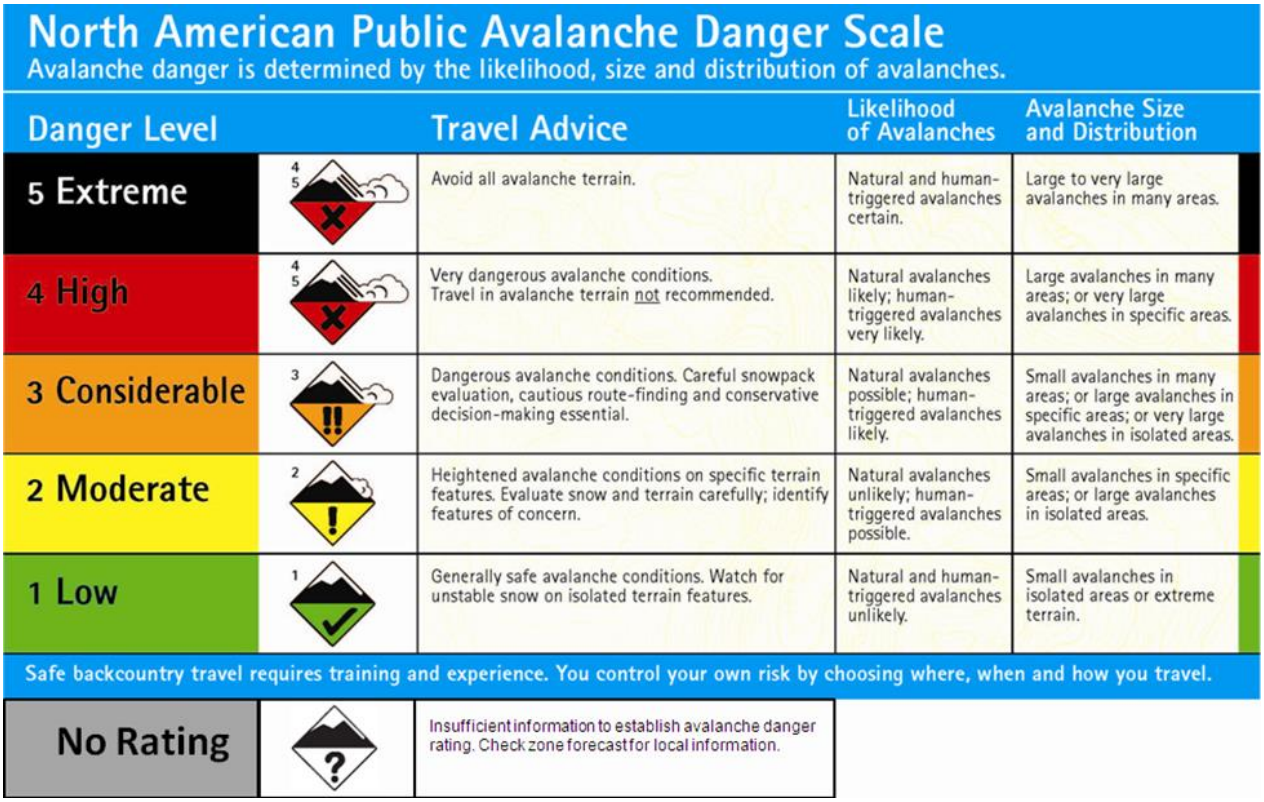
- Weather:
  - Storms—A large percentage of all snow avalanches occur during and shortly after storms.
  - Rate of snowfall—Snow falling at a rate of 1 inch or more per hour rapidly increases avalanche danger.
  - Temperature—Storms starting with low temperatures and dry snow, followed by rising temperatures and wetter snow, are more likely to cause avalanches than storms that start warm and then cool with snowfall.
  - Wet snow—Rainstorms or spring weather with warm, moist winds and cloudy nights can warm the snow cover, resulting in wet snow avalanches. Wet snow avalanches are more likely on sun-exposed terrain (south-facing slopes) and under exposed rocks or cliffs.
- Terrain:
  - Ground cover—Large rocks, trees, and heavy shrubs help anchor snow.
  - Slope profile—Dangerous slab avalanches are more likely to occur on convex slopes.
  - Slope aspect—Leeward slopes are dangerous because windblown snow adds depth and creates dense slabs. South-facing slopes are more dangerous in the springtime.
  - Slope steepness—Snow avalanches are most common on slopes of 30 to 45 degrees.

Avalanches can result in injury, death, and limited property damage in the County. Closure of major roads or rail lines due to avalanche activity can result in serious transportation disruptions as well as limited emergency response capabilities due to the limited number of roads in the County and minimal personnel. Backcountry avalanche incidents typically involve search and rescue teams and resources, which can put these teams at risk.

The time of an avalanche release depends on the condition of the snowpack, which can change rapidly during a day and particularly during rainfall. Although forecasts can provide information regarding when avalanches are more likely to occur, an avalanche can occur with little or no warning time.

The North American Avalanche Danger Scale is shown in Figure 4-7.

Figure 4-7 Avalanche Danger Scale



North American Public Avalanche Danger Scale

Avalanche danger is determined by the likelihood, size and distribution of avalanches.

Danger Level	Travel Advice	Likelihood of Avalanches	Avalanche Size and Distribution
5 Extreme	Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Large to very large avalanches in many areas.
4 High	Very dangerous avalanche conditions. Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
3 Considerable	Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
2 Moderate	Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
1 Low	Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.

Safe backcountry travel requires training and experience. You control your own risk by choosing where, when and how you travel.

No Rating	Insufficient information to establish avalanche danger rating. Check zone forecast for local information.

Source: CAIC Website (http://avalanche.state.co.us/wp-content/uploads/2013/09/ads.jpg.)

In an avalanche, the impact forces of the rapidly moving snow and debris and the burial of areas in the runout zone can result in the destruction of structures and anything else in its path. Avalanches causing death or injury are usually human triggered in the backcountry and can result in isolated injuries or fatalities. On rare occasions, roads, highways, and railroads may be damaged and blocked by snow and debris, resulting in travel delays and costly efforts to clear and repair transportation routes.

Avalanches have killed more people in Colorado than any other natural hazard, and Colorado accounts for one-third of all avalanche deaths in the United States.

4.3.5 Probability of Future Events

Colorado has more avalanche-related deaths than any other state, and Pitkin County has more average annual fatalities due to avalanche than any other county in the state.

Figure 4-8 U.S. Avalanche Fatalities by State, 2011-12 to 2020-21

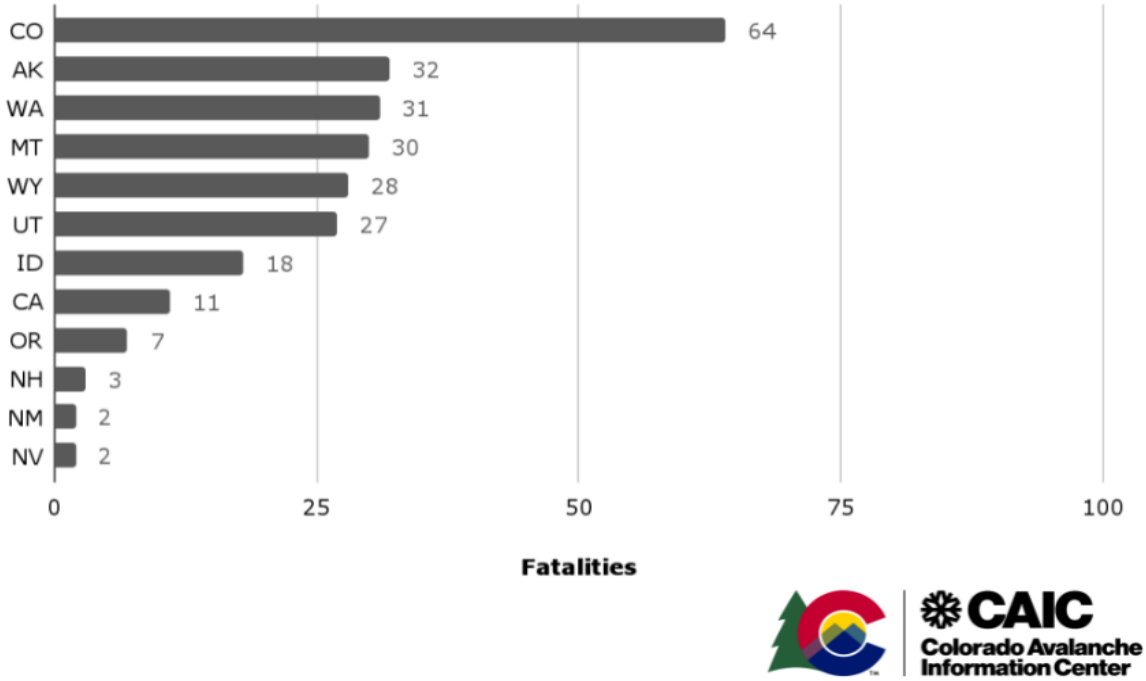
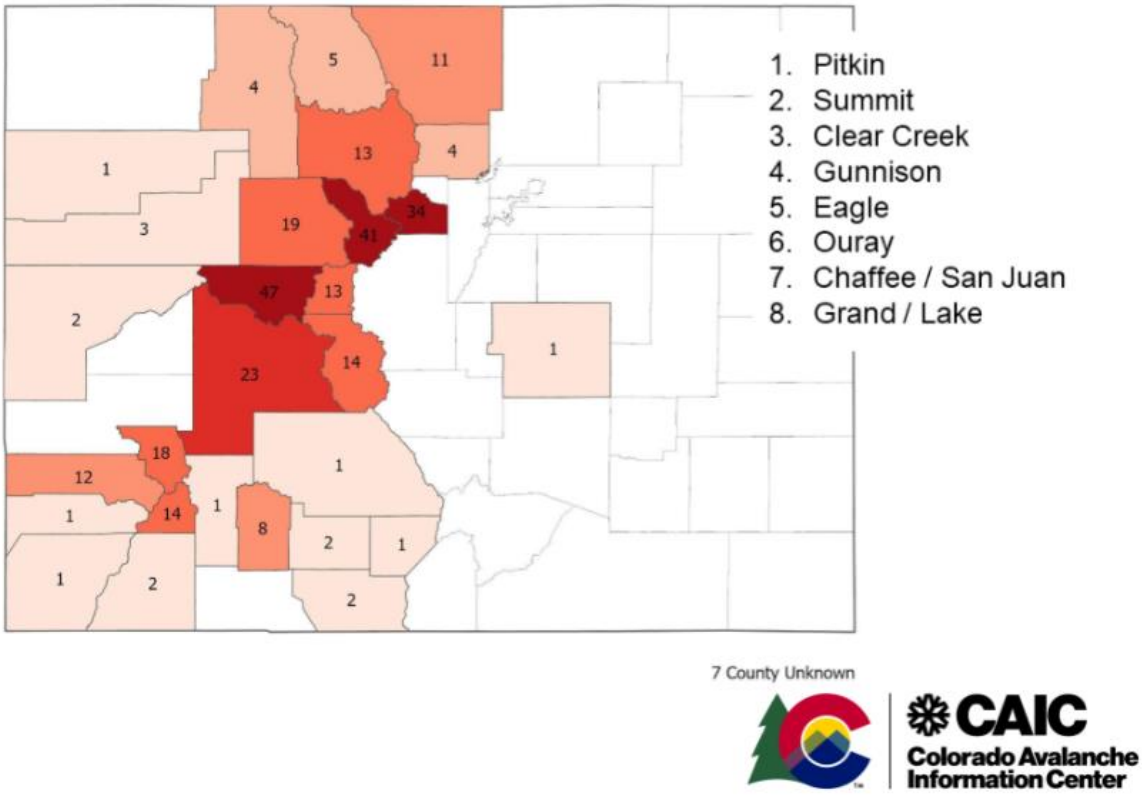


Figure 4-9 Colorado Avalanche Fatalities by County, 1950-51 to 2020-21



As shown in Figure 4-8 and Figure 4-9, Colorado has recorded 64 avalanches in the last 10 years, 9 of which were in Pitkin County. There are no good records of how many are caught in avalanches and survive, since non-fatal avalanche incidents often go unreported.

The likelihood of an avalanche increases with heavy accumulation of snow. The probability of future occurrence will depend on weather patterns and levels of recreational activity within known avalanche zones. The avalanche hazard is rated highly likely in the unincorporated County and likely in the other jurisdictions.

4.3.6 Climate Change Considerations

Warmer weather can weaken a mountain's snowpack and make it more difficult for the layers of snow to stick together. Climate warming affects the quality of mountain snow cover, possibly leading to more frequent and deadly avalanches. The Intergovernmental Panel on Climate Change (IPCC) warned that warming temperatures have destabilized mountain climates, leading to more avalanches, melting glaciers and more intense storms.

Less snow and thinner snowpacks may actually lead to more avalanches in years when early winter snowpack is thin and weak and fails to hold on to new snow that falls due to weak bonds between the crystals, forming a weak-base layer. Dry weather can help to form a base of what avalanche experts call “depth hoar” that can take months to stabilize. Also referred to as “sugar snow,” the snow grains resemble raw sugar and do not bond well. Once these weak layers are buried by new snow, the weakness is preserved. New snow falling on top of weak layers can be easily dislodged by backcountry recreationists, setting off deadly slides. Conversely, intense amounts of snow in a short period of time can increase avalanche potential and magnitude.

4.3.7 Vulnerability Assessment

With prime conditions of wind or snow load, avalanches can be triggered easily. Potential tourist, travelers and motorist need to be made aware of all types of avalanche risks when taking in any of the natural wildernesses or forests within Pitkin County.

People

Every year, snow avalanches kill and injure winter recreationists in Colorado’s high country, including cross-country skiers, downhill skiers/snowboarders, snowshoers, hikers, climbers, and snowmobilers. Approximately 1.5 million visitors travel to the Aspen area each year. The Aspen Mountain and Highlands, along with the Five Fingers Bowl, Rayburn, Snowmass are very active during most winters. Rising numbers of outdoor enthusiasts may lead to an increase in fatal avalanche occurrences, as avalanche events can be triggered by people’s recreational activities. Beyond backcountry skiing, there has been an increased interest in other forms of winter recreation such as snowmobiling and motorized and non-motorized snow biking. Backcountry avalanche incidents involve search and rescue teams and resources, which can put these personnel at risk.

The key actions to limiting impacts to individuals recreating in hazardous areas include spreading knowledge and awareness of the hazard and being properly equipped for self-rescue, if necessary, with tools such as locater beacons, shovels, GPS units and other communication tools and probes. Excessive winter storm cycles may result in risk to people in structures.

In addition to recreationists, the parcel analysis shown in Table 4-10 indicates there are approximately 658 people living in areas with avalanche potential.

Property

Private property losses are rare, due to local regulation of known avalanche zones, although lack of knowledge of avalanche runout potential (the farthest reach of snow and debris) has occasionally resulted in damages to residences and private vehicles in other parts of Colorado.

Parcel analysis shown below in Table 4-10 found 304 structures located in areas at risk of avalanche risk, with a combined value estimated at over $637 million, mostly in the unincorporated area.

Table 4-10 Properties at Risk of Avalanches by Jurisdiction and Property Type

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	POPULATION
Aspen	Residential	8	8	$11,436,700	$5,718,350	$17,155,050	16
	Total	**8**	**8**	**$11,436,700**	**$5,718,350**	**$17,155,050**	**16**
Basalt	Commercial	1	1	$2,681,400	$2,681,400	$5,362,800	
	Residential	7	7	$17,198,100	$8,599,050	$25,797,150	16
	Total	**8**	**8**	**$19,879,500**	**$11,280,450**	**$31,159,950**	**16**
Snowmass Village	Exempt	5	8	$11,720,800	$11,720,800	$23,441,600	
	Residential	61	61	$36,508,000	$18,254,000	$54,762,000	135
	Total	**66**	**69**	**$48,228,800**	**$29,974,800**	**$78,203,600**	**135**
Unincorporated	Agricultural	3	4	$9,903,900	$9,903,900	$19,807,800	
	Commercial	1	1	$212,200	$212,200	$424,400	
	Exempt	3	5	$15,287,200	$15,287,200	$30,574,400	
	Residential	183	209	$306,674,400	$153,337,200	$460,011,600	491
	Total	**190**	**219**	**$332,077,700**	**$178,740,500**	**$510,818,200**	**491**
Grand Total		**272**	**304**	**$411,622,700**	**$225,714,100**	**$637,336,800**	**658**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, Colorado Geologic Survey, WSP GIS Analysis

Critical Facilities and Infrastructure

Avalanches can lead to the temporary blockage of roads. Most structures, including the County's critical facilities, should be able to provide adequate protection from avalanches to individuals but the structures themselves could suffer broken windows and dented exteriors. Those facilities with backup generators are better equipped to handle these types of hazards should the power go out. Significant damage to an essential government facility could force the temporary closure of that facility, disrupting the ability of local governments to provide the usual level of service to residents.

Analysis of the community assets described in Section 4.2 found five critical facilities in areas at risk of avalanche, including eight transportation assets and two communications assets. As noted in Section 4.2.3, some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns.

Table 4-11 Critical Facilities Exposed to Avalanche Risk by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	-	-	1	-	1	1
Energy	-	-	-	-	-	-	-
Food, Water, Shelter	-	-	-	-	-	-	-
Hazardous Material	-	-	-	-	-	-	-
Health and Medical	-	-	-	-	-	-	-

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Safety and Security	-	-	-	-	-	-	-
Transportation	-	-	-	4	-	4	4
Total	**0**	**0**	**0**	**5**	**0**	**5**	**5**

Source: Pitkin County, CEPC, CGS, HIFLD, NBI, RFFR

Economy

Avalanche activity inside or outside the County (along connecting roadways) can disrupt transportation in and out of the local communities, which could result in temporary economic impacts. Tourism is the main economic driver for the study area, and a major closure of roads in other counties and surrounding region could leave Pitkin County and the unincorporated portions without this vital sector, even during non-winter months.

Historic, Cultural, and Natural Resources

Moderate damage occurred to forests below avalanche runout zones during the 2019 avalanche cycle. This also disturbed stream habitat with debris piles, and debris removal costs were incurred by the County. There are also historic mining sites likely to be at risk throughout the county.

4.3.8 Development Trends

Avalanche vulnerability could increase to a degree with future development and population growth as there will be a higher number of people driving on roadways and taking part in backcountry recreation, as well as potentially requiring search and rescue and emergency response and services. Risk to structures can potentially increase without careful siting and planning.

4.3.9 Differences by Jurisdiction

All participating jurisdictions have some avalanche risk, but that risk is higher in the unincorporated County and the fire protection districts. Snowmass Village also has a greater area at risk compared to Aspen or Basalt.

4.3.10 Risk Summary

- The overall significance of avalanche in Pitkin County ranges from **Low** to **Medium**.
- From 1997 through 2021 there have been 19 recorded avalanche fatalities in Pitkin County and historically the greatest number of fatalities in Colorado.
- Backcountry recreationalists, road crews, and motorists along the main roadways are the most at risk to avalanche dangers. Human-caused avalanches are most common cause of events.
- The risk is higher in the unincorporated county and fire districts.
- Related hazards: Winter Storm, Severe Wind, Drought.

4.4 Contagious Disease

Contagious Disease	Location	Magnitude/ Severity	Probability of Future Events	Overall Significance
Pitkin County	Extensive	Critical	Occasional	**Medium**
Aspen	Extensive	Critical	Occasional	**Medium**
Basalt	Extensive	Critical	Occasional	**Medium**
Snowmass Village	Extensive	Critical	Occasional	**Medium**
Aspen Fire	Extensive	Critical	Occasional	**Medium**
Roaring Fork Fire	Extensive	Critical	Occasional	**Medium**

4.4.1 Description

A contagious (or communicable) disease is one that is spread from one person to another through a variety of ways that include: contact with blood and bodily fluids; breathing in an airborne virus; or by being bitten by an insect. This hazard profile focuses primarily on major contagious disease outbreaks, such as endemics and pandemics.

A pandemic can be defined as a public health emergency that attacks a large population across great geographic distances. Pandemics are larger than epidemics in terms of geographic area and number of people affected. Epidemics tend to occur seasonally and affect much smaller areas. Pandemics, on the other hand, are most often caused by new subtypes of viruses or bacteria to which humans have little or no natural resistance. Consequently, pandemics typically result in more deaths, social disruption, and economic loss than epidemics.

Three conditions must be met before a pandemic begins:

1. A new virus subtype must emerge that has not previously circulated in humans (and therefore there is no pre-existing immunity),
2. This new subtype must be able to cause disease in humans, and
3. The virus must be easily transmissible from human to human.

As of July 2022, Pitkin County, the nation, and the world are dealing with the COVID-19 pandemic, confirming that the pandemic is a key public health hazard in the county. This hazard risk assessment includes an analysis of pandemic risk in Pitkin County and an analysis of the impacts of the hazards profiled in this plan on public health.

Unlike seasonal flu, an influenza pandemic has much greater potential for loss of life and significant social disruption due to higher rates of transmission and more severe health impacts. The COVID-19 virus has a much higher rate of transmission than the seasonal flu, primarily by airborne transmission of droplets/bodily fluids. Common symptoms include fever, cough, fatigue, shortness of breath or breathing difficulties, and loss of smell and taste. While most people have mild symptoms, some people develop acute respiratory distress syndrome. A key challenge in containing the spread has been the fact that it can be transmitted by asymptomatic people.

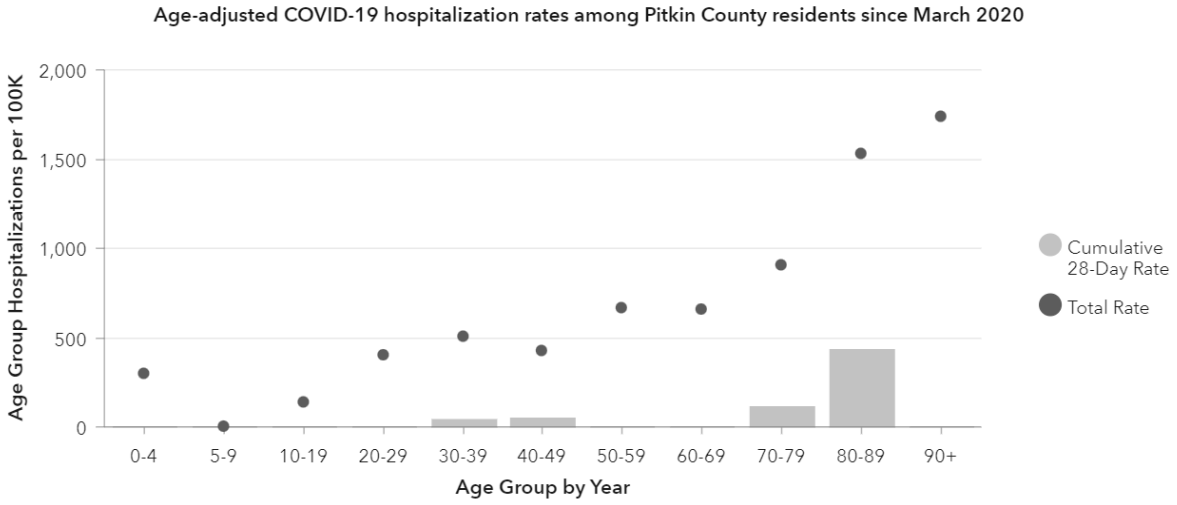
4.4.2 Past Events

Since the early 1900s, five lethal pandemics have swept the globe:

- **1918-19 Spanish flu (H1N1):** This flu is estimated to have infected 20-40 percent of the world's population. An estimated 17 to 100 million people lost their lives. Between September 1918 and April 1919, 500,000 Americans died. The flu spread rapidly; many died within a few days of infection, others from secondary complications. The attack rate and mortality were highest among adults 20-50 years old; the reasons for this are uncertain. The Spanish flu likely impacted Pitkin County given the nature of that particular strain, but exact impacts are unknown.
- **1957-58 Asian flu (H2N2):** This virus was quickly identified due to advances in technology, and a vaccine was produced. Globally, more than 500 million people were infected and an estimated 1 to 4 million people lost their lives. Infection rates were highest among school children, young adults, and pregnant women. The elderly had the highest rates of death. A second wave developed in 1958. In total, there were about 70,000 deaths in the United States.

- **1968-69 Hong Kong flu (H3N2):** This strain descended from the H2N2 virus which caused the Asian flu pandemic. Globally, more than 500 million people were infected, resulting in 1 to 4 million deaths. It was first detected in Hong Kong in early 1968 and spread to the United States later that year. Those over age 65 were the most vulnerable and severely affected. This virus returned in 1970 and 1972 and still circulates today.
- **2009 H1N1 Swine flu:** The 2009 H1N1 virus was first detected in the United States in April 2009. It is now believed that the outbreak began in either Mexico or somewhere in Asia. The World Health Organization officially declared a pandemic on June 11, 2009. Testing of the strain indicated that it did not contain markers associated with high death rates or increased risk of severe disease. About 70 percent of people who have been hospitalized with this 2009 H1N1 virus have had one or more medical conditions previously recognized as placing people at "high risk" of serious seasonal flu-related complications. This included pregnancy, diabetes, heart disease, asthma, and kidney disease. Young children were also at high risk of serious complications from 2009 H1N1, just as they are from seasonal flu. The elderly were not disproportionately affected by this strain, which is rare for most flu viruses. And while people 65 and older were the least likely to be infected with 2009 H1N1 flu, if they got sick, they were also at high risk of developing serious complications from their illness. The World Health Organization (WHO) declared the pandemic to be officially over in June 2010. The WHO estimated that over 18,000 people died of the H1N1 strain worldwide. This number could potentially be much higher. Deaths related to this particular strain of the virus could have gone unconfirmed or unreported. Nevertheless, this number is lower than the 250,000 to 500,000 people around the world who die of seasonal flu strains each year.
- **2020-Ongoing COVID-19:** The COVID-19 or novel coronavirus pandemic began in December 2019 and was declared a pandemic in March 2020. As of July 8, 2022, 554 million cases have been reported around the world with over 6.3 million deaths, including over 88 million cases and over 1 million deaths in the United States. As of July 21, 2022, Pitkin County has seen 7,382 cases and several variants (shown in the figure below), resulting in eight deaths. The average age of hospitalizations is 55, with the age group 80-89 having the largest rate of hospitalizations per 100,000 (shown in the figure below). The pandemic is expected to persist into the foreseeable future, as the virus continues to mutate into different variants.

Figure 4-10 COVID-19 Hospitalization Rates Among Pitkin County Residents



4.4.3 Location

Pitkin County and surrounding areas of City of Aspen, Town of Basalt, and Town of Snowmass Village could all potentially be affected by a pandemic flu outbreak.

4.4.4 Magnitude and Severity

Overall, the impacts of a pandemic flu outbreak in Pitkin County could be critical, with a significant percentage of the planning area's population affected. Local medical facilities could be rapidly overwhelmed. The medical facilities of neighboring jurisdictions would most likely be overwhelmed as well and unable to provide assistance to Pitkin County.

4.4.5 Probability of Future Events

Although it is impossible to predict the next disease outbreak, there is recent history that shows these outbreaks are not uncommon and are likely to reoccur. Based on the five pandemics that have affected the United States in roughly the last 100 years, a pandemic occurs on average roughly every 20 years. In other words, there is a 5% probability that a pandemic that affects the entire United States will occur in any given year.

For the current COVID-19 pandemic, due to the virus's ability to mutate and rapidly infect those who are not vaccinated, the pandemic may extend for several years, and booster vaccines may be necessary to prevent future outbreaks. In just the last couple of decades, the world has drastically increased points of transmission through global travel and trade to levels unseen in human history – this may have a drastic impact on the frequency of pandemics and the speed with which they spread in coming years.

4.4.6 Climate Change Considerations

As the earth's climate continues to warm, researchers predict wild animals will be forced to relocate their habitats — likely to regions with large human populations — dramatically increasing the risk of a viral jump to humans that could lead to the next pandemic. This link between climate change and viral transmission is described by an international research team led by scientists at Georgetown University and is published on April 28, 2022, in *Nature*. The scholars noted that the geographic range shifts due to climate change could cause species that carry viruses to encounter other mammals to share thousands of viruses. The viruses can then further be spread to humans. In addition, rising temperatures caused by climate change will impact bats, which account for the majority of novel viral sharing. Bats' ability to fly will allow them to travel long distances and share the most viruses. Altogether, the study suggests that climate change will become the biggest upstream risk factor for disease emergence — exceeding higher-profile issues like deforestation, wildlife trade and industrial agriculture. The authors say the solution is to pair wildlife disease surveillance with real-time studies of environmental change ("New Study Finds Climate Change Could Spark the Next Pandemic - Georgetown University Medical Center" 2022).

4.4.7 Vulnerability Assessment

People

Pandemics can affect large segments of the population for long periods of time. According to the 2018 Colorado State Hazard Mitigation Plan, a pandemic flu outbreak could affect approximately 30% of the state's overall population, with as much as 10% possibly needing hospitalization. The number of hospitalizations and deaths will depend on the virulence of the virus. Risk groups cannot be predicted with certainty; the elderly, people with underlying medical conditions, and young children are usually at higher risk, but as discussed above this is not always true for all influenza strains. People without health coverage or access to good medical care are also likely to be more adversely affected. Compared to other counties in Colorado, Pitkin County's social vulnerability index is low. However, one of the long-term effects of a pandemic that lasts several years as demonstrated by COVID-19 is mental health, which may impact many people throughout the County.

Property

For the most part, the property itself would not be impacted by a human disease epidemic or pandemic. However, as concerns about contamination increase, property may be quarantined or destroyed as a precaution against spreading illness. Additionally, traditional sheltering facilities including homeless shelters or facilities stood up to support displaced persons due to an evacuation or other reasons due to a simultaneous disaster occurring cannot be done in a congregate setting. This requires additional planning considerations or the use of facilities that allow for non-congregate shelter settings which may require

approval of a request to FEMA for non-congregate sheltering and may have an increased cost (such as the use of individual hotel rooms) as opposed to traditional congregate sheltering facilities.

Critical Facilities and Infrastructure

Hospitals and morgues will be heavily affected and may be overwhelmed. Other critical facilities and infrastructure are not directly affected by a pandemic but may have difficulty maintaining operations and maintenance activities due to a significantly decreased workforce. Schools may be forced to close. Government facilities may have difficulty continuing to provide services due to staffing shortages.

Economy

In a normal year, lost productivity due to illness costs U.S. employers an estimated $530 billion. During a pandemic, that figure would likely be considerably higher and could trigger a recession or even a depression. Mandatory shutdowns of businesses and services in the early weeks of the COVID-19 pandemic, for example, resulted in over 22 million people without jobs.

FluWorkLoss 1.0 is a tool developed by the Center for Disease Control (CDC) to estimate the potential economic impact of pandemic influenza on a community in terms of the number of workdays lost. Days missed from work cost both employees in lost wages, and employers in work not completed. Table 4-12 shows the total estimated number of days lost from work in Pitkin County due to a hypothetical four-week-long influenza pandemic with a 25% clinical attack rate. The available workdays are calculated as a product of the total population in the working age group (2021 Census data), the employment rate of Pitkin County (2016-2020 Census data), and five workdays in a week. Results are estimated based on three scenarios: a mild, best-case scenario; a most likely scenario, and a more severe worst-case scenario.

Table 4-12 Total Workdays Lost (Pandemic Influenza)

SCENARIO	WORKDAYS LOST
Minimum Loss Scenario	8,899
Most Likely Scenario	10,546
Maximum Loss Scenario	13,173

Source: FluWorkLoss 1.0, CDC

The number of workdays lost includes days lost for both self-care and care of sick family members and shows the County could lose hundreds of thousands of workdays in a month. Moreover, these estimates do not include workdays lost due to secondary impacts such as social distancing and the closure of schools and businesses.

Historic, Cultural, and Natural Resources

Impacts on these resources are typically minimal. However, reduced tourism could lead to additional economic impacts.

4.4.8 Development Trends

Population growth and development contribute to pandemic exposure. Future development in and around the County has the potential to change how infectious diseases spread through the community and impact human health in both the short and long-term. New development may increase the number of people and facilities exposed to public health hazards and greater population concentrations (often found in special needs facilities and businesses) put more people at risk. During a disease outbreak, those in the immediate isolation area would have little to no warning, whereas the population further away in the dispersion path may have some time to prepare and mitigate against disease depending on the hazard, its transmission, and public notification.

4.4.9 Differences by Jurisdiction

A pandemic is likely to eventually affect the entire County, including all jurisdictions. Some of the more remote areas of the County such as Brush Creek Village, Aspen Village and Castle/Maroon Creek, Crystal River Valley and Lenado may not be affected immediately as the residents may not contact infected people right away. However, smaller jurisdictions may not have adequate supplies if the incidence rate spikes quickly, and a significant proportion of the population needs medical care. The City of Aspen has the largest

population (as shown in Table 3-2) of 7,721 people, so the City of Aspen will likely experience pandemic effects before smaller jurisdictions.

4.4.10 Risk Summary

Ongoing mitigation activities should focus on preventing infection during flu season. This includes, but is not limited to, pre-season community outreach campaigns to educate the public about risks and available support; establishing convenient vaccination centers; reaching out to vulnerable populations and care givers; and issuing advisories and warnings.

- Pandemics affecting the U.S. occur roughly once every 20 years but cannot be reliably predicted.
- Effects on people will vary, but as much as 30% of the population could become ill, and 10% may need to be hospitalized
- Effects on property are typically minimal, although quarantines could result in short-term closures. Critical facilities may have difficulty maintaining operations due to staffing shortages.
- Lost productivity due to illness and potential business closures could potentially have severe economic impacts. Social distancing requirements and fear of public gatherings could significantly reduce in-person commerce.
- Related Hazards: None

4.5 Cyber-Attack

CYBER-ATTACK	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Extensive	Critical	Likely	**High**
Aspen	Extensive	Critical	Likely	**High**
Basalt	Extensive	Critical	Likely	**High**
Snowmass Village	Extensive	Critical	Likely	**High**
Aspen Fire	Extensive	Moderate	Likely	**Medium**
Roaring Fork Fire	Extensive	Moderate	Likely	**Medium**

4.5.1 Description

The 2018 Colorado State Hazard Mitigation Plan defines cyber-attacks as "deliberate exploitation of computer systems, technology-dependent enterprises, and networks." Cyber-attacks use malicious code to alter computer operations or data. The vulnerability of computer systems to attacks is a growing concern as people and institutions become more dependent upon networked technologies. The Federal Bureau of Investigation (FBI) reports that, "cyber intrusions are becoming more commonplace, more dangerous, and more sophisticated," with implications for private- and public sector networks. Cyber threats can take many forms, including:

- **Phishing attacks**: Phishing attacks are fraudulent communications that appear to come from legitimate sources. Phishing attacks typically come through email but may come through text messages as well. Phishing may also be considered a type of social engineering meant to exploit employees into paying fake invoices, providing passwords, or sending sensitive information.
- **Malware attacks**: Malware is malicious code that may infect a computer system. Malware typically gains a foothold when a user visits an unsafe site, downloads untrusted software, or may be downloaded in conjunction with a phishing attack. Malware can remain undetected for years and spread across an entire network.
- **Ransomware**: Ransomware typically blocks access to a jurisdiction's/agency's/ business' data by encrypting it. Perpetrators will ask for a ransom to provide the security key and decrypt the data, although many ransomware victims never get their data back even after paying the ransom.
- **Distributed Denial of Service (DDoS) attack**: Perhaps the most common type of cyber-attack, a DDoS attack seeks to overwhelm a network and causes it to either be inaccessible or shut down. A DDoS typically uses other infected systems and internet connected devices to "request" information from a specific network or server that is not configured or powerful enough to handle the traffic.
- **Data breach**: Hackers gaining access to large amounts of personal, sensitive, or confidential information has become increasingly common in recent years. In addition to networked systems, data breaches can occur due to the mishandling of external drives.
- **Critical Infrastructure/SCADA System attack**: There have been recent critical infrastructure Supervisory Control and Data Acquisition (SCADA) system attacks aimed at taking down lifelines such as power plants and wastewater facilities. These attacks typically combine a form of phishing, malware, or other social engineering mechanisms to gain access to the system.

The 2018 Colorado State Hazard Mitigation Plan concludes: "This is a newly developing threat, so as more resources are devoted to countering the hazard, the risk of a disruption would hopefully decrease. Mitigation opportunities for this hazard include continued diligence of the state's Office of Information Technology (OIT), as well as for other government and private sector entities to continue to monitor, block, and report cyber-attacks, and continually assess the vulnerability of systems."

The Pitkin County Information Technology Department's IT Security (ITSec) team is constantly working to maintain and improve the County's defenses against cyber-attacks.

4.5.2 Past Events

According to the FBI's 2021 Internet Crime Report, the FBI received an average of 552,000 cyber-crime complaints per year over the last five years. The Crime Report also noted a trend of increasing cyber-crime

complaints and losses each year. Nationwide losses in 2021 alone exceeded $6.9 billion, a 392% increase since 2017. Over the past five years, nationwide cyber-crime complaints totaled to 2.76 million, with $18.7 billion in losses. Colorado ranked 14th among states in losses, with $130,631,286 in total losses, and 17th in number of victims, with 10,537 victims of cyber-crime.

Ransomware is one of the most common types of cyber-attack. These attacks accounted for 3,729 complaints and over $49M in reported losses in 2021. Since many attacks go unreported, the actual numbers are likely higher. The cybersecurity firm Symantec reported in 2016 that one in every 131 emails contained malware, and the company's software blocked an average of 229,000 web attacks every day. And according to a 2016 study by Kaspersky Lab, roughly one in five ransomware victims who pay their attackers never recover their data. The FBI Internet Crime Report predicts that ransomware will remain popular because of the increased use of remote school and work due to the COVID-19 pandemic.

In 2018, CDOT was impacted by a SamSam ransomware attack resulting in approximately a million dollars in loss. In 2020 both the Town of Erie and the Town of Lafayette Colorado fell victim to different types of cyber-attacks. The Town of Erie lost more than a million dollars during a business email account (BEA) scam. Layfette lost approximately $45,000 resulting from a ransomware attack.

A 2017 study found ransomware payments over a two-year period totaled more than $16 million. Even if a victim is perfectly prepared with full offline data backups, recovery from a sophisticated ransomware attack typically costs far more than the demanded ransom.

The Privacy Rights Clearinghouse, a non-profit organization based in San Diego, maintains a timeline of 9,741 data breaches resulting from computer hacking incidents in the United States from 2005-2019. The database lists 47 data breaches against systems located in Colorado, totaling over 400,000 impacted records; it is difficult to know how many of those affected Pitkin residents. Attacks happening outside of the state can also impact local businesses, personal identifiable information, and credit card information. Table 4-13 shows several of the most significant cyber-attacks in Colorado in recent years. The data aims to provide a general understanding of the impacts from cyber-attacks by compiling an up-to-date list of incidents but is limited by availability of data: "this is an incomplete look at the true scope of the problem due in part to varying state laws."

Table 4-13 Major Cyber-Attacks Impacting Colorado (100,000+ Records), 2005-2021

DATE REPORTED	TARGET	ORGANIZATION TYPE	TOTAL RECORDS	DESCRIPTION
7/9/2008	Division of Motor Vehicles Colorado	Government	3,400,000	The Department of Motor Vehicles (DMV) failed to properly limit access to its database.
3/29/2012	Department of Child Support Services, IBM, Iron Mountain, Inc.	Government	800,000	Several computers being shipped were lost.
12/3/2010	Mesa County, Western Colorado Drug Task Force	Government	200,000	Sensitive information was accidently posted in a place that was publicly accessible on the Internet.
4/22/2008	College Invest	Non-government Organization	200,000	Customers had personal information stored on a computer hard drive that disappeared during a move.
6/11/2006	Denver Election Commission	Government	150,000	Records containing personal information are missing at city election offices.
7/22/2010	Colorado Department of Health Care Policy and Financing	Government	105,470	A hard drive containing personal information was stolen.

DATE REPORTED	TARGET	ORGANIZATION TYPE	TOTAL RECORDS	DESCRIPTION
7/9/2010	Governor's Office of Information Technology	Medical	105,470	Personal records were stolen.

Source: The Privacy Rights Clearinghouse

Recent years have seen an increase in ransomware attacks, particularly against local government systems. The City of Atlanta, Georgia, was hit by a major ransomware attack in 2018, recovery from which wound up costing a reported $2.6 million, significantly more than the $52,000 ransom demand. A similar attack against the City of Baltimore, Maryland, in 2019 affected the city government's email, voicemail, property tax portal, water bill, and parking ticket payment systems, and delayed more than 1,000 pending home sales. In March 2019, Orange County, North Carolina was attacked with a ransomware virus, causing slowdowns and service problems at key public offices such as the Register of Deeds, the Sheriff's Office, and county libraries. The attack impacted a variety of county services, including disrupting the county's capability to process real estate closings, issue marriage licenses, process fees or permits, process housing vouchers, and verify tax bills.

A large, sophisticated malware attack, known as Olympic Destroyer, was launched against the 2018 Winter Olympics in PyeongChang, South Korea. The attack initially took down servers, email, Wi-Fi, and ticketing systems, which could have severely disrupted the games. Fortunately, the organizing committee had a robust cybersecurity group that was able to quickly restore most functions.

HIPAA Journal reported on a cyber-attack incident in Pitkin County that occurred in 2020. The news source stated that 1,454 Pitkin County residents had personal information exposed online and made available to unauthorized individuals. The data leaked was information from the county's COVID-19 contact tracing system. Leaked information included the names, birthdays, employment, and COVID-19 test results, and information on the school/day care used by the individuals. Pitkin County offered 12 free months of identity restoration and credit monitoring to the affected individuals.

4.5.3 Location

Cyber-attacks can and have occurred in every location regardless of geography, demographics, and security posture. Anyone with information online is vulnerable to a cyber-attack. Incidents may involve a single location or multiple geographic areas. A disruption can have far-reaching effects beyond the location of the targeted system; disruptions that occur far outside the state can still impact people, businesses, and institutions within the County. All servers in Pitkin County are potentially vulnerable to cyber-attacks. Businesses, industry, and even individuals are also susceptible to cyber-attacks.

4.5.4 Magnitude/Severity

There is no universally accepted scale to explain the severity of cyber-attacks. The strength of a DDoS attack is often explained in terms of a data transmission rate. One of the largest DDoS disruptions ever, known as the Dyn Attack which occurred on October 21, 2016, peaked at 1.2 terabytes per second and impacted some of the internet's most popular sites to include Amazon, Netflix, PayPal, Twitter, and several news organizations.

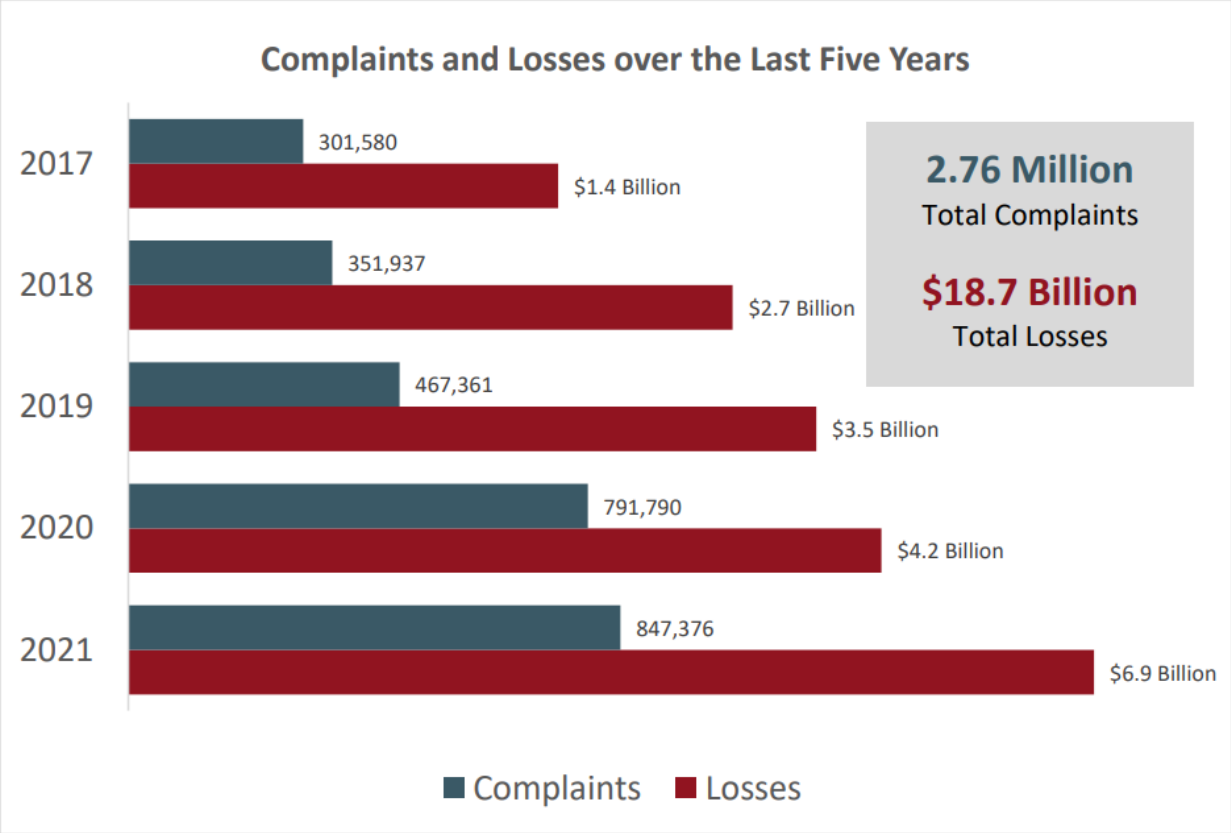
Data breaches are often described in terms of the number of records or identities exposed. The largest data breach ever reported occurred in August 2013, when hackers gained access to all three billion Yahoo accounts. The hacking incidents associated with Colorado in the Privacy Rights Clearinghouse database are of a smaller scale, ranging from just 32 records to approximately 60,000, along with several cases in which an indeterminate number of records may have been stolen.

Ransomware attacks are typically described in terms of the amount of ransom requested, or by the amount of time and money spent to recover from the attack. One report from cybersecurity firm Emsisoft estimates the average successful ransomware attack costs $81 million and can take 287 days to recover from.

4.5.5 Probability of Future Events

Small-scale cyber-attacks such as DDoS attacks occur daily, but most have negligible impacts at the local or regional level. Data breaches are also extremely common, but again most have only minor impacts on government services. Additionally, the FBI Internet Crime Report 2021 found that there is a trend of increasing cyber-attacks over the past 5 years. These trends are shown in Figure 4-11.

Figure 4-11 Trends of the Frequency of Cyber-attacks, 2016-2021



Source: The FBI Internet Crime Report 2021

Perhaps of greatest concern to Pitkin County are ransomware attacks, which are becoming increasingly common. It is difficult to calculate the odds of Pitkin County or one of its municipal governments being hit with a successful ransomware attack in any given year, but it is likely to be attacked in the coming years.

The possibility of a larger disruption affecting systems within the County is a constant threat, but it is difficult to quantify the exact probability due to such highly variable factors as the type of attack and intent of the attacker. Major attacks specifically targeting systems or infrastructure in the County cannot be ruled out.

4.5.6 Climate Change Considerations

Changes in development have no impact to the threat, vulnerability, and consequences of a cyber-attack.

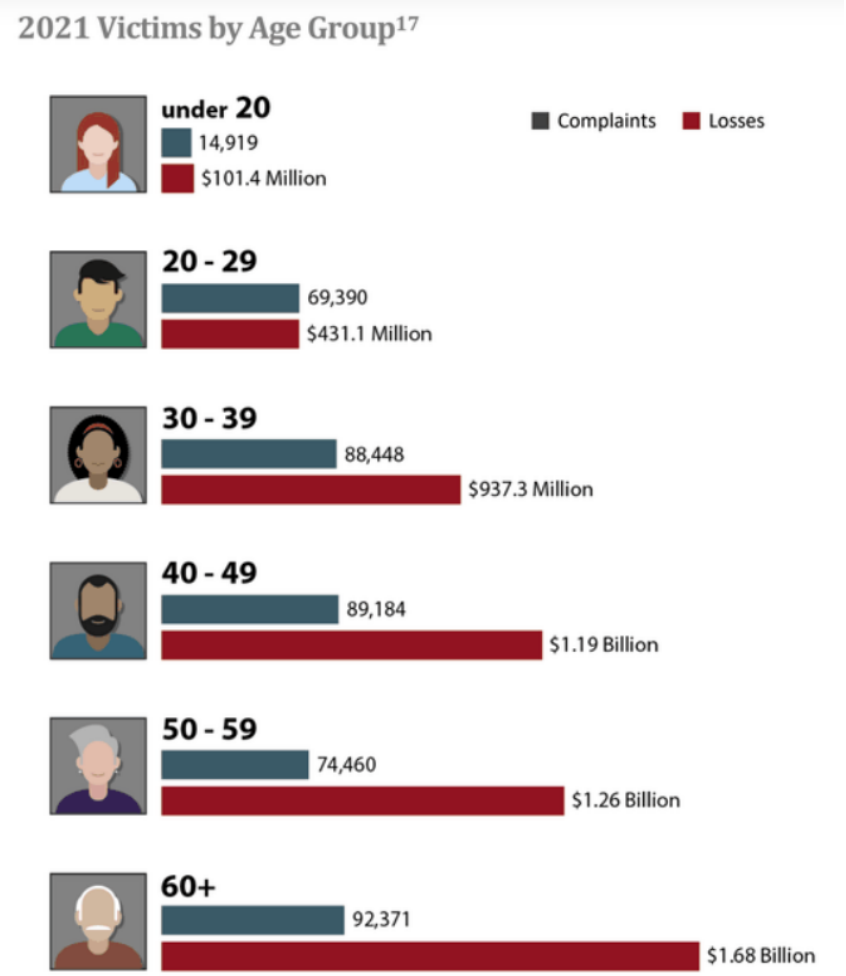
4.5.7 Vulnerability Assessment

People

Injuries or fatalities from cyber-attacks would generally only be possible from a major cyber terrorist attack against critical infrastructure. More likely impacts to the public are financial losses and an inability to access systems such as public websites and permitting sites. Indirect impacts could include interruptions to traffic control systems or other infrastructure.

The FBI Internet Crime Reports on the victims of cyber-attack by age group. While the number of cyber-attack complaints is comparable across age groups, the losses increase significantly as the age group increases, with individuals 60 years and older experiencing greatest losses. This is likely due to seniors being less aware of cyberthreats, lack the tools to identify cyberthreats, and ”Grandparent Scams”, which is a cyber-attack where criminals impersonate a loved one in need, such as a grandchild, and ask for money. Figure 4-12 displays the breakdown of victims by age group in 2021.

Figure 4-12 Victims of Cyber-Attacks by Age Group in 2021



Source: The FBI Internet Crime Report 2021

Property

Most cyber-attacks affect only data and computer systems and have minimal impact on general property. However, sophisticated attacks have occurred against the SCADA systems of critical infrastructure, which could potentially result in system failures on a scale equal to natural disasters. Facilities and infrastructure such as the electrical grid could become unusable. A cyber-attack took down the power grid in Ukraine in 2015, leaving over 230,000 people without power. A ransomware attack on the Colonial Pipeline in 2021 caused temporary gas shortages for the East Coast. The 2003 Northeast Blackout, while not the result of a cyber-attack, caused 11 deaths and an estimated $6 billion in economic loss.

Critical Facilities and Infrastructure

The delivery of services can be impacted since governments rely to a great extent upon electronic delivery of services. Most agencies rely on server backups, electronic backups, and remote options for Continuity

of Operations/Continuity of Government. Access to documents on the network, OneDrive access, and other operations that require collaboration across the County will be significantly impacted.

Cyber-attacks can interfere with emergency response communications, access to mobile data terminals, and access to critical pre-plans and response documents. According to the Cyber & Infrastructure Security Agency, cyber risks to 9-1-1 systems can have "severe impacts, including loss of life or property; job disruption for affected network users; and financial costs for the misuse of data and subsequent resolution." CISA also compiled a recent list of attacks on 9-1-1 systems including a DDoS in Arizona, unauthorized access with stolen credentials in Canada, a network outage in New York, and a ransomware attack in Baltimore.

Public confidence in the government will likely suffer if systems such as permitting, DMV, voting, or public websites are down for a prolonged amount of time. An attack could raise questions regarding the security of using electronic systems for government services.

Economy

Data breaches and subsequent identity thefts can have huge impacts on the public. The Internet Crime Complaint Center (IC3) estimates that identity theft alone resulted in $2.7 billion in losses to businesses and $149 million in losses to individuals. The FBI Internet Crime Report 2021 reported losses in Colorado due to cyber-attacks totaled $130,631,286 in 2021 alone.

Economic impacts from a cyber-attack can be debilitating. The cyber-attack in 2018 that took down the City of Atlanta cost at least $2.5 million in contractor costs and an estimated $9.5 million additional funds to bring everything back online. The attack in Atlanta took more than a third of the 424 software programs offline and recovery lasted more than 6 months. The 2018 cyber-attack on the CDOT cost an estimated $1.5 million. None of these statistics consider the economic losses to businesses and ongoing IT configuration to mitigate from a future cyber-attack.

Historic, Cultural, and Natural Resources

Most cyber incidents have little to no impact on historic, cultural, or natural resources. A major cyber terrorism attack could potentially impact the environment by triggering a release of a hazardous materials, or by causing an accident involving hazardous materials by disrupting traffic control devices.

4.5.8 Development Trends

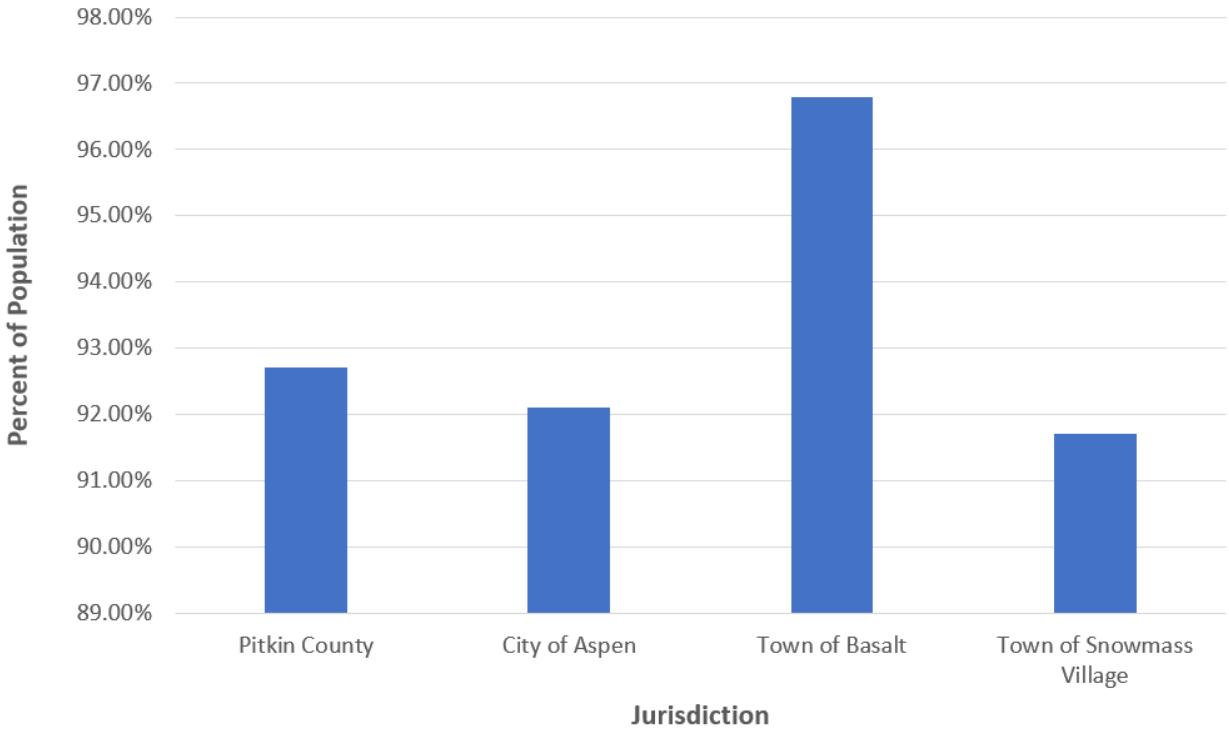
Cyber-attacks can and have targeted small and large jurisdictions, multi-billion-dollar companies, small mom-and-pop shops, and individual citizens. The decentralized nature of the internet and data centers means that the cyber threat is shared by all, regardless of new construction and changes in development.

Changes in development have little direct impact on the threat, vulnerability, and consequences of a cyber-attack. However, as more systems become more reliant on technology, this will likely increase the community's vulnerability. For example, a cyber-attack on self-driving vehicles could be a mass casualty event.

4.5.9 Differences by Jurisdiction

All jurisdictions in the planning area are vulnerable to cyber-attack. Nearly all businesses, governments, and organizations use computers to store and communicate information that can be hacked by criminals online. A significant portion of the population in all jurisdictions have access to the internet, making them vulnerable to hackers. Being connected to the internet provides cyber criminals with a means to access, alter, and monitor information on that device. In Pitkin County, 92.7% of households have access to broadband internet. In the City of Aspen, this is 92.1%, 96.8% for the Town of Basalt, and 91.7% for the Town of Snowmass Village. Based on this information, a vast majority of the population in Pitkin County is vulnerable to cyber-attack, with the largest portion of at-risk households in the Town of Basalt. Figure 4-13 displays the portion of households with internet access in each jurisdiction in the planning area.

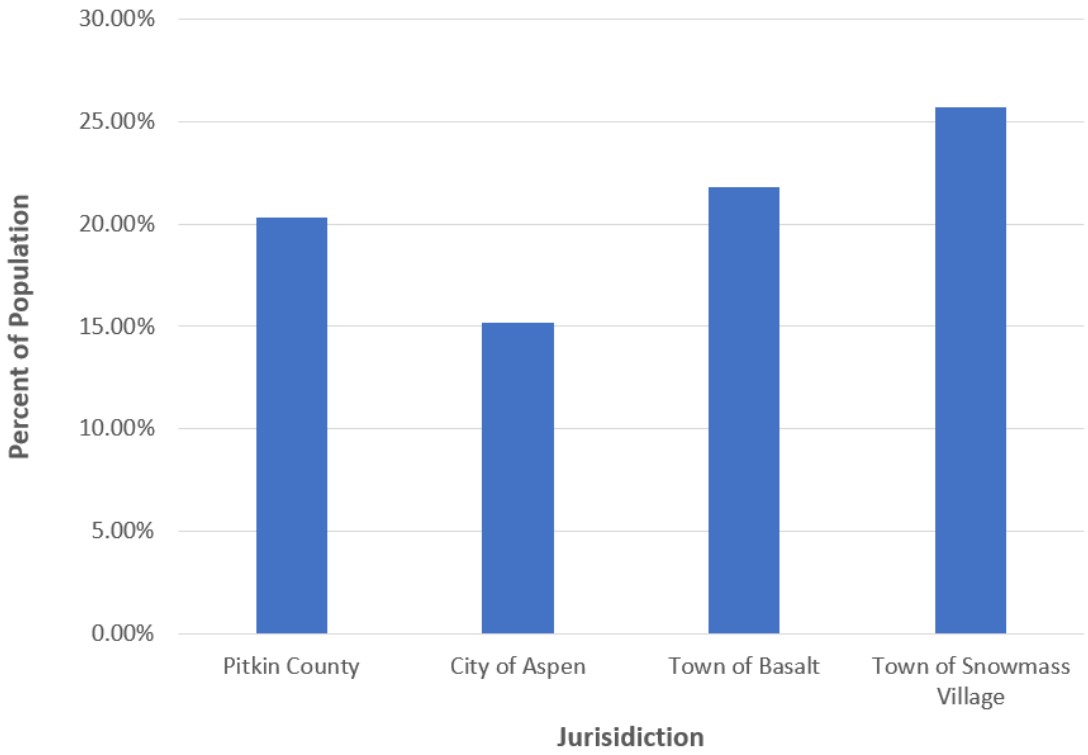
Figure 4-13 Portion of Households with Internet Access



Source: Data from U.S. Census Bureau 2020, Image Created by WSP

As discussed above, some groups or people and types of organizations are more likely to experience greater losses from cyber-attacks. The FBI Internet Crime Report found that the elder population, typically those over 65 years of age, have been found to experience a comparable number of cyber-attacks, but experience significantly greater monetary losses from these attacks than people in other age groups. The 2020 U.S. Census Bureau found that 20.3% of the population in Pitkin County is in this vulnerable age group of 65+ years. In comparison, 15.2% of the City of Aspens population is 65+, 21.8% in the Town of Basalt, and 25.7% in Snowmass Village. Based on these statistics, Snowmass Village has the largest portion of their population likely to experience greatest losses in comparison with other jurisdictions in the county. Figure 4-14 displays the difference in portion of the population 65+ years by jurisdictions in the planning area.

Figure 4-14 Portion of the Population 65+ Years (2020)



Source: Data from U.S. Census Bureau 2020, Image Created by WSP

Local governments have become an increasing target for cyber-attacks. Sensitive information regarding personal and political data can be accessed by criminals if government servers are compromised. Additionally, there has been an increasing trend in cyber-attacks against public services, such as hospitals, police stations, and fire departments. While the Aspen Fire Protection District and Roaring Fork Fire Rescue are less likely to experience frequent cyber-attacks, it is possible that cyber criminals could attack these jurisdictions to interfere with dispatch communications.

4.5.10 Risk Summary

- The risk of cyber-attack in the planning area ranges from medium to high significance
- Cyber-attacks can occur anywhere and on any computer network, therefore, this hazard is rated as “extensive” location
- There is an increasing trend in the number of cyber-attacks in the U.S. each year. The probability of future occurrence is therefore rated as “likely”
- People ages 65+ are the most likely age group to experience greatest monetary losses, although anyone of any age can be victim to a cyber-attack
- Small business worth less than $10 million and local governments are increasingly becoming targets for cyber-attack, with criminals assuming these smaller organizations will lack the resources to prevent an attack
- The potential magnitude of cyber-attacks is rated as “moderate”. Critical infrastructure such as electronic communication and energy networks can be interrupted by cyber-attacks

4.6 Dam Inundation

DAM INUNDATION	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Limited	Critical	Unlikely	**Low**
Aspen	Limited	Critical	Unlikely	**Low**
Basalt	Significant	Critical	Unlikely	**Medium**
Snowmass Village	Limited	Critical	Unlikely	**Low**
Aspen Fire	Limited	Critical	Unlikely	**Low**
Roaring Fork Fire	Limited	Critical	Unlikely	**Low**

4.6.1 Description

A dam is a barrier constructed across a watercourse that stores, controls, or diverts water. Dams are constructed for a variety of uses, including flood protection, power, agriculture/irrigation, water supply, and recreation. Dams typically are built of earth, rock, concrete, or mine tailings. The water impounded behind a dam is referred to as the reservoir and is usually measured in acre-feet, with one acre-foot being the volume of water that covers one acre of land to a depth of one foot. Depending on local topography, even a small dam may have a reservoir containing many acre-feet of water.

Causes of Dam Failure

Dam failures in the United States typically occur in one of four ways:

- Overtopping of the primary dam structure, which accounts for 34% of all dam failures, can occur due to inadequate spillway design, settlement of the dam crest, blockage of spillways, and other factors.
- Foundation defects due to differential settlement, slides, slope instability, uplift pressures, and foundation seepage can also cause dam failure. These account for 30% of all dam failures.
- Failure due to piping and seepage accounts for 20% of all failures. These are caused by internal erosion due to piping and seepage, erosion along hydraulic structures such as spillways, erosion due to animal burrows, and cracks in the dam structure.
- Failure due to problems with conduits and valves, typically caused by the piping of embankment material into conduits through joints or cracks, constitutes 10% of all failures.

The remaining 6% of U.S. dam failures are due to miscellaneous causes. Many dam failures in the United States have been secondary results of other disasters. The prominent causes are earthquakes, landslides, extreme storms, massive snowmelt, equipment malfunction, structural damage, foundation failures, and sabotage.

Poor construction, lack of maintenance and repair, and deficient operational procedures are preventable or correctable by a program of regular inspections. Terrorism and vandalism are serious concerns that all operators of public facilities must plan for; these threats are under continuous review by public safety agencies.

Non-Failure Flooding

Dam inundation can also occur from non-failure events or incidents such as when outlet releases increase during periods of heavy rains or high inflows. Controlled releases to allow water to escape when a reservoir is overfilling can help prevent future overtopping or failure. When outlet releases are not enough, spillways are designed to allow excess water to exit the reservoir and prevent overtopping. This protects the dam from risk of damage or failure but can still result in flooding downstream.

Dam safety incidents are defined as situations at dams that require an immediate response by dam safety engineers.

The Colorado DNR has a statewide database that identifies the potential for non-failure dam inundation to show potential areas of flooding where outlet capacity exceeds the downstream channel capacity. The dams at the highest risk of non-failure inundation are shown in Table 4-14. The ranking shown in the table represents the likelihood of hazardous conditions existing below the dams during a worst-case, maximum

outlet release scenario. Dams are ranked as high, moderate, or low likelihood for outlet releases to cause conditions that could require an emergency response to reduce potential downstream consequences. Should there be a need to relieve pressure on the dam (e.g., if there was excess inflow from high rains or snowmelt) releases from the dams ranked as high or moderate may result in downstream flooding.

Table 4-14 Dams with Risk of Non-Failure Flooding

DAM NAME	DAM ID	OUTLET DESCRIPTION	MAX OUTLET RELEASE CAPACITY (CFS)	COMPOSITE RANKING	OUTLET RELEASE RANKING
Ruedi	380136	11' Tunnel, 76" SP, 5X6' Tunnel	7,350	128	High
Grizzly	380109	4'X 4'RCB	550	367	High
Wildcat	380133	24" DIP	53	198	Moderate
Lake Deborah	380222	18" CONC. Encased HDPE	28.2	236	Moderate
Lake Ann	380117	12" VCP (original) 14 PVC replacement in 2011	9	322	Low

Source: Colorado Division of Water Resources, Dam Safety

Low Head Dams

A low head dam is an engineered structure built into and across stream and river channels. Low head dams were historically built for a variety of purposes to support industrial, municipal, and agricultural water usage through the diversion of water from streams. Low head dams have also been built to provide recreational amenities for boating, rafting, and tubing as well as improve aquatic habitats (Colorado DNR). Water flows over the dams creating a recirculating current that can trap unknowing river users. Due to the low height of this type of dam, low head dams can be difficult to see by river users that are not aware of them and because of the tranquil pool that gives the appearance there is no danger. There are several low head dams in Pitkin County, which are shown in Figure 4-16.

Regulatory Oversight

The potential for catastrophic flooding due to dam failures led to the passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure to protect the lives and property of the public.

Colorado Rules and Regulations for Dam Safety and Dam Construction

The Colorado Rules and Regulations for Dam Safety and Dam Construction (2-CCR 402-1, January 1, 2007) apply to any dam constructed or used to store water in Colorado. These rules apply to applications for review and approval of plans for the construction, alteration, modification, repair, enlargement, and removal of dams and reservoirs, quality assurance of construction, acceptance of construction, non-jurisdictional dams, safety inspections, owner responsibilities, emergency action plans, fees, and restriction of recreational facilities within reservoirs. Certain structures (defined in Rule 17) are exempt from these rules. The purpose of the rules is to provide for public safety through the Colorado Safety of Dams Program by establishing reasonable standards and creating a public record for reviewing the performance of a dam.

U.S. Army Corps of Engineers Dam Safety Program

The United States Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The USACE has inventoried dams; surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety (USACE 1997).

Federal Energy Regulatory Commission Dam Safety Program

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric

projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license

Every 5 years, an independent engineer approved by the FERC must inspect and evaluate projects with dams higher than 32.8 feet (10 meters) or with a total storage capacity of more than 2,000 acre-feet.

FERC monitors and evaluates seismic research and applies it in investigating and performing structural analyses of hydroelectric projects. FERC also evaluates the effects of potential and actual large floods on the safety of dams. During and following floods, FERC visits dams and licensed projects, determines the extent of damage, if any, and directs any necessary studies or remedial measures the licensee must undertake. The FERC publication Engineering Guidelines for the Evaluation of Hydropower Projects guides the FERC engineering staff and licensees in evaluating dam safety. The publication is frequently revised to reflect current information and methodologies.

FERC requires licensees to prepare emergency action plans and conducts training sessions on how to develop and test these plans. The plans outline an early warning system if there is an actual or potential sudden release of water from a dam due to failure. The plans include operational procedures that may be used, such as reducing reservoir levels and reducing downstream flows, as well as procedures for notifying affected residents and agencies responsible for emergency management. These plans are frequently updated and tested to ensure that everyone knows what to do in emergency situations.

4.6.2 Past Events

There is no record of dam failures or incidents in Pitkin County.

Colorado does have a history of dam failure, with more than 130 known dam failures since 1890. According to the Association of State Dam Safety Officials, there have been 14 dam failures and 55 non-failure dam incidents in Colorado in the last 100 years.

4.6.3 Location

Data from the Colorado Division of Water Resources (CDWR) Dam Safety Branch lists 69 dams in Pitkin County. CDWR classifies dams based on the potential hazard to the downstream area resulting from failure or mis-operation of the dam or facilities:

- **High Hazard Potential**: Probable loss of life (one or more).
- **Significant Hazard Potential:** No probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns; often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **Low Hazard Potential:** No probable loss of human life and low economic or environmental losses; losses are principally limited to the owner's property.

It is important to keep in mind that the hazard classification of a dam is a measure of the consequences if the dam were to fail, not a measure of how likely the dam is to fail.

Based on these classifications, there are six high hazard potential dams and seven significant hazard potential dams in Pitkin County. There are also one high hazard potential dam and one significant hazard potential dam in Eagle County that would inundate certain areas of Pitkin County if they were to breach. These dams are listed in Table 4-15 with their associated stream, downstream town, the distance to town, the normal storage capability of the dam, its hazard classification, and the date of their Emergency Action Plan as listed with CDWR.

Table 4-15 High and Significant Hazard Potential Dams in Pitkin County

NAME	STREAM	DOWNSTREAM TOWN	TOWN DISTANCE (MILES)	NORMAL STORAGE (ACRE-FEET)	HAZARD CLASS	DATE OF EAP
Grizzly	Lincoln Creek	Aspen	18	590	High	9/4/2020
Lake Ann	West Sopris Creek	El Jebel	8	460	High	12/28/2015
Lake Deborah	Brush Creek	Snowmass Village	0.4	248	High	3/5/2019
Ruedi	Fryingpan River	Basalt	12	102,369	High	7/1/2011
Saddle Pond	Trentaz Gulch	Woody Creek	3	31	High	1/7/2022
Wildcat	Wildcat Creek	Basalt	6	1,100	High	7/22/2020
Christenson	Snowmass Creek	Old Snowmass	5	13	Significant	- (EAP Not Prepared)
Ivanhoe	Ivanhoe Creek	Thomasville	16	752	Significant	10/2/2017
Lazy O Reservoir No 2	Capital Creek	Snowmass	3	16	Significant	10/12/2004
Leonard Thomas Reservoir	Castle Creek	Aspen	3	10	Significant	8/30/2016
Sheer Bliss	NA	Snowmass Village	2	11	Significant	10/12/2016
Thomas	Thomas Creek	Carbondale	3	172	Significant	4/20/2012
Valana K Reservoir No. 1	East Sopris	Basalt	3	10	Significant	5/7/2020
Spring Park	Blue Creek	El Jebel	3	1,732	High	3/15/2021
Lake Christine	Lucksinger Creek	Basalt	0	27	Significant	12/1/2010

Source: CDWR, Dam Safety

Ruedi Reservoir is the second newest high hazard dam in the county, which was built in 1968, with Saddle Pond being the newest high hazard dam, which was built in 1988. Ruedi Reservoir is by far and has always been the largest reservoir at over 100,000 acre-feet (the next largest high hazard dam is Wildcat at 1,100 acre-feet). The oldest high hazard dam, Lake Ann, is over 100 years old and was built in 1912.

As of July 2022, the State Engineer has rated Christenson, Valana K Reservoir No.1 and Lake Christine dams as unsatisfactory, meaning they have storage restrictions due to structural concerns. Six other dams are rated as conditionally satisfactory, although they are currently granted conditional full storage.

There is an uncounted number of 'non-jurisdictional' dams on public and private lands in the county. These are small dams that normally do not store water but may impound water during heavy precipitation events. Because they are not monitored or maintained, there is potential for them to overtop or fail and cause flooding and property damage during a significant rainfall event. The extent and risk associated with these dams is not known.

The areas of the county most likely to be impacted by a dam failure are along streams and waterways in general. Four high and two significant hazard potential dams could impact the Towns of Aspen, Basalt and Snowmass Village.

Figure 4-15 shows the locations of dams throughout Pitkin County and the adjacent counties with the potential inundation from dam incidents. Dam inundation areas were provided by the CDWR and include narrow portions along streams in Basalt, Snowmass Village and Aspen. Figure 4-16 shows the location of low head dams discussed in Section 4.6.1.

4.6.4 Magnitude and Severity

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property located in the inundation area downstream. As noted above, dams are classified as high hazard potential if failure is likely to result in loss of life, or significant hazard potential if failure is likely to cause property damage, economic loss, environmental damage, or disruption of lifeline facilities.

There are no dam failure events of record for Pitkin County with sufficiently detailed profiles to allows for a specific discussion on the severity and magnitude of such events. However, the rating system utilized in dam classification is a useful measurement for assessing the potential magnitude and severity of a dam failure. In addition, all high hazard dams in Colorado are required to have emergency action plans (EAPs) that include predicted inundation maps for dam failure scenarios. These tools allow planners to measure the estimated worst-case or event-of-record occurrences for a dam failure.

There have been no recorded occurrences of significant dam failures in Pitkin County in the past 80 years. According to the National Performance of Dams Program Database from Stanford University, there have been two non-failure dam incidents with high and significant hazard dams in Pitkin County. A seepage event happened with the Ruedi Dam on August 18, 1998, while an inflow flood – hydrological event happened with the Thomas dam on May 1, 1973.

Dam failure flooding, similar to the earthquake hazard, is a low-risk/high-consequence hazard. Although the likelihood of a partial or complete failure of a high or significant hazard potential dam in Pitkin County is very low, if an incident did occur, local officials would be faced with an immediate threat to lives and potentially widespread property damages.

Two factors that influence the potential severity of a full or partial dam failure are the amount of water impounded and the density, type, and value of development and infrastructure located downstream. Dam failure floods result from a sudden uncontrolled release, or excessive controlled release, of water from an impounding structure. The release may be caused by damage to or failure of the structure, flood conditions unrelated to failure, or any condition that may affect the safe operation of the dam. Depending on dam conditions and the location of downstream development, a dam failure flood may present a danger to human life, downstream property, or the operation of the structure.

Figure 4-15 Dams in and Near Pitkin County

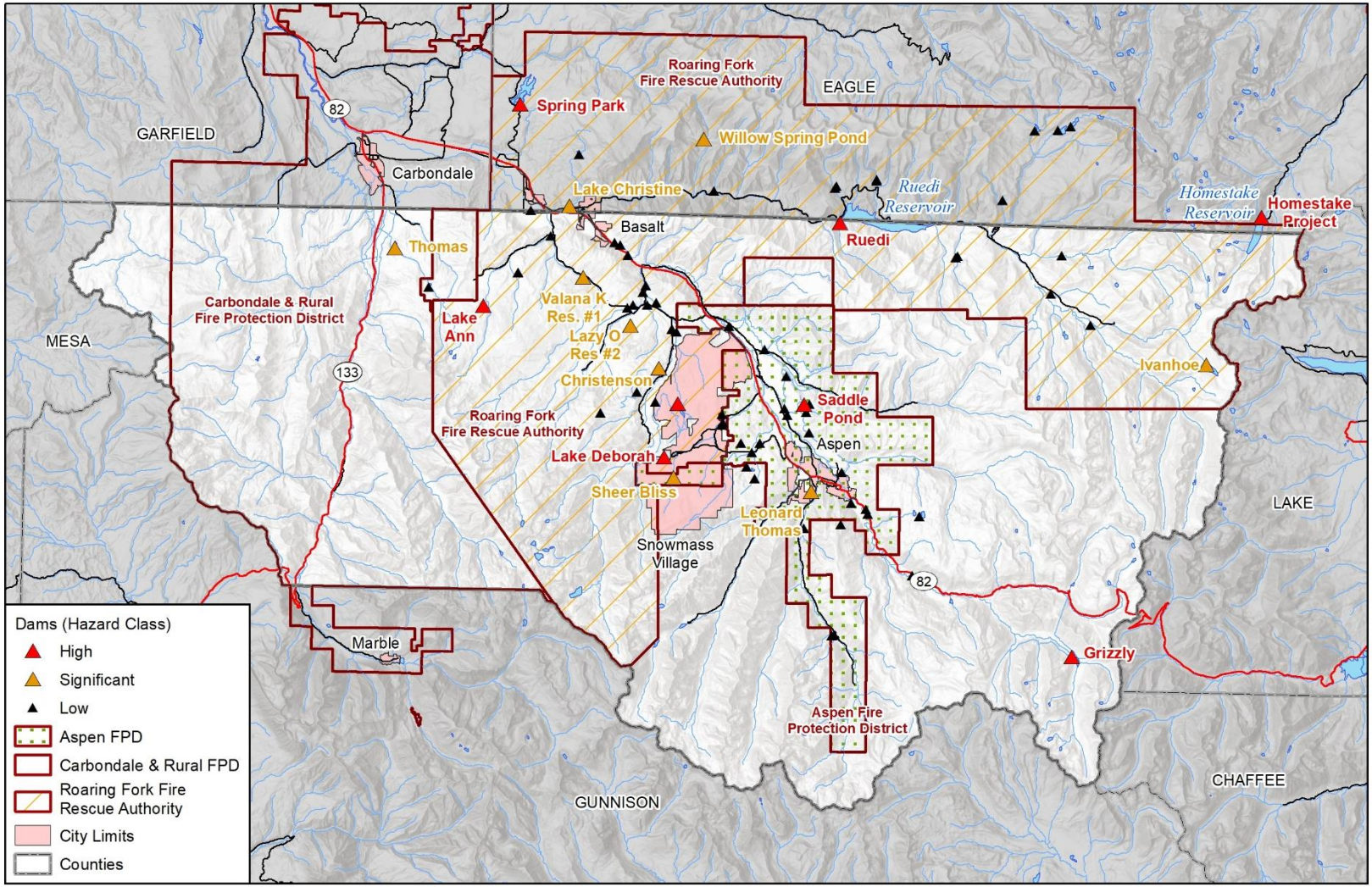
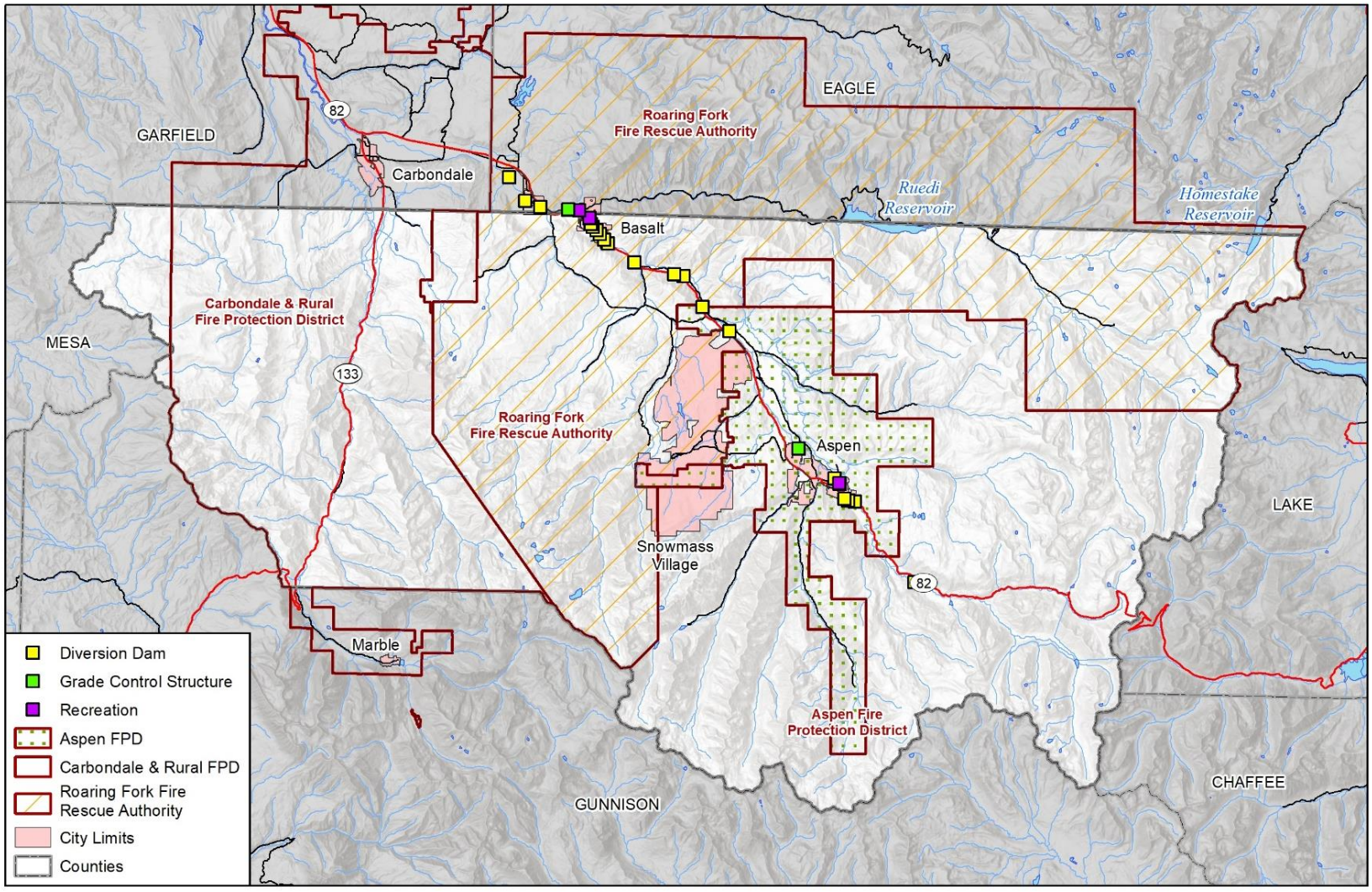


Figure 4-16 Low Head Dams in Pitkin County



4.6.5 Probability of Future Events

Dams are considered “high potential loss facilities” by the Department of Homeland Security and FEMA and are also a critical part of the infrastructure system. The high and significant hazard potential dams listed in the tables above are routinely inspected, structurally sound and have EAPs in place, although Christenson, Valana K Reservoir No.1 and Lake Christine dams are currently determined to be unsatisfactory and then have restrictions on storage/operation. However, the storage capacities of these three dams are relatively small (10 – 20 acre-feet).

Warning time for dam failure varies depending on the cause of the failure. In events of extreme precipitation or massive snowmelt, evacuations can be planned with sufficient time. In the event of a structural failure due to an earthquake, there may be no warning time. A dam’s structural type also affects warning time. Earthen dams do not tend to fail completely or instantaneously. Once a breach is initiated discharging water erodes the breach until either the reservoir water is depleted, or the breach resists further erosion. Concrete gravity dams also tend to have a partial breach as one or more monolith sections are forced apart by escaping water. The time of breach formation ranges from a few minutes to a few hours.

The probability of future occurrences is unlikely. There have been no dam failures recorded in Pitkin County, and only two reported non-failure incidents over an 80-year period. This results in an approximate 2.5% chance of a dam incident in any given year. Therefore, the probability of a failure or incident in the future is minimal.

4.6.6 Climate Change Consideration

The potential for climate change to affect the likelihood of dam failure has been incorporated into the 2020 Rules and Regulations for Dam Safety and Dam Construction. The climate change-related Rule is based on a state-of-the-practice regional extreme precipitation study completed in 2018 (DWR, 2018). This study determined a very high likelihood of temperature increases, resulting in increased moisture availability to extreme storms. As such, an atmospheric moisture factor of 7% is required to be added to estimates of extreme rainfall for spillway design.

With a potential for increases in extreme precipitation events due to climate change, dam failure and dam incidents could become a larger issue if increased rainfall events result in large floods that stress dam infrastructure. Dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams have historically experienced increases in stream flows from earlier dam releases.

4.6.7 Vulnerability Assessment

While dam failures are unlikely, a major failure could have severe consequences. Structures, aboveground infrastructure, critical facilities, and natural environments are all vulnerable to dam failure. Roads closed due to dam failure floods could result in serious transportation disruptions due to the limited number of roads in the county. Information for the exposure analysis provided in the sections below is based on dam inundation data provided by the state.

The most significant issue associated with dam failure involves the properties and populations in the inundation areas. Flooding as a result of a dam failure would significantly impact these areas. There is often limited warning time for dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard.

People

The population impacted by dam failure was estimated using the structure count of buildings within the dam inundation area and applying the U.S. Census value of 1.97, 2.25, 2.22, 2.35 persons per household for Aspen, Basalt, Snowmass Village, and the unincorporated County, respectively. Dam inundation areas include narrow portions along streams in Basalt, Snowmass Village and Aspen. Based on GIS spatial analysis carried out, approximately 3,238 people are exposed within the dam inundation areas in the planning area.

Vulnerable populations are all populations downstream from dam failures that are incapable of escaping the area within the allowable timeframe. This population includes the elderly and young who may be unable to get themselves out of the inundation area. The vulnerable population also includes those who would not have an adequate warning from a television or radio emergency warning system.

Property

Vulnerable properties are those within and close to the dam inundation area. These properties would experience the largest, most destructive surge of water. Low-lying areas are also vulnerable since they are where the dam waters would collect.

Communities located below a high or significant hazard dam and along a waterway are potentially exposed to the impacts of a dam failure. High hazard potential dams threaten lives and property, while significant hazard potential dams threaten property only. Inundation maps that identify anticipated flooded areas (which may not coincide with known floodplains) are produced for many high hazard potential dams. Six of the high or significant hazard dams contained dam inundation extents in a spatial form that were analyzed to quantify risk across the planning area. Table 4-16 shows the number and values of parcels and structures for overlapping inundation layers for dams with a potential to impact the planning area. Total building exposure numbers were based on 2022 county assessor data.

The analysis shows that of 1,711 buildings at risk, roughly a third (614) are located in the Town of Basalt, another third (514) in the City of Aspen, with the remainder distributed between the unincorporated County (307) and Snowmass Village (208). However, 57% of the total value at risk is found in the City of Aspen.

A breakdown of risk by individual dams can be found in Appendix H.

Table 4-16 Pitkin County Structures Within Dam Inundation Areas, By Jurisdiction and Property Types

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	POPULATION
Aspen	Commercial	30	30	$14,113,800	$14,113,800	$28,227,600	
	Exempt	10	10	$6,632,200	$6,632,200	$13,264,400	
	Residential	462	474	$1,185,958,500	$592,979,250	$1,778,937,750	934
	Total	**502**	**514**	**$1,206,704,500**	**$613,725,250**	**$1,820,429,750**	**934**
Basalt	Commercial	121	124	$58,937,920	$58,937,920	$117,875,840	
	Exempt	6	6	$7,407,900	$7,407,900	$14,815,800	
	Industrial	1	1	$1,152,100	$1,152,100	$2,304,200	
	Mixed Use	9	9	$6,813,000	$6,813,000	$13,626,000	20
	Residential	455	473	$322,299,390	$161,149,695	$483,449,085	1,069
	Vacant	1	1	$321,900	$321,900	$643,800	
	Total	**593**	**614**	**$396,932,210**	**$235,782,515**	**$632,714,725**	**1,089**
Snowmass Village	Commercial	5	16	$5,761,800	$5,761,800	$11,523,600	
	Exempt	8	9	$3,503,100	$3,503,100	$7,006,200	

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	POPULATION
	Mixed Use	2	2	$3,964,000	$3,964,000	$7,928,000	4
	Residential	179	181	$211,403,600	$105,701,800	$317,105,400	402
	Total	**194**	**208**	**$224,632,500**	**$118,930,700**	**$343,563,200**	**406**
Unincorporated	Agricultural	11	15	$6,288,100	$6,288,100	$12,576,200	
	Commercial	3	4	$295,400	$295,400	$590,800	
	Exempt	4	11	$3,884,000	$3,884,000	$7,768,000	
	Mixed Use	2	3	$782,100	$782,100	$1,564,200	7
	Residential	286	341	$251,571,500	$125,785,750	$377,357,250	801
	Vacant	1	1	$48,500	$48,500	$97,000	
	Total	**307**	**375**	**$262,869,600**	**$137,083,850**	**$399,953,450**	**808**
	Grand Total	**1,596**	**1,711**	**$2,091,138,810**	**$1,105,522,315**	**$3,196,661,125**	**3,238**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, DWR Dam Safety, WSP GIS Analysis

Critical Facilities and Infrastructure

A total dam failure can cause catastrophic impacts to areas downstream of the water body, including critical infrastructure. Any critical asset located under the dam in an inundation area would be susceptible to the impacts of a dam failure. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. Roads closed due to floods caused by dam failure or incident could result in serious transportation disruptions due to the limited number of roads in the county. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. The loss of these utilities could create additional isolation issues for the inundation areas.

Based on the critical facility inventory considered in the updating of this plan and intersected with the dam inundation extents available, 31 critical facilities were found to be at risk. These at-risk facilities are listed in Table 4-17 by jurisdiction and lifeline category. As noted in Section 4.2.3, some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns.

Table 4-17 Critical Facilities at Risk to Dam Inundation by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	1	2	-	-	3	**3**
Energy	-	-	-	-	-	-	**-**
Food, Water, Shelter	1	-	1	-	1	1	**2**
Hazardous Material	-	1	-	-	-	-	**1**
Health and Medical	-	-	-	-	-	1	**1**
Safety and Security	-	1	2	2	2	3	**5**
Transportation	3	3	1	12	5	14	**19**
Total	**4**	**6**	**6**	**14**	**8**	**22**	**31**

Source: Pitkin County, CO Dam Safety, CEPC, HIFLD, NBI, RFFR

Impacts to transportation corridors and communications lines resulting from a dam incident could affect first responders' ability to effectively respond. Isolated areas cutoff from the rest of the County due to transportation route impacts could make search and rescue efforts difficult. Damage to facilities/personnel in incident area may require temporary relocation of some operations. Regulatory waivers may be needed locally. Fulfillment of some contracts may be difficult. The public may question the local government's ability to respond and recover if planning, response, and recovery are not timely and effective, regardless of the dam owner.

Economy

Extensive and long-lasting economic impacts could result from a major dam failure or inundation event, including the long-term loss of water in a reservoir, which may be critical for potable water needs. A major dam failure and loss of water from a key structure could bring about direct business and industry damages and potential indirect disruption of the local economy. A dam failure can have long-lasting economic impacts and could deter visitors for a period of time.

Historic, Cultural, and Natural Resources

Reservoirs held behind dams affect many ecological aspects of a river. River topography and dynamics depend on a wide range of flows, but rivers below dams often experience long periods of very stable flow conditions or saw-tooth flow patterns caused by releases followed by no releases. Water releases from dams usually contain very little suspended sediment; this can lead to the scouring of riverbeds and banks.

The environment would be vulnerable to many risks in the event of dam failure. The inundation could introduce many foreign elements into local waterways, potentially destroying downstream habitats.

4.6.8 Development Trends

The vulnerability to dam failure could increase if development occurs in inundation areas downstream of dams. Often these inundation areas are not shown on plat or planning maps or NFIP maps and thus are not regulated. This type of development can change the designation of a dam from low to high hazard. Guiding future land use and growth through the county and municipal comprehensive plans and zoning ordinances may help reduce future risk and exposure. Flood-related policies in the comprehensive plans will help reduce the risk associated with the dam failure hazard for all future development in the planning area.

4.6.9 Differences by Jurisdictions

Aspen has the highest total value in improved parcels that are exposed to potential dam failure incidents – over $1.8 billion, followed by Basalt's $632 million. Basalt, on the other hand, has the highest total population that is at risk of potential dam failure incidents – 1,089 people, followed by Aspen's 934 people. However, for Basalt this represents a more significant percentage of the Town as a whole.

4.6.10 Risk Summary

- The overall significance of this hazard is Medium for Basalt and Low for the rest of the County.
- While an incident or failure is a low probability, the presence of seven high hazard potential and eight significant hazard potential dams in Pitkin County and Eagle County do pose a risk.
- Approximately 3,238 people are exposed within the dam inundation areas in the County.
- Approximately 1,711 buildings are exposed within the dam inundation areas in the County, along with 31 critical facilities.
- A dam failure and loss of water from a critical reservoir or structure could include direct and indirect business and industry damages or disruption of the local economy and key county resources (e.g., potable water).
- Related hazards: Flooding, Earthquake, Landslide

4.7 DROUGHT

DROUGHT	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Extensive	Limited	Likely	**High**
Aspen	Extensive	Limited	Likely	**High**
Basalt	Extensive	Limited	Likely	**High**
Snowmass Village	Extensive	Limited	Likely	**High**
Aspen Fire	Extensive	Limited	Likely	**High**
Roaring Fork Fire	Extensive	Limited	Likely	**High**

4.7.1 Description

Drought is a normal phase in the climatic cycle of most geographical areas, including Colorado due to its semiarid climate. According to the National Drought Mitigation Center (NDMC), drought originates from a deficiency of precipitation over an extended period, usually a season or more. This results in a water shortage for some activity, group, or environmental sector. Drought is the result of a significant decrease in water supply relative to what is "normal" in a given location. Unlike most disasters, droughts normally occur slowly but last a long time. According to the 2018 Colorado Drought Mitigation and Response Plan, "Drought is a complex and a gradual phenomenon in Colorado. Although droughts can be characterized as emergencies, they differ from other emergency events in that most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts typically occur slowly, over a multi- year period, and it is often not obvious or easy to quantify when a drought begins and ends."

Drought is defined as a period of time where the amount of water available is insufficient to meet the demands on that water supply. Scientists and researchers also distinguish between the different types of droughts:

- Meteorological drought is usually defined by a period of below average precipitation.
- Agricultural drought occurs when there is an inadequate water supply to meet the needs of agricultural operations, based on soil moisture deficiencies relative to water demands of crops and rangeland.
- Hydrologic drought refers to deficiencies in surface and subsurface water supplies and is measured as streamflow, snowpack, reservoir, and groundwater levels.
- Socioeconomic drought occurs when a drought impacts health, well-being, and quality of life, or when drought effects start to have an adverse economic impact on a region.

There are also distinctions between drought mitigation planning and water conservation planning:

- Drought mitigation planning identifies temporary responses to potential water supply shortages, such as mandatory restrictions on certain water uses, water allocation or the temporary use of an alternative water supply. These measures are intended to be temporary responses to water supply shortages
- Water conservation planning involves long-term improvements in water use efficiency, such as managing landscape irrigation, implementing conservation water rate structures, and replacing or retrofitting water fixtures.

Droughts originate from a deficiency of precipitation resulting from an unusual weather pattern. If the weather pattern lasts a short time (a few weeks or a couple months), the drought is considered short-term. If the weather pattern becomes entrenched and the precipitation deficits last for several months or years, the drought is considered to be long-term. It is possible for a region to experience a long-term circulation pattern that produces drought, and to have short-term changes in this long-term pattern that result in short-term wet spells. Likewise, it is possible for a long-term wet circulation pattern to be interrupted by short-term weather spells that result in short-term drought.

Precipitation, as snowmelt runoff, is the main source of Colorado's water supply. Annual precipitation in Aspen is approximately 14.8 inches per year. According to the 2018 Colorado State Drought Mitigation and Response Plan, there are no major rivers that flow into Colorado (McKee et al. 1999). There are several major river basins originating in the Colorado Rockies, which flow out of the state, providing water to much

of the southwestern United States, and contributing to the Missouri and Mississippi Rivers as well. Thus, Colorado earns its title as "the Mother of Rivers" (CWCB 2013). This supply is stored in five forms throughout the state: snowpack, streamflow, reservoir water, soil moisture, and groundwater (McKee and others 2000).

Droughts are climatic patterns that occur over long periods of time. Only generalized warnings can take place due to the numerous variables that affect drought conditions. Scientists do not currently know how to predict drought more than a month in advance for most locations, with predictions relying on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale. Although the ability to predict drought in advance is limited, drought conditions can be monitored through these variables, and the slow-onset nature of drought allows ample time to issue warnings and water restrictions if needed as drought severity increases.

4.7.2 Past Events

Colorado has experienced multiple severe droughts. According to the 2018 Colorado Drought Mitigation and Response Plan, Colorado has experience drought in 2020, 2018, 2011-2013, 2006-2004, 1996, 1994, 1990, 1989, 1975-1979, 1963-1965, 1951-1957, 1931-1941, and 1893-1905. The most significant are listed in Table 4-18. Although drought conditions can vary greatly across the state, it is likely that Pitkin County was affected to some degree by each of these dry periods.

Table 4-18 Historic Dry and Wet Periods in Colorado

DATE	DRY	WET	DURATION (YEARS)
1893-1905	X		12
1905-1931		X	26
1931-1941	X		10
1941-1951		X	10
1951-1957	X		6
1957-1959		X	2
1963-1965	X		2
1965-1975		X	10
1975-1978	X		3
1979-1999*		X	20
2000-2006*	X		6
2007-2010*		X	3
2011-2013*	X		2
2018-2020**	X		3

Source: McKee, et al. 1999
*Modified for 2018 State of Colorado Drought Mitigation and Response Plan Update based on input from the Colorado Climate Center
**Modified for 2023 Pitkin County HMP update

The most intense single year of drought in state history occurred in 2002, an extremely dry year imbedded in an extended dry period between 2000 and 2006. Drought conditions in 2002 resembled those of 1934, the worst of the Dust Bowl years between 1931 and 1941. The magnitude of drought conditions in 2002 was rated as "exceptional" by the U.S. Drought Monitor, making 2002 the most severe drought in the state since the 1930s. In Colorado, snowpack statewide on April 1, 2002, measured just 52% of normal. The lack of snow resulted in major adverse impacts to the ski industry and tourism in Pitkin County, which spilled over into the summer of 2002 with river levels too low for rafting and fishing and fire bans that kept campers and other recreationists away. Pitkin County was part of a statewide drought declaration that year, approved by USDA based on the Governor's request, which cited an estimated $1.1 billion in losses to Colorado's agricultural, tourism and recreational industries.

Another historic dry spell of note in Pitkin County occurred during the winter of 1976-1977, when lack of snow delayed the opening of lifts at Aspen Mountain and Buttermilk until January and, even then, conditions were very poor. That season, free soup was given out on the mall, town residents did snow dances (to no avail), and parents sent plane tickets to their ski-bum kids so they could come home.

From 2012 to 2021, Pitkin County received 17 USDA Disaster Declarations for drought.

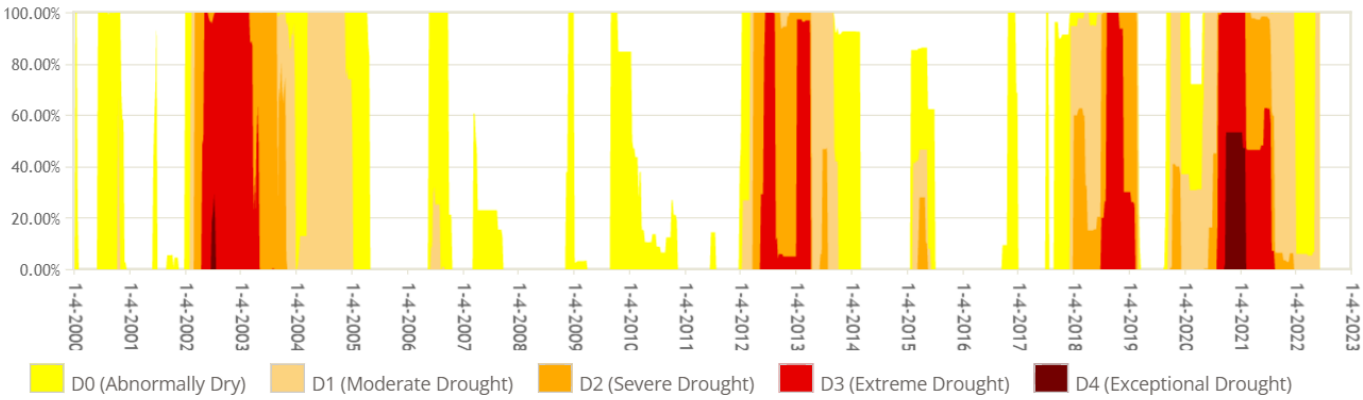
According to the U.S. Drought Monitor records for Pitkin County, in the 1,172-week period from January 1, 2000, through June 14, 2022, the county spent 740 weeks (63% of the time) in some level of drought, defined as Abnormally Dry (D0) or worse conditions. Approximately 41% of the time, or 479 weeks, was spent in Moderate Drought (D1) or worse conditions. Weeks in drought are summarized in Table 4-19 and shown in time series in Figure 4-17.

Table 4-19 Pitkin County Weeks in Drought by Intensity, 2000-2021

CATEGORY	DESCRIPTION	PALMER DROUGHT SEVERITY INDEX (PDSI)	STANDARDIZED PRECIPITATION INDEX (SPI)	PITKIN COUNTY WEEKS IN DROUGHT, 2000-2021
D0	Abnormally Dry	-1.0 to -1.9	-0.5 to -0.7	740
D1	Moderate Drought	-2.0 to -2.9	-0.8 to -1.2	479
D2	Severe Drought	-3.0 to -3.9	-1.3 to -1.5	318
D3	Extreme Drought	-4.0 to -4.9	-1.6 to -1.9	189
D4	Exceptional Drought	-5.0 or less	-2.0 or less	24

Source: U.S. Drought Monitor

Figure 4-17 Pitkin County Drought Intensity, 2000-2022



Source: U.S. Drought Monitor

The NDMC developed the Drought Impact Reporter in response to the need for a national drought impact database for the United States. Information comes from a variety of sources: online, drought-related news stories and scientific publications, members of the public who visit the website and submit a drought-related impact for their region, members of the media, and members of relevant government agencies. The database is being populated beginning with the most recent impacts and working backward in time. The Drought Impact Reporter contains information on 71 impacts from droughts that affected the entire State of Colorado and 31 impacts for Pitkin County for the 10.5-year period from January 2012 through June 2022. Table 4-20 summarizes the drought impacts reported by category and years reported for Pitkin County. Note that some impacts are assigned to more than one category. Based on these NDMC records, Pitkin County experienced impacts of drought in six of the last 10 years.

Table 4-20 Reported Drought Impacts in Pitkin County, 2012-June 2022

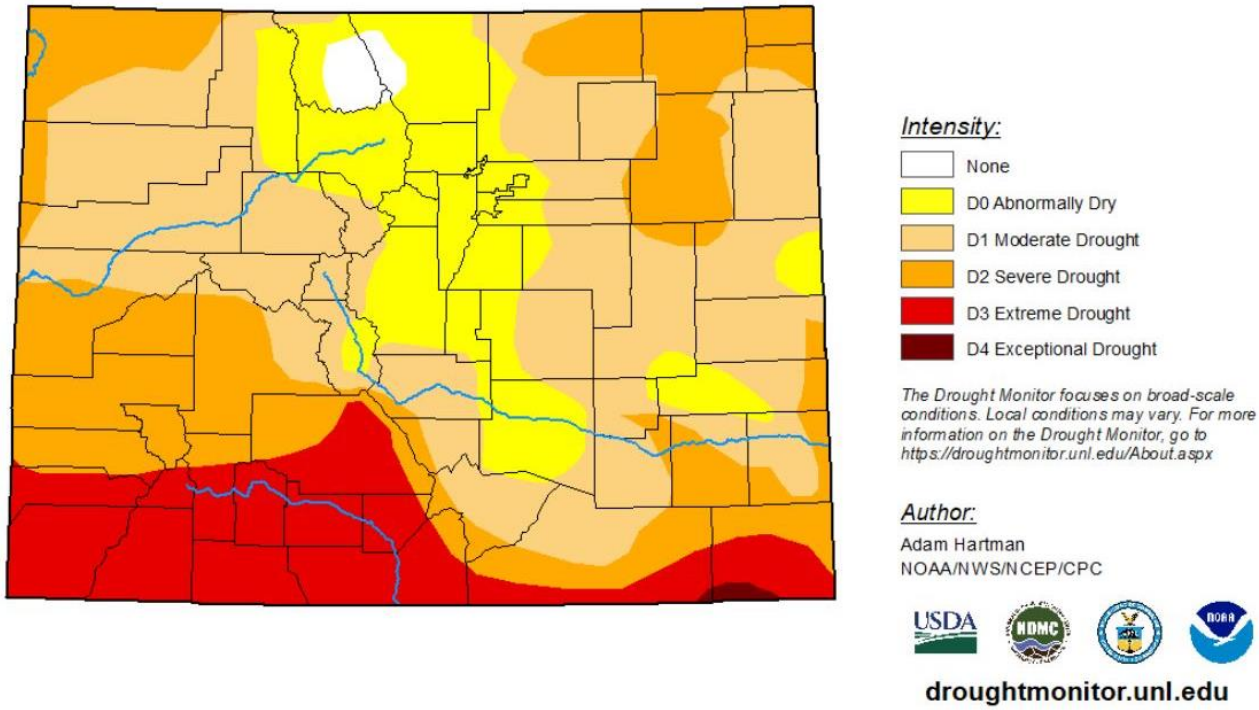
DROUGHT IMPACT CATEGORY	COUNT OF IMPACTS	YEARS REPORTED
Agriculture	11	2021, 2020, 2018, 2013, 2012
Business & Industry	4	2021, 2018, 2017
Fire	7	2021, 2020, 2018
Plants & Wildlife	12	2021, 2020, 2018, 2017, 2012
Relief, Response, and Restrictions	15	2021, 2020, 2018, 2013, 2012
Society & Public Health	3	2017, 2012
Tourism & Recreation	9	2021, 2018, 2017, 2012
Water Supply & Quality	10	2021, 2020, 2018, 2012

Source: NDMC Drought Impact Reporter

4.7.3 Location

Drought is a regional phenomenon that affects all areas within the county with equal frequency and severity, giving this hazard a location rating of extensive. Drought impacts are most severe for commercial and agricultural interests that rely on an uninterrupted supply of water. With annual precipitation in Pitkin County averaging only 11-15 inches per year, any decrease in moisture over a single year or for a multi-year period can have significant impacts on the tourism and recreation economy. Many Pitkin County residents rely on individual ground wells and constructed water retention structures for their water resources. Local ranchers depend on ponds and ditches for livestock and irrigation of crops. The U.S. Drought Monitor provides online maps of the current drought status nationwide, updated weekly. As shown in Figure 4-18 below, drought is a regional phenomenon and although it is severity may differ across locations, it is highly likely that if some portion of Pitkin County is experiencing drought the entire county will be experiencing drought.

Figure 4-18 U.S. Drought Monitor, as of June 14, 2022



4.7.4 Magnitude and Severity

Although no injuries or property damages are typically associated with drought, the loss of farmland, diminishing domestic water supply and tourism impacts can stress Pitkin County's local economy. According to the Colorado Natural Hazards Mitigation Plan, "Drought impacts are wide reaching and may

come in different forms, such as economic, environmental, and/or societal. The most significant impacts associated with drought in Colorado are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. A reduction of electric power generation and water quality deterioration are also potential effects. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion."

The severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly. The U.S. Drought Monitor provides a drought classification scheme (shown in Figure 4-19) used to monitor drought nationwide. The figure below shows historical impacts by drought category, which can be used as a measure of the magnitude of drought.

Figure 4-19 Historically Observed Impacts by Drought Monitor Category in Colorado

Category	Historically observed impacts
D0	Hay production decreases; rangeland is dry
	Irrigation begins sooner
D1	Rangeland growth is stunted; very little hay is available
	Dryland crops suffer
	Wildfires increase
	Pheasant population declines; ski season is limited
D2	CRP lands suffer
	Farmers reduce planting; producers sell cattle
	Fire season is extended
	Snowpack is low; surface water levels are low; river flow is reduced
D3	Pasture conditions worsen
	City landscapes are dying
	Large fires develop
	Rafting, fishing, hunting, skiing are reduced; fish kills occur
	Grasshopper and insect infestation are noted
	Reservoirs are extremely low; mandatory water restrictions are implemented; water temperature increases
D4	Dust storms and topsoil removal are widespread
	Agricultural and recreational economic losses are large

The 2018 State of Colorado Drought Mitigation and Response Plan evaluated the vulnerability of different sectors to drought for all counties in Colorado. (The evaluation excluded the Municipal and Industrial sector because that sector did not follow standard methodology). The sector vulnerability scores for Pitkin County are shown in Table 4-21. A score of 3.0 or above means that sector is vulnerable to drought. Under this vulnerability assessment, Pitkin County was ranked one of the most vulnerable counties in the state for the socioeconomic sector. This is largely due to the County's relative lack of economic diversity and dependence on tourism as an economic base. This also includes vulnerability to secondary economic impacts, behavioral health impacts, and public health concerns specific to drought.

Table 4-21 Drought Vulnerability Scores by Sector

SECTOR	PITKIN COUNTY SCORE
Recreation	2.26
Energy	1.00
Agriculture	1.63
State Assets	1.43
Socioeconomic	3.60
Environment	1.11
Average Overall Vulnerability	1.84

Source: 2018 State of Colorado Drought Mitigation and Response Plan

4.7.5 Probability of Future Occurrences

The probability of a future drought in Pitkin County is considered likely, with a recurrence interval of 10 years or less. Droughts typically occur as short durations in Pitkin County but can last for multiple years. As mentioned in the past events section, since 2000 Pitkin County has spent approximately 63% of the time in some level of drought. According to a study cited in the 2018 Colorado Drought Mitigation and Response Plan, droughts occur somewhere in Colorado in nearly nine out of every ten years (McKee and others 2000).

4.7.6 Climate Change Considerations

The long-term effects of climate change on regional water resources are not fully understood, but global water resources are already experiencing the following non-climate stresses:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure

Per the 2018 Colorado Drought Mitigation and Response Plan, regional studies commissioned by the Colorado Water Conservation Board (CWCB) suggest a reduction in the total water supply in Colorado by the mid-21st century. Projections show a decline in snowpack across western Colorado by the mid-21st century, including severe declines at lower elevations and modest declines at high elevations. Additionally, warming temperatures have been resulting in earlier onset of streamflow from melting snow, which may cause a reduction in late summer flows.

The Fourth National Climate Assessment reports that throughout the southwest region, increased temperatures are resulting in decreases in snowpack and its water content, an earlier peak of snow-fed streamflow, and increases in the proportion of rain to snow, all of which exacerbate hydrological drought. Additionally, drought risk is being exacerbated by the depletion of groundwater.

With a warmer climate, droughts could become more frequent, more severe, and longer lasting. From 1987 to 1989, losses from drought in the U.S. totaled $39 billion (Congressional Office of Technology Assessment [OTA] 1993). More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages. In addition, drought conditions can greatly increase the likelihood and severity of wildfire.

In all likelihood, the direct impacts of climate change on water resources will be hidden beneath natural climate variability. With a warmer climate, droughts and floods could become more frequent, severe, and longer lasting. The potential increase in these hazards is a great concern given the stresses being placed on water resources and the high costs resulting from recent hazards. The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing

conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

4.7.7 Vulnerability Assessment

Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to the ability to produce goods and provide services. Drought can affect a wide range of economic, environmental, and social activities. The vulnerability of an activity to the effects of drought usually depends on its water demand, how the demand is met, and what water supplies are available to meet the demand. Based on the multiple recent multi-year droughts and Colorado's drought history, it is evident that all of the planning area is vulnerable to drought.

Drought does not usually present life safety issues or directly impact critical infrastructures such as roads, bridges, utilities, communications systems, or public safety resources. However, drought presents ongoing challenges for most Colorado communities, requiring sustained planning and conservation efforts to ensure a reliable water supply to meet current and future needs. Although communities in the Roaring Fork Valley have addressed conservation and water supply issues on a number of levels, the persistence of the hazard will require sustained mitigation efforts. Water supply planners must also be cognizant of the effects of climate change on the frequency and severity of future droughts.

The most significant impacts from drought are related to water intensive activities, such as agriculture (both crops and livestock), wildfire protection, municipal usage, commerce, recreation, and wildlife preservation, as well as a reduction of electric power generation and water quality deterioration. Secondary impacts of drought are wildfires, wind erosion, and soil compaction that can make an area more susceptible to flooding. Drought impacts increase with the length of a drought.

People

The historical and potential impacts of drought on populations include agricultural and recreation/tourism sector job loss, secondary economic losses to local businesses and public recreational resources, increased cost to local and state government for large-scale water acquisition and delivery, and water rationing and water wells running dry for individuals and families. Other public health issues can include impaired drinking water quality, increased incidence of mosquito-borne illness, an increase in wildlife-human confrontations and respiratory complications as a result of declined air quality in times of drought.

Property

Drought does not typically have a direct impact on buildings, although an increase in expanding or collapsing soils could affect building foundations. Developed areas may experience damages to landscaping if water use restrictions are put in place, however these losses are not considered significant.

Critical Facilities and Infrastructure

Water supply issues for municipal, industrial, and domestic needs will be a concern for the entire County during droughts. Critical facility elements such as landscaping may not be maintained due to limited resources, but the risk to the planning area's critical facilities inventory will be largely aesthetic. For example, when water conservation measures are in place, landscaped areas will not be watered and may die. These aesthetic impacts are not considered significant.

Economy

One measure of exposure to drought is market value of agricultural products. According to the USDA Census of Agriculture, the market value of agricultural products sold in Pitkin County was $2,912,000 in 2017 (a non-drought year), down 2 percent from the 2012 Census of Agriculture. Livestock accounted for 65 percent of sales and crops accounted for 35 percent. Drought may impact all crops grown in Pitkin County and the pastureland used to sustain private livestock. Agricultural damages may result from direct impacts or water usage restrictions that limit irrigation.

In addition to agriculture, economic exposure is largely associated with industries that use water or depend on water for their business. Drought impacts on the County's natural environment and the cascading impacts to the recreation sector could lead to less people visiting and spending money in County which could have a negative impact on the entire local economy. Recreation and tourism industries, including rafting, angling, and ski resorts, have experienced past losses due to low flows and/or low snowpack; these businesses continue be exposed to drought impacts. Refer to Table 4-21 above for the results of the section vulnerability analysis from the 2018 State of Colorado Drought Mitigation and Response Plan. Growing dependency on water resources may make the County more vulnerable to drought in the future.

Historic, Cultural, and Natural Resources

Environmental losses from drought can include damage to plants, animals, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

Drought can also increase risk of wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought may also weaken trees in areas already affected by mountain pine beetle infestations, causing more extensive damage to trees and increasing wildfire risk, at least temporarily (CWCB 2018).

Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion (CWCB 2018).

4.7.8 Development Trends

Drought vulnerability will increase with future development and population growth as there will be increased demands for limited water resources. Increased development also lends itself to the increased potential for impervious surface development, which reduces the amount of water absorbed into the ground from precipitation.

The Future Avoided Cost Explorer (FACE) tool developed by the CWCB provides an in-depth look at the potential economic impacts and expected annual damages from future flood, drought, and wildfire events. The tool looks at three different climate scenarios (current climate conditions, moderately warmer climate by 2050, and severely warmer climate by 2050) as well as compares current population to low, medium, and high growth population scenarios. The following table compares the estimated annual damages for Pitkin County due to drought events for each of the climate and population scenarios.

Table 4-22 Potential Future Economic Losses from Drought in Pitkin County

CLIMATE SCENARIOS	POPULATION SCENARIOS LOW GROWTH (~20,150)	MEDIUM GROWTH (~23,200)	HIGH GROWTH (~26,000)
Current Conditions	Total Damages: $7.1M	Total Damages: $7.1M	Total Damages: $8.1M
	Total Damages per person: $350	Total Damages per person: $310	Total Damages per person: $310
Moderately Warmer Climate by 2050	Total Damages: $30M	Total Damages: $30M	Total Damages: $30M
	Total Damages per person: $1500	Total Damages per person: $1300	Total Damages per person: $1200
Severely Warmer Climate by 2050	Total Damages: $40M	Total Damages: $40M	Total Damages: $40M
	Total Damages per person: $2000	Total Damages per person: $1700	Total Damages per person: $1500

Source: CWCB Future Avoided Cost Explorer: Hazards https://cwcb.colorado.gov/FACE

4.7.9 Differences by Jurisdiction

As mentioned throughout this chapter, drought is a hazard with impacts typically felt on a regional scale. As such, there is not a great deal of variability in impacts between jurisdictions in Pitkin County.

There may however be differences between the jurisdictions' capabilities and vulnerabilities to drought. For instance, the City of Aspen, which relies on stream flow for its water supply rather than surface water storage, is vulnerable to a warming climate even though historic hydrology conditions indicate water supply will be sufficient to meet future demands. The drought of 2012 followed by a lower-than-normal snowpack the next winter cost the City $1.2 million in additional power purchased due to lost hydroelectric generation. As a result, the City has developed several water supply projects to prepare for an uncertain future.

4.7.10 Risk Summary

- The overall significance of drought is High.
- Drought vulnerability may increase over time as demand for water from different sectors increases and as the County plans for economic development around the use of water resources.
- Climate change may result in an increase in the frequency and severity of drought which could lead to impacts to the recreation and tourism industry in the County.
- The effects of recent droughts have exposed the vulnerability of the planning area's economy to drought events
- Related hazards: Wildfire, Erosion, Flooding, Ice Jam Release

4.8 FLOODING

FLOODING	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Limited	Critical	Likely	**Medium**
Aspen	Significant	Catastrophic	Likely	**High**
Basalt	Extensive	Catastrophic	Likely	**High**
Snowmass Village	Limited	Critical	Likely	**Medium**
Aspen Fire	Limited	Critical	Likely	**Medium**
Roaring Fork Fire	Limited	Critical	Likely	**Medium**

4.8.1 Description

A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of stream banks, (2) the unusual and rapid accumulation of runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flooding results when the flow of water is greater than the normal carrying capacity of the stream channel or drainage system. Flooding in Pitkin County can occur as a result of rain, melting snow, rainfall-on-melting snow, or due to a stream ice jam or the failure of a dam (dam inundation flooding is discussed as a separate hazard in Section 4.6). Pitkin County is susceptible to riverine, stormwater, flash flood, snowmelt, and ice-jam flood events.

Riverine Flooding

Riverine flooding occurs when a watershed and downstream channels receive too much water from above-normal rainfall or snowmelt and the excess water exceeds a stream's capacity. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. Riverine flooding varies with terrain. In relatively flat areas riverine flooding may be characterized by a slow steady rise in stream stage and a peak flood of long duration. In mountainous areas with narrow channels, floodwaters may rise quickly and have rapid, deep flows. However, in general, the velocity of moving water in a riverine flood event, measured in feet per second, is much slower than the velocity of a flash flood or mudflow flood event. The area adjacent to a river channel that becomes inundated during a flood event is its floodplain.

Flash Flooding

Flash flooding usually occurs due to very heavy rains in a short period of time over a small geographic area. Flash flooding is characterized by a sudden rise in stream level, short duration, and a relatively small volume of runoff. Because there is little or no warning time, the term "flash flood" is often used to describe flooding from thunderstorms. Flash flood events commonly trigger and accompany debris flows and mudflows, magnifying the risks to lives and property in the drainageway where a flash flood occurs. Flash floods associated with debris flows and mudflows typically cause more damage than riverine, or "clear-water" flooding due to the combination of the debris and sediment with the force of the debris-filled water. The NFIP provides flood insurance coverage for damages caused by mudflow flooding but does not map or require floodplain management measures in these areas. The extreme terrain in much of Pitkin County increases the potential for severe flash flood events.

Stormwater Flooding

Stormwater refers to water that runs off the ground instead of infiltrating and collects on the ground surface or is carried in the stormwater system when it rains. In runoff events where the amount of stormwater is too great for the system, or if the channel system is disrupted by vegetation or other debris that blocks inlets or pipes, excess water remains on the surface. This water may pond in low-lying areas, often in street intersections. Stormwater ponding, also known as localized flooding, may result in deep water and pollution. Stormwater can pick up debris, chemicals, dirt, and other pollutants from impervious surfaces.

Snowmelt Flooding

Snowmelt floods result from melting of winter snowpack in the high mountain areas. Snowmelt floods typically begin as spring runoff appears, after the first spring warming trend. Per the 2018 State Flood Hazard Mitigation Plan, if the warming trend continues up to 8 to 10 consecutive days in a basin where the snowpack has a water content more than about 150% of average, serious flooding can develop. The total duration of snowmelt floods is usually over a period of weeks rather than days. They yield a larger total volume in comparison to other types of floods in Colorado. Peak flows, however, are generally not as high as flows for the other types. A single cold day or cold front can interrupt a melting cycle causing the rising water to decline and stabilize until the cycle can begin again. Once snowmelt floods have peaked, the daily decreases are moderate, but fairly constant. Snowmelt flooding usually occurs in May, June, and early July.

Ice-Jam Flooding

Ice-jam floods can occasionally occur when a surge of runoff breaks upriver ice and forms an ice debris dam at a bridge or other channel obstruction. Upstream flooding can occur as water is held back and downstream flooding may occur when the jam finally breaks. In addition to localized flooding, ice jams can disrupt transportation, affect hydropower operations, cause riverbank erosion, and adversely impact wildlife habitat. Ice Jams are covered in more detail in Section 4.10.

Flooding and Floodplains

The area adjacent to a river or stream channel that becomes inundated during a flood is its floodplain. Floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

When floodwaters recede after a flood event, they leave behind layers of rock and mud. These gradually build up to create a new floor of the floodplain. Floodplains generally contain unconsolidated sediments (accumulations of sand, gravel, loam, silt, or clay), often extending below the bed of the stream, which provide a natural filtering system, with water percolating back into the ground and replenishing groundwater. These are often important aquifers, the water drawn from them being filtered compared to the water in the stream. Fertile, flat reclaimed floodplain lands are commonly used for agriculture, commerce, and residential development.

Connections between a river and its floodplain are most apparent during and after major flood events. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. When a river is separated from its floodplain with levees and other flood control facilities, natural, built-in benefits can be lost, altered, or significantly reduced.

Floodplains are frequently defined as the area that is inundated by the 100-year flood. The 100-year flood, which is a flood event with a 1% annual probability of occurrence, is the national standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The FIS presents water surface elevations for floods of various magnitudes, including the 1% annual chance flood and the 0.2% annual chance flood (the 500-year flood). Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRM), which are the principal tool for identifying the extent and location of the flood hazard. The 100-year floodplain is defined as the Special Flood Hazard Area for floodplain management purposes. Participation in the NFIP requires adoption of a local floodplain management ordinance and its enforcement within the mapped Special Flood Hazard Area (SFHA). Regulation of floodplain development by the community entitles citizens to purchase federal flood insurance.

Pitkin County, the City of Aspen, and the Towns of Basalt and Snowmass Village participate in the NFIP. The County's current FIRM, also effective for the City of Aspen and the Town of Snowmass Village, was last updated on August 15, 2019. The Town of Basalt's effective maps have a date of December 4, 2007; however September 24, 2021 preliminary map data was used for mapping and analysis.

The potential for flooding and the extent of floodplains can be altered by land use changes and changes to land surface. New development and an increase in impervious surface can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels. Changes in the environment can also be brought about by other natural hazards such as drought, wildfires, and extreme weather events. In Colorado, the timing of peak river levels has changed since the middle of the last century in response to warming trends. Snowmelt-fed rivers have earlier peak flow trends due to declines in spring snowpack, the effects of dust-on-snow, and larger percentages of precipitation falling as rain instead of snow. Wildfires create hydrophobic soils, a hardening of the earth's surface that prevents rainfall from being absorbed into the ground, which can increase runoff, erosion, and downstream sedimentation of channels.

4.8.2 Past Events

Flooding is a natural event and all streams and rivers in Pitkin County have experienced periodic flooding with associated debris and mudflows. The National Centers for Environmental Information Storm Events Database includes 35 flood events that have occurred in Pitkin County between 1997 and 2022. According to the database, these events have resulted in a total of $3,487,000 in property damage but have not caused any direct or indirect deaths or injuries. Many of these events resulted from thunderstorms and heavy rain events, five events were associated with ice jams (see Section 4.10), and three events resulted from snowmelt.

Table 4-23 NCEI Reported Flood Events in Pitkin County (1997-2022)

DATE	LOCATION	EVENT TYPE	PROPERTY DAMAGE
7/22/1997	Redstone	Flash Flood	$0
7/22/1997	Redstone	Flash Flood	$0
9/4/1997	Redstone	Flash Flood	$2,000
9/4/1997	Snowmass	Flash Flood	$3,000
7/21/1998	Aspen	Flash Flood	$0
7/27/1998	Aspen	Flash Flood	$0
7/31/1998	Redstone	Flash Flood	$0
7/28/1999	Redstone	Flash Flood	$150,000
7/28/1999	Redstone	Flash Flood	$30,000
8/6/2001	Redstone	Flash Flood	$0
8/6/2001	Aspen	Flash Flood	$0
5/29/2003	Gore And Elk Mountains/Central Mountain Valleys (Zone)	Flood	$0
5/29/2003	Central Colorado River Basin (Zone)	Flood	$0
6/1/2003	Gore And Elk Mountains/Central Mountain Valleys (Zone)	Flood	$3,240,000
9/6/2003	Redstone	Heavy Rain	$0
7/3/2006	Snowmass	Flash Flood	$40,000
7/18/2007	Aspen	Flash Flood	$5,000
7/19/2007	Redstone	Flash Flood	$2,000
7/19/2007	Redstone	Heavy Rain	$0
7/27/2007	Aspen	Heavy Rain	$0
7/21/2008	Woody Creek	Heavy Rain	$3,000
7/26/2009	Redstone	Flash Flood	$0
6/6/2011	Snowmass	Flood	$10,000
7/18/2011	Snowmass	Heavy Rain	$0
7/19/2011	(Ase)Aspen Airport	Flash Flood	$0

DATE	LOCATION	EVENT TYPE	PROPERTY DAMAGE
7/30/2012	Redstone	Flash Flood	$0
7/24/2014	Redstone	Flash Flood	$0
7/31/2014	Redstone	Flash Flood	$0
8/4/2017	Basalt	Heavy Rain	$2,000
1/3/2019	Snowmass	Flash Flood/ Ice Jam	$0
7/13/2019	Snowmass	Flash Flood	$0
12/22/2021	Snowmass	Flash Flood/ Ice Jam	$0
1/13/2022	Snowmass	Flash Flood/ Ice Jam	$0
2/1/2022	Snowmass	Flash Flood/ Ice Jam	$0
3/11/2022	Snowmass	Flash Flood/ Ice Jam	$0

Source: NCEI Storm Events Database

In May 1984, Pitkin County was one of 15 Western Slope counties designated a federal disaster area by FEMA for damages from severe storms, mudslides, landslides, and flooding. Runoff from an above-average snowpack resulted in floods and mudslides that damaged infrastructure in Aspen and Snowmass Village, including roads, bridges, recreational facilities and other publicly owned property.

To date, Pitkin County has not experienced a catastrophic flood event that resulted in loss of life or large-scale property damages. However, flash floods that produce debris flows and mudflows are fairly common events and have caused significant damages in the past to homes, roads, bridges, and culverts. Areas in the county that are subject to flash floods, debris flows, and mudflows are generally drainages and channels that are outside of the FEMA-mapped, regulatory floodplains.

Table 4-24 below provides additional information and event descriptions about some of the more notable flood, flash flood and mudflow events that have occurred in Pitkin County in recent history, compiled from several sources.

Table 4-24 Significant Flood/Flash Flood Events in Pitkin County, 1980-2022

DATE	LOCATION	DESCRIPTION
May 1984	Aspen, Snowmass Village, Pitkin County	Federally declared disaster (FEMA-719-DR) for Public Assistance ($172,000) due to flooding and mudslides.
July 11, 1995	Basalt	25-year flood event on Roaring Fork R. flooded a mobile home park and basements in Basalt, eroded a levee, and washed out a section of old Hwy. 82.
July 22, 1997	Redstone	Heavy rains triggered mudflows closing a 5-mile stretch of Hwy. 133 near Redstone with mud up to 5- ft. deep.
August 4, 1997	Carbondale, Redstone	Mudflows caused by heavy rain buried a 30-ft. stretch of Hwy. 133 near Carbondale with 2-4 ft. of mud and blocked a subdivision road near Redstone.
July 21-31, 1998	Pitkin County	Heavy rains resulted in flood, debris flow and mudflow events at various locations, including Maroon Creek Rd., Castle Creek Rd., and along Avalanche Creek.
July 28, 1999	Pitkin County	Heavy rains resulted in multiple flood, debris flow and mudflow events, closing Hwy. 133 and causing $180,000 damage to roads and culverts 6 miles northeast of Redstone.
August 6, 2001	Pitkin County	Heavy rainfall resulted in flooding with mud and rocks covering roads in two locations: (1) Hwy. 133 south of Redstone and (2) Maroon Creek Rd.

DATE	LOCATION	DESCRIPTION
July 18-19, 2007	Pitkin County	Heavy rains produced flooding and mudflows that caused damages to Maroon Creek Rd., Maroon Creek Day Use Area (trailhead/parking lot), and a United States Forest Service (USFS) road between Hwy. 133 and Avalanche Creek Campground.
Spring 2008	Pitkin County	Heavy runoff in upper Castle Creek Valley washed out Pearl Pass Rd. and a bridge below the intersection with Montezuma Rd. (bridge rebuilt in 2010).
July 26, 2009	Pitkin County	Heavy rains produced flooding and mudflows that covered Hwy. 133 4-ft. deep in mud.
July 29, 2011	Pitkin County	Heavy rains resulted in flood, debris flow and mudflow events at various locations, including the Rio Grande Trail, Stein Trail, and Aspen/Pitkin County Airport.
August 4, 2017	Snowmass Village	A series of strong thunderstorms produced torrential rainfall in the Elk Run subdivision which resulted in water that flowed into several homes. A home on Red Tail Court took the brunt of water flowing off the hillside and had two feet of water in the lower level. Some of the streets in Elk Run were coated with as much as 6 inches of mud. Radar estimated 1 to 1.5 inches of rain fell throughout the day.

Source: Colorado Natural Hazards Mitigation Plan (2013); National Centers for Environmental Information.

4.8.3 Location

Pitkin County is a mountainous county with many of its watercourses having steep, defined channels. Pitkin County has experienced frequent incidents of localized flooding and mudflow events in the past 20 years. Fortunately, most of these events occur outside of developed areas and impacts have been limited to roads, bridges, culverts, and recreational facilities. The City of Aspen, Town of Basalt, and unincorporated areas of Pitkin County including Redstone have all experienced events that have closed roads and, in some cases, caused damage to public and private property. Historically, the Town of Basalt has been one of the more flood-prone areas of the county due to its location at the confluence of the Roaring Fork and Fryingpan Rivers. Likewise, the area in and around the community of Redstone, located at the confluence of Coal Creek and Crystal River, is susceptible to flood events. Primary flood sources in the County include the Roaring Fork River, the Fryingpan River, and the Crystal River and their tributaries.

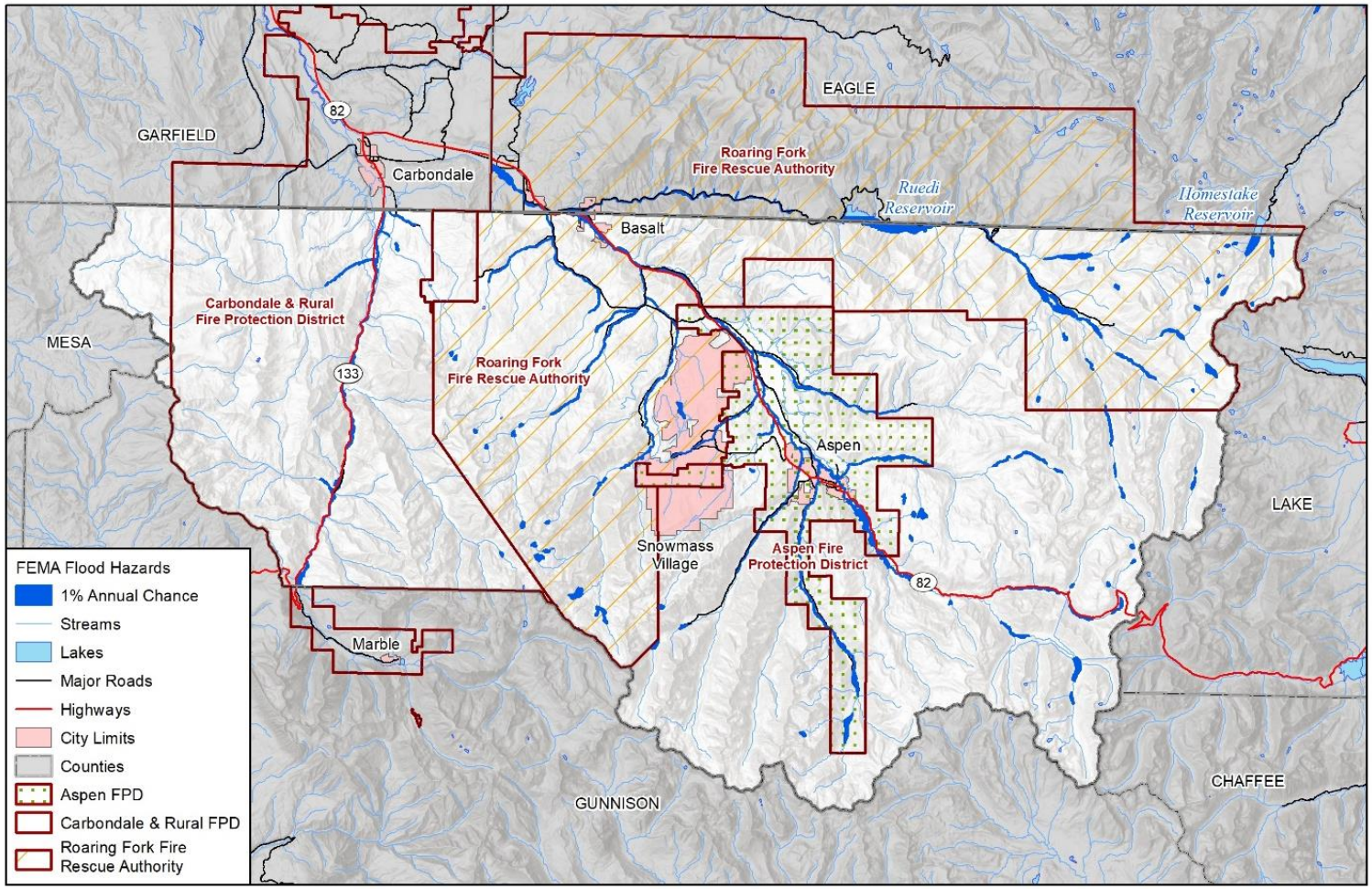
From its headwaters on Independence Pass, the Roaring Fork River runs 70 miles through Aspen, Basalt, and Carbondale until it reaches its confluence with the Colorado River in Glenwood Springs. Over that span, the water drops over 6,000 feet in elevation (more than the Mississippi River drops in its entire length). Many species of wildlife rely on the river corridor for their survival, making it a great place to view elk, bald eagles, osprey, great blue herons, moose, mule deer, and more. The Roaring Fork River offers abundant recreational opportunities including white water rafting, stand-up paddle boarding, kayaking, and fishing. Gold Medal trout waters can be found within the section between Basalt and Glenwood Springs.

The Fryingpan River is a main tributary of the Roaring Fork River and flows into Ruedi Reservoir. The Fryingpan River is a renowned Gold Medal trout fishery whose designation stretches 14 miles from Ruedi Dam to its confluence with the Roaring Fork River in the Town of Basalt. This river boasts healthy rainbow, brown, and cutthroat trout populations, providing year-round fishing opportunities. Both Roaring Fork River and Fryingpan River pass through the Town of Basalt in Eagle County, and those sections are included in this analysis.

The Crystal River begins in the Elk Mountains of Gunnison County in Colorado and flows for 40 miles before it reaches the confluence with the Roaring Fork River in Carbondale. This scenic valley is home to bald eagles, bighorn sheep, large elk populations, Lewis's woodpeckers, geothermal hot springs, rare orchids such as the stream orchid, and one of the few places in the state to view fireflies. The Crystal River valley is a popular kayaking and fishing location, provides drinking water to 7,000 people, and continues to support a strong ranching and agriculture industry.

Pitkin County has 7,303 acres in the 1%-annual-chance floodplain according to the current countywide FIS, revised August 15, 2019. An additional 137 acres are located in the 1%-annual-chance floodplain in the portion of Basalt in Eagle County. Figure 4-20 shows the location of FEMA flood hazard areas throughout Pitkin County. Figure 4-21 through Figure 4-23 provide a closer view of the floodplain limits within the municipal limits of the City of Aspen, the Town of Basalt, and the Town of Snowmass Village.

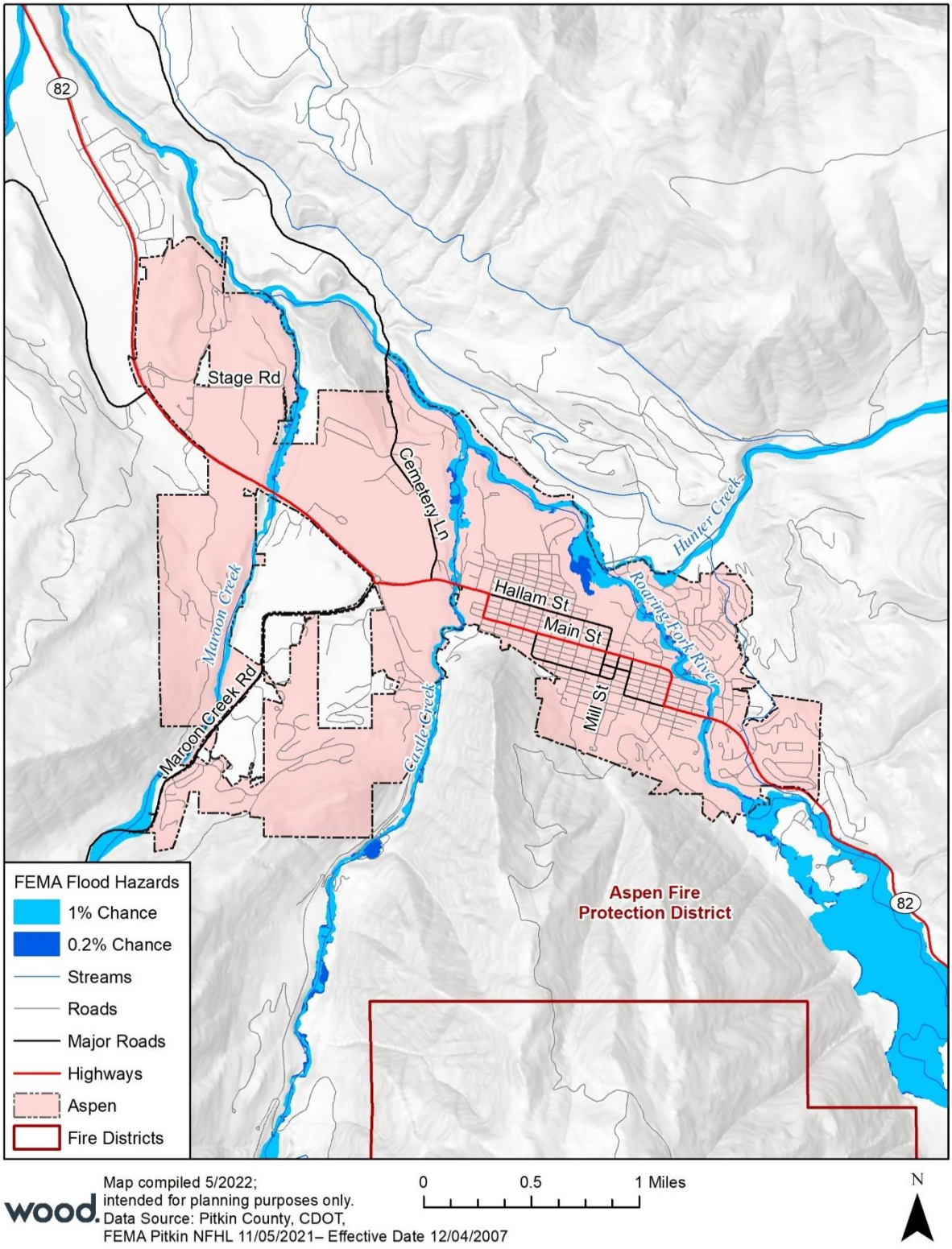
Figure 4-20 Pitkin County FEMA Flood Hazard Areas



wood.

Map compiled 6/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT, RFFR,
FEMA Pitkin NFHL 11/05/2021– Effective Date 12/04/2007:
Eagle NFHL Preliminary 9/24/2021 – Effective Date 12/04/2007

Figure 4-21 City of Aspen FEMA Flood Hazard Areas



Map compiled 5/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT,
FEMA Pitkin NFHL 11/05/2021– Effective Date 12/04/2007

Figure 4-22 Town of Basalt FEMA Flood Hazard Areas

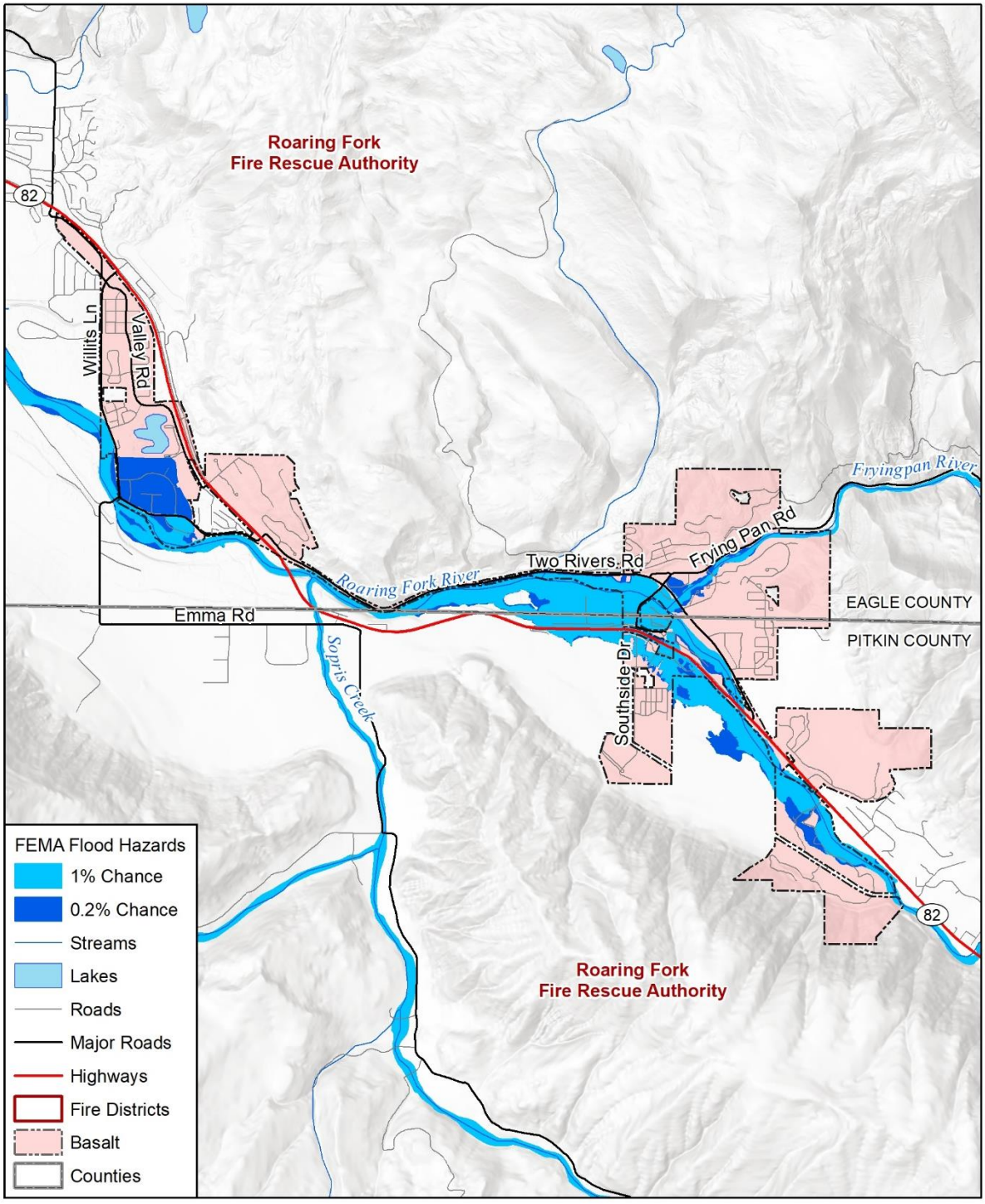
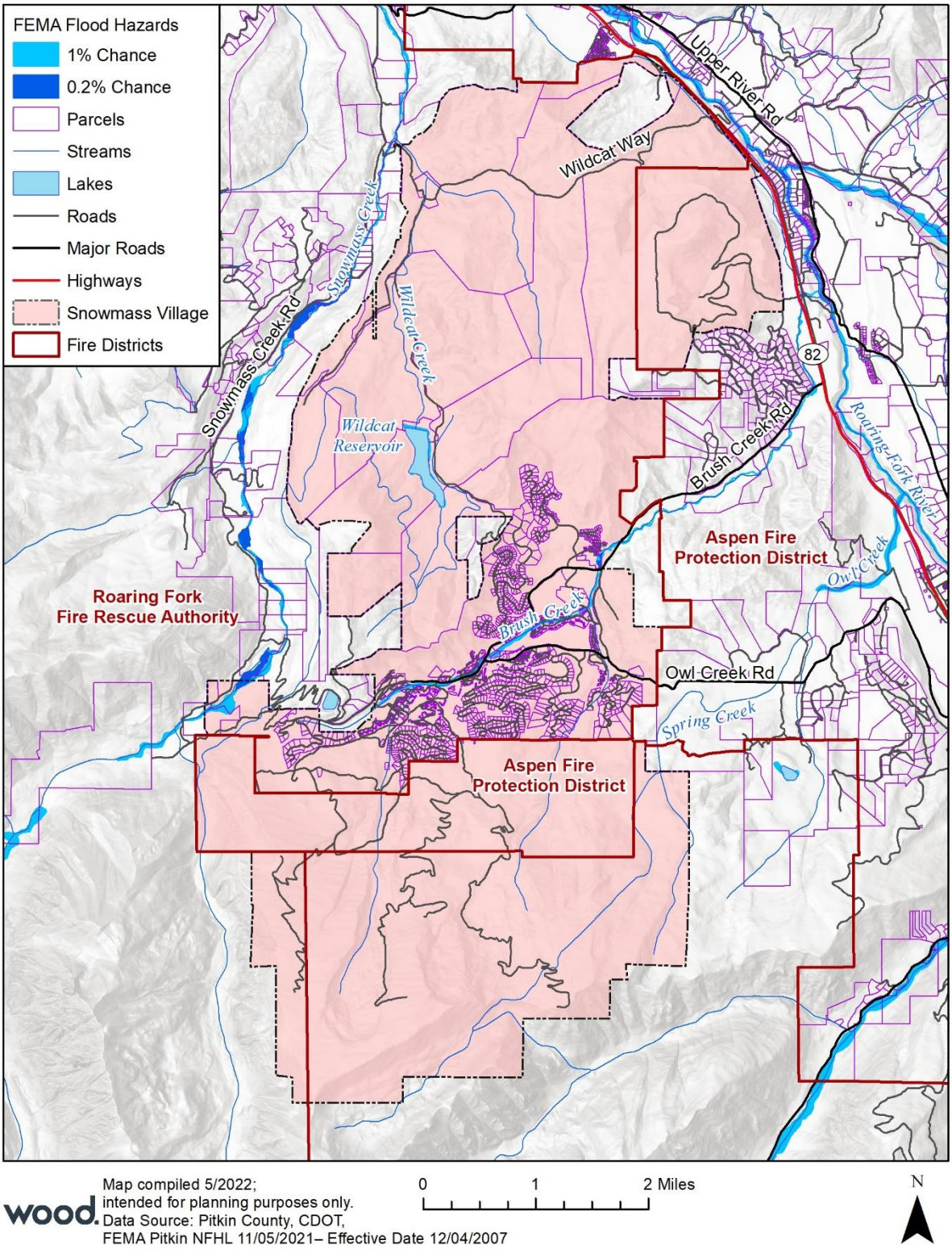


Figure 4-23 Town of Snowmass Village FEMA Flood Hazard Areas



4.8.4 Magnitude and Severity

Magnitude and severity can be described by several factors that contribute to the relative vulnerabilities of certain areas in the floodplain. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood vulnerability range from specific characteristics of the floodplain to characteristics of the structures located within the floodplain. The following is a brief discussion of some of these flood factors which pose risk.

- **Elevation:** The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage, due to the higher likelihood that it will come into contact with water for a prolonged amount of time.
- **Flood depth:** The greater the depth of flooding, the higher the potential for significant damages due to larger availability of flooding waters.
- **Flood duration:** The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage.
- **Velocity:** Flowing water exerts forces on the structural members of a building, increasing the likelihood of significant damage (such as scouring).
- **Construction type:** Certain types of construction and materials are more resistant to the effects of floodwaters than others. Typically, masonry buildings, constructed of brick or concrete blocks, are the most resistant to damages simply because masonry materials can be in contact with limited depths of flooding without sustaining significant damage. Wood frame structures are more susceptible to damage because the construction materials used are easily damaged when inundated with water.

Major flood events present a risk to life and property, including buildings, contents, and their use. Floods can also affect lifeline utilities (e.g., water, sewage, and power), transportation, the environment, jobs, and the local economy.

Past flood events in Pitkin County have damaged roads, bridges, private property, businesses, and public facilities. Future events may result in greater damages depending on patterns of growth, land use development and climate change. The communities of Aspen and Basalt have rated the potential magnitude/severity of a major flood as catastrophic, meaning that multiple deaths, damaged and destroyed structures, and/or interruption of essential facilities and service for more than 72 hours can be expected in a major flood event. Pitkin County and the Town of Snowmass Village have rated the magnitude/severity of the flood hazard as critical, meaning that isolated deaths/injuries; major or long-term impacts to property, infrastructure, and critical services; and service disruptions of 24-72 hours are possible.

4.8.5 Probability of Future Events

The 1% annual chance flood event is the standard national measurement for flood mitigation actions and insurance. This recurrence level is an average and does not mean that a flood of that magnitude will occur exactly every 100 years. Likewise, a 500-year flood event has a 0.2% (or 1 in 500) chance of occurring in any given year.

Pitkin County has not experienced a catastrophic flood event resulting in loss of life or large-scale property damages. Although serious flood events in Pitkin County are rare, severe weather and snowmelt runoff present a threat of serious flooding along rivers and creeks in the county each year. Flash floods that produce debris flows and mudflows occur regularly and have caused significant damages in the past to homes, roads, bridges, and culverts. Based on the historical record of 35 events over the 26 years reported in the NCEI Storm Events Database, Pitkin County averages 1.3 flood events per year. Of these 35 events, 18 occurred in the unincorporated county or countywide, 11 occurred in Snowmass, and six occurred in Aspen. Using past occurrences as an indicator of future probability, flooding has a probability of future occurrence rating of likely throughout most of Pitkin County. On a jurisdictional level, there is approximately a 69% chance of occurrence in the unincorporated county, 42% chance in Snowmass Village, and 23% chance in Aspen. No data was reported on past events in Basalt that could inform an estimate of future probability; however, Basalt is considered one of the more flood-prone areas of the county due to its location at the confluence of the Roaring Fork and Fryingpan Rivers.

4.8.6 Climate Change Considerations

To date, projections from climate models have been mixed about whether climate warming will increase or decrease precipitation in Colorado. However, because warmer air can hold more moisture, events producing heavy rainfall and flooding can be expected to increase as temperatures rise in the years to come. In general, heavier rains lead to a larger fraction of rainfall running off and, depending on the surface conditions, more potential for flash flooding.

Warming is likely to directly affect flooding in many mountain settings, as catchment areas receive increasingly more precipitation as rain rather than snow, or more rain falling on existing snowpack. In some such settings, river flooding may increase as a result – even where precipitation and overall river flows decline.

According to the 2014 National Climate Assessment, southwestern river basins including the Colorado River Basin will experience gradual runoff declines during this century but flooding in the region is generally expected to increase. In Colorado, however, there are no specific projections or trends that have been noted to indicate that more substantial or more frequent flooding events can be expected to occur.

Global warming may also lead to more ice-jam flooding along mountain streams, when heavy rainfall or upstream melting raises stream flows to the point of breaking up the ice cover, which can pile up on bridge piers or other channel obstructions and cause flooding behind the jam.

Once the ice jam breaks up, downstream areas are vulnerable to flash floods. Global warming could create conditions ripe for ice-jam floods. The increasing possibility of mid-winter thaws and heavy rainfall events could increase the risk of sudden ice break up. Flooding can be further exacerbated if the ground is still frozen and unable to soak up rainwater.

Other influences on flood generation that should be considered in projections of future flood risks are land cover, flow and water supply management, soil moisture and channel conditions. In addition to discouraging development in flood-prone areas and protecting natural systems such as wetlands, local government planners and engineers should design infrastructure with the capacity to accommodate heavy rains and manage stormwater runoff during extreme events.

4.8.7 Vulnerability

This section describes vulnerabilities in terms of population, property, infrastructure, and environment. The vulnerability analysis was performed at the parcel level using GIS during the 2022 update.

During the previous update of this plan in 2017, new digital Flood Insurance Rate Maps (DFIRMs) for Pitkin County were developed and made available for public review, comment, and appeals, but had yet to be approved by FEMA and were unavailable for analysis. These FIRMs became revised effective on August 15, 2019 and were used to evaluate flood exposure and vulnerability for this plan update. September 24, 2021 preliminary map data was used for the Town of Basalt.

People

Injuries or fatalities typically result if people are caught off guard by the flood event, more commonly associated with flash floods. Most fatalities occur when people attempt to drive across flooded areas.

Population counts of those living in the floodplain in the planning area were generated by analyzing tax assessor data and building footprints that intersect with the 1% annual chance and 0.2% annual chance floodplains (sometimes referred to as the 100-year and 500-year floodplains) identified on the National Flood Hazard Layer (NFHL). Total populations were estimated by multiplying the number of residential properties exposed to the floodplain by the average household size of Pitkin County and the respective communities (ranging from 1.97 to 2.35 persons per household).

Using this approach, an estimated 830 people countywide live within the 100-year floodplain; 486 in the unincorporated county, 167 in Aspen, 174 in Basalt, and two in Snowmass Village. An additional 367 people live in the 500-year floodplain; 148 in the unincorporated county, 32 in Aspen, and 188 in Basalt. This

analysis does not account for the visitor population, which swells in the summer months when flash flooding is more likely.

Property

Table 4-25 summarizes the total number of improved parcels and number of structures in the 100-year floodplain by municipality and unincorporated areas. The analysis determined that there are an estimated 446 structures within the 100-year floodplain total. Approximately 54% of these structures are in unincorporated areas and approximately 80% of the structures are residential. There are fewer structures in the 500-year floodplain, with a total of only 277 structures, as shown in Table 4-26. The analysis does not account for those structures that might have been more recently constructed in accordance with local floodplain management regulations, and thus are not prone to 1% annual chance flooding. Properties constructed in the 500-year floodplain are not regulated, however.

Table 4-25 Property and Estimated Values in the 1% Annual Chance Flood Hazard

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	ESTIMATED LOSS
Aspen	Exempt	7	7	$819,800	$819,800	$1,639,600	$409,900
	Residential	84	85	$138,405,400	$69,202,700	$207,608,100	$51,902,025
	Total	**91**	**92**	**$139,225,200**	**$70,022,500**	**$209,247,700**	**$52,311,925**
Basalt	Commercial	24	24	$17,579,860	$17,579,860	$35,159,720	$8,789,930
	Exempt	9	9	$6,078,860	$6,078,860	$12,157,720	$3,039,430
	Residential	63	77	$54,937,770	$27,468,885	$82,406,655	$20,601,664
	Vacant	1	1	$321,900	$321,900	$643,800	$160,950
	Total	**97**	**111**	**$78,918,390**	**$51,449,505**	**$130,367,895**	**$32,591,974**
Snowmass Village	Residential	1	1	$182,300	$91,150	$273,450	$68,363
	Total	**1**	**1**	**$182,300**	**$91,150**	**$273,450**	**$68,363**
Unincorporated	Agricultural	8	10	$9,356,100	$9,356,100	$18,712,200	$4,678,050
	Commercial	6	12	$7,340,700	$7,340,700	$14,681,400	$3,670,350
	Exempt	7	12	$2,551,700	$2,551,700	$5,103,400	$1,275,850
	Mixed Use	11	15	$6,449,800	$6,449,800	$12,899,600	$3,224,900
	Residential	168	192	$133,094,900	$66,547,450	$199,642,350	$49,910,588
	Vacant	1	1	$48,500	$48,500	$97,000	$24,250
	Total	**201**	**242**	**$158,841,700**	**$92,294,250**	**$251,135,950**	**$62,783,988**
	Grand Total	**390**	**446**	**$377,167,590**	**$213,857,405**	**$591,024,995**	**$147,756,249**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, Pitkin FEMA NFHL Effective 12/4/2007, Eagle FEMA NFHL Preliminary 9/24/2021, WSP GIS Analysis

Table 4-26 Property and Estimated Values in the 0.2% Annual Chace Flood Hazard

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	ESTIMATED LOSS
Aspen	Commercial	1	1	$29,100	$29,100	$58,200	$14,550
	Residential	16	16	$41,480,000	$20,740,000	$62,220,000	$15,555,000
	Total	**17**	**17**	**$41,509,100**	**$20,769,100**	**$62,278,200**	**$15,569,550**
Basalt	Commercial	95	98	$47,200,000	$47,200,000	$94,400,000	$23,600,000
	Exempt	2	2	$10,022,660	$10,022,660	$20,045,320	$5,011,330

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE	ESTIMATED LOSS
	Residential	80	83	$57,144,980	$28,572,490	$85,717,470	$21,429,368
	Total	**177**	**183**	**$114,367,640**	**$85,795,150**	**$200,162,790**	**$50,040,698**
Unincorporated	Commercial	4	4	$511,000	$511,000	$1,022,000	$255,500
	Exempt	2	10	$15,426,500	$15,426,500	$30,853,000	$7,713,250
	Residential	60	63	$29,729,800	$14,864,900	$44,594,700	$11,148,675
	Total	**66**	**77**	**$45,667,300**	**$30,802,400**	**$76,469,700**	**$19,117,425**
	Grand Total	**260**	**277**	**$201,544,040**	**$137,366,650**	**$338,910,690**	**$84,727,673**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, Pitkin FEMA NFHL Effective 12/4/2007, Eagle FEMA NFHL Preliminary 9/24/2021, WSP GIS Analysis

National Flood Insurance Program

Table 4-27 lists flood insurance statistics that help identify vulnerability in the planning area. Pitkin County, the City of Aspen, and the Towns of Basalt and Snowmass Village participate in the NFIP.

Table 4-27 National Flood Insurance Program Statistics

JURISDICTION	INITIAL FIRM EFFECTIVE DATE	CLAIMS (AS OF 6/2/2022)	VALUE OF CLAIMS PAID (AS OF 6/2/2022)
City of Aspen	12/4/1985	8	$152,971.69
Town of Basalt	3/18/1980	6	$88,657.96
Town of Snowmass Village	6/4/1987	2	$5,717.30
Unincorporated County	6/4/1987	18	$45,990.52
Total		**34**	**$293,337.47**

Source: FEMA

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted may be more vulnerable to flooding because they do not meet code or are located in hazardous areas.

Repetitive Loss

The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period since 1978. At least two of the claims must be more than 10 days apart but within 10 years of each other. A repetitive loss property may or may not be currently insured by the NFIP.

Pitkin County, the City of Aspen, and the Towns of Basalt and Snowmass Village have no repetitive loss or severe repetitive loss properties as defined by FEMA.

Critical Facilities and Infrastructure

To estimate the potential impact of floods on critical facilities, a GIS overlay was performed of the flood hazard layer for critical facility point locations critical facilities at risk to the 1% annual chance flood are listed in Table 4-28. Critical facilities at risk to the 0.2% annual chance flood are shown in Table 4-29. As noted in Section 4.2.3, some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns. In total, 33 facilities were identified in the 1% floodplain, and another 4 in the 0.2% floodplain.

Replacement values were not available, thus an estimate of potential monetary loss could not be performed. Impacts to any of these facilities could have wide ranging ramifications, in addition to property damage.

Table 4-28 Critical Facilities in 1% Annual Chance Flood Hazard Areas

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	-	-	-	-	-	**0**
Energy	-	-	-	1	1	-	**1**
Food, Water, Shelter	-	-	-	1	-	-	**1**
Hazardous Material	-	-	-	-	-	-	**0**
Health and Medical	-	-	-	-	-	-	**0**
Safety and Security	-	-	-	2	1	-	**2**
Transportation	3	5	1	20	10	16	**29**
Total	**3**	**5**	**1**	**24**	**12**	**16**	**33**

Source: HIFLD, Pitkin FEMA NFHL Effective 12/4/2007, Eagle FEMA NFHL Preliminary 9/24/2021, WSP GIS Analysis

Table 4-29 Critical Facilities in 0.2% Annual Chance Flood Hazard Areas

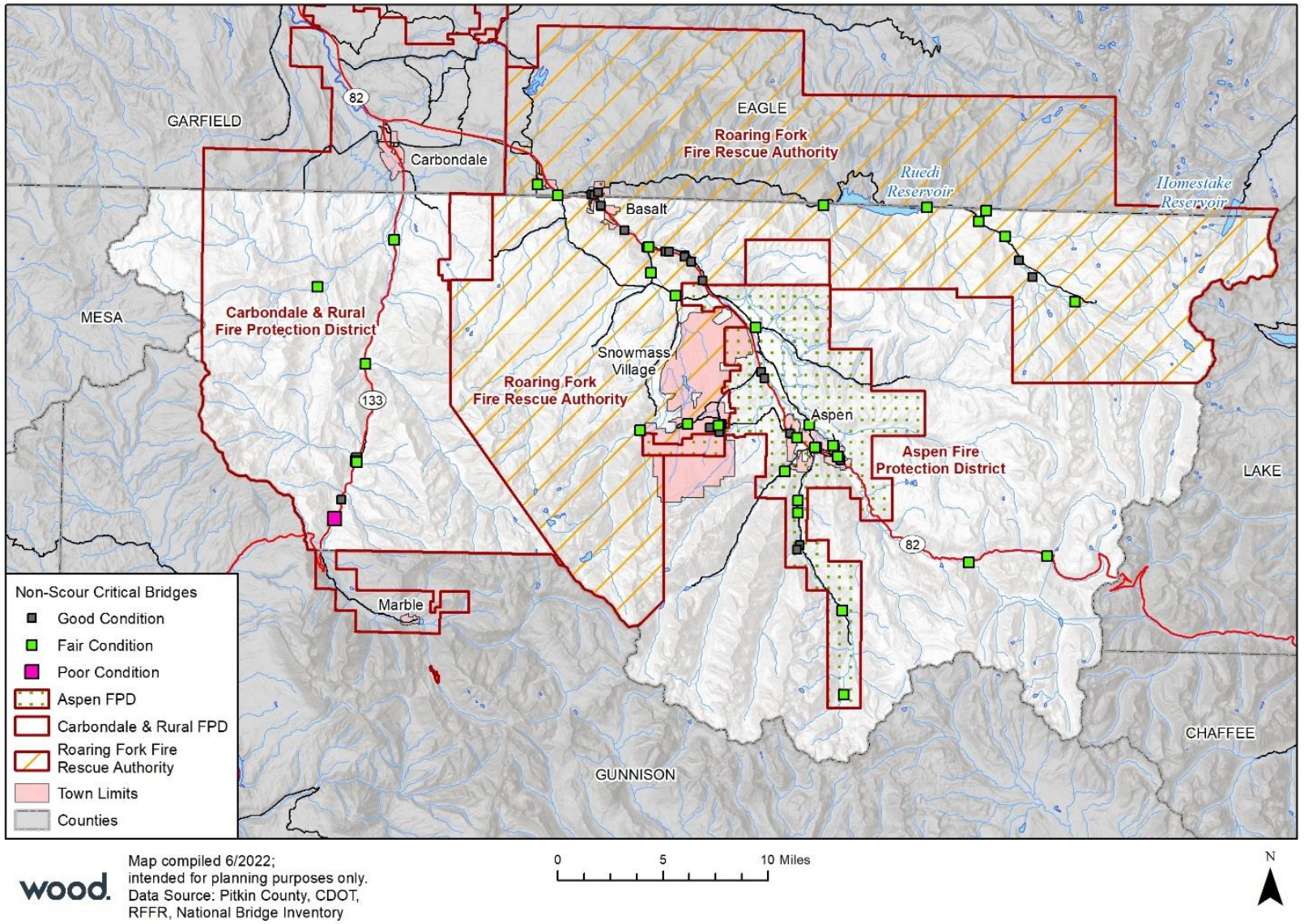
CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	1	-	-	-	1	**1**
Energy	-	-	-	-	-	-	**0**
Food, Water, Shelter	-	-	-	-	-	-	**0**
Hazardous Material	-	-	-	-	-	-	**0**
Health and Medical	-	-	-	-	-	-	**0**
Safety and Security	-	-	-	1	1	-	**1**
Transportation	-	-	-	2	-	1	**2**
Total	**0**	**1**	**0**	**3**	**1**	**2**	**4**

Source: HIFLD, Pitkin FEMA NFHL Effective 12/4/2007, Eagle FEMA NFHL Preliminary 9/24/2021, WSP GIS Analysis

Transportation routes could be cut off due to floodwaters, isolating portions of the planning area. These impacts may last after the floodwater recedes as flash floods in the area have been known to cause extensive damage to roadway infrastructure.

Pitkin County does not have any scour critical bridges, which are bridges with a foundation element determined to be unstable for the observed or evaluated scour condition. However, other issues of concern include when a bridge is structurally deficient (when key components like the superstructure are inspected and rated 'poor' or worse by a bridge engineer) or functionally obsolete (when design components are outdated). Based on a search of the National Bridge Inventory there is one bridge in the County that falls within these categories, located in the southwest area of the County as shown in Figure 4-24 below.

Figure 4-24 Pitkin County Bridges



Economy

Flooding can have a major negative impact on the economy. Based on the flood loss analysis, there are 30 commercial structures worth an estimated $49.8 million in total value directly at risk to flooding in the 1% annual chance zone. Based on the loss analysis this could result in approximately $12.5 million in direct losses. This does not account for other indirect losses such as business interruption, reduced tourism and visitation, lost wages, and other downtime costs.

These indirect losses can also have a significant economic cost. Flood events can cut off customer access to a business, interrupt the supply chain, as well as close a business for repairs or permanently. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating, relocating, or floodproofing flood-prone business structures.

Historic, Cultural, and Natural Resources

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in, flooding can impact the environment in negative ways. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams, damaging water quality. Human development such as bridge abutments can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

4.8.8 Development Trends

The potential for flooding and the extent of floodplains can be altered by land use changes and changes to land surface. New development and an increase in impervious surface can create localized flooding problems inside and outside of natural floodplains by altering or confining watersheds or natural drainage channels.

All municipal planning partners are participants in the NFIP and have adopted flood damage prevention ordinances in response to its requirements. The County and all municipal planning partners have committed to maintaining their good standing under the NFIP through initiatives identified in this plan.

The Future Avoided Cost Explorer (FACE) tool described in Section 4.7.8 estimates future annual damages from future flood events. The tool looks at three different climate scenarios (current climate conditions, moderately warmer climate by 2050, and severely warmer climate by 2050) as well as compares current population to low, medium, and high growth population scenarios. The following table compares the estimated annual damages for Pitkin County from flooding for each of the climate and population scenarios.

Table 4-30 Potential Future Economic Losses from Flooding in Pitkin County

CLIMATE SCENARIOS	POPULATION SCENARIOS LOW GROWTH (~20,150)	MEDIUM GROWTH (~23,200)	HIGH GROWTH (~26,000)
Current Conditions	Total Damages: $5.0M	Total Damages: $5.0M	Total Damages: $5.0M
	Total Damages per person: $240	Total Damages per person: $220	Total Damages per person: $190
Moderately Warmer Climate by 2050	Total Damages: $16M	Total Damages: $17M	Total Damages: $17M
	Total Damages per person: $780	Total Damages per person: $730	Total Damages per person: $650
Severely Warmer Climate by 2050	Total Damages: $40M	Total Damages: $50M	Total Damages: $50M
	Total Damages per person: $1900	Total Damages per person: $2200	Total Damages per person: $1900

Source: CWCB Future Avoided Cost Explorer: Hazards https://cwcb.colorado.gov/FACE

4.8.9 Differences by Jurisdiction

The mapped flood hazard area is shown by jurisdiction in Figure 4-20 through Figure 4-23.

Maroon Creek, Castle Creek, Hunter Creek, and Roaring Fork River run through the City of Aspen. There are 91 properties, primarily residential, with a total value of over $209 million in the SFHA in Aspen. The 1% annual chance flood event is estimated to cause over $52.3 million in losses in the City. Overall significance rating for flood in Aspen is High.

Roaring Fork River runs through much of the Town of Basalt, which is located at the confluence of the Roaring Fork and Fryingpan Rivers. There are 97 properties located in the SFHA in Basalt, including 24 commercial structures and 63 residential structures, with a total value of over $130 million. The 1% annual chance flood event is estimated to cause nearly $35.6 million in losses in the Town. Overall significance rating for flood in Basalt is High.

Snowmass Creek and Roaring Fork River run around the Town of Snowmass Village, and several smaller tributaries, including Wildcat Creek and Bruch Creek run through the Town. However, 1% and 0.2% annual chance flood hazard areas in the Town are very limited, and the Town's only property exposure to these flood hazard areas is one residential property in the 1% annual chance floodplain. Overall significance rating for flood in Snowmass Village is Medium.

4.8.10 Risk Summary

- The overall significance rating for flood in Pitkin County is Medium.
- Flash flooding that occurs with little or no warning will continue to impact the planning area.
- Flooding may be exacerbated by other hazards, such as wildfires.
- Flooding frequently causes other related hazards, such as erosion and mudflows.
- Countywide an estimated $591 million in total property value is located within the SFHA, and the 1% annual chance flood event is estimated to cause $147.76 million in losses to property.
- Related hazards: Wildfire, Erosion, Ice Jam Release, Drought

4.9 Geologic Hazards: Landslides, Debris Flows, Mudflows and Rockfalls

LANDSLIDES, DEBRIS FLOWS, MUDFLOWS, ROCKFALLS	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Significant	Critical	Highly Likely	**High**
Aspen	Significant	Critical	Highly Likely	**High**
Basalt	Significant	Limited	Highly Likely	**Medium**
Snowmass Village	Significant	Critical	Highly Likely	**High**
Aspen Fire	Limited	Limited	Likely	**Medium**
Roaring Fork Fire	Limited	Critical	Likely	**High**

4.9.1 Description

The 2018-2023 Colorado Natural Hazards Mitigation Plan defines landslides as the "downward and outward movement of slopes composed of natural rock, soils, artificial fills, or combinations thereof." Landslides can damage infrastructure, destroy, or destabilize structures, and cover rail and roadways, resulting in extended closures and temporary disruptions of utility services. Damage to oil and natural gas pipelines and electrical conduits may result in an interruption of services both in the affected areas and those further down the pipelines from affected areas. Geologic hazards are most common in areas with steep slopes and grading but may occur anywhere that natural or artificial materials may shift or slide.

The geologic hazards profiled in this section are landslides, debris flows, mudflows and rockfalls. Although the term landslide refers to a wide range of earth and ground movements, there are important distinctions between landslides, debris flows, mudflows and rockfalls with respect to preparedness, insurance, and hazard mitigation.

- **Landslides** are masses of soil and rock that move downward and outward from a slope along a defined sliding surface. Factors that influence the occurrence of landslides include steepness of slope, soil moisture, soil thickness and vegetation. Landslides are commonly triggered by saturated soils caused by heavy rainfall and/or melting snowpack.
- **Debris flows** are rapidly moving masses of mud, sand, soil, rock, and water that can reach speeds of 100 miles per hour. Due to their high speed and destructive forces, debris flows present a considerable threat to public safety and can destroy structures and other improvements in their path. To be considered a debris flow, more than half of the moving material must be larger than sand grains (i.e., gravel, pebble, cobble, and boulders).
- **Mudflows**, or mud flows, are masses of water and fine-grained earth materials that flow rapidly and turbulently downslope, usually in a drainageway. Mudflows commonly have the consistency of pancake batter or freshly mixed concrete and can incorporate trees, rocks, and other debris in its path, thereby increasing the erosive and destructive power of the flow. To be considered a mudflow, more than half of the particles in the mass must be sand-sized or smaller.
- **Rockfalls**, or rock falls, are the fastest type of landslide and occur most frequently in the spring when there is high soil moisture and repeated freezing and thawing. Most rockfalls only involve the movement of one or a few rocks or boulders (sometimes referred to as rock topple). The failure of a large mass of rocks, sometimes referred to as a rockslide or rock avalanche, presents a greater potential risk to people and property that may be in the path. Indirect impacts include maintenance costs associated with clearing highway ditches in rockfall areas.

4.9.2 Past Events

In the 1970s and 1980s, Pitkin County experienced a spike in landslide problems in developing residential areas near ski slopes. Since then, several notable, destructive events have occurred, as indicated in the table below. Table 4-31 provides a summary of past geologic hazard events in Pitkin County.

Table 4-31 Significant Geologic Hazard Events in Pitkin County, 1980-2022

YEAR	LOCATION	EVENT DESCRIPTION
1984	Woody Creek	Mudslide washed out Woody Creek Rd. 7 miles from intersection with River Rd., causing several injuries.
1993	Castle Creek	A large mudslide on Castle Creek damaged the Aspen Music School.
1994	Shale Bluffs	A large mudslide occurred in the area known as Shale Bluffs, west of the Aspen/Pitkin County Airport, during a visit by President Clinton.
1996	Aspen Mountain	Two debris flow events on the west side of Aspen Mountain in May 1996 deposited 5-ft. deep mud and debris, burying cars and damaging the Music Hall.
1997	Aspen Country Day School	A spring landslide in a tributary drainage of Castle Creek damaged buildings, grounds and cars and forced relocation of classes for remainder of school year.
2010	Redstone	Multiple debris flows and mudflows in July-August 2010 covered parts of Colorado 133, Redstone Blvd., and Redstone Campground ($34,000 to remove, including geotechnical studies).
2011	Independence Pass	A mudslide closed Independence Pass for 3 hours in June 2011 near the ghost town of Independence, stranding motorists, but causing no injuries.
2011	Buttermilk Ski Area	Rapid warmup after heavy snowfall in May 2011 caused mudflow that sent 2 feet of mud into one home ($2 million).
2012	Hagerman Peak	One hiker killed, one injured in rockslide about 11 miles southeast of Aspen.
2016	Redstone	In July, heavy rainfall from showers and thunderstorms led to rising waters which resulted in a mudslide at the confluence of the middle and lower Thompson Creek just outside of Carbondale.
2017	Aspen Airport	Several rockslides occurred after showers and storms produced heavy rain, which blocked eastbound lanes on portions of Colorado Highway 82. Radar estimated 0.50 to 0.70 inches of rain fell earlier in the afternoon. The Aspen-Pitkin County Airport ASOS measured 0.93 of an inch of rain in the early evening.
2019	Redstone	Showers and thunderstorms produced heavy rain which led to a mudslide along County Road 3 near Marble. The road was closed in both directions as a result.
2021	Redstone	Mudslides occurred on Colorado Highway 133 at Redstone Boulevard, 9 miles north of McClure Pass near mile marker 55. The highway was closed in both directions for almost twelve hours due to cleanup operations. Estimated property damages totaled $50,000
2021	Redstone	Several mudslides occurred along Colorado Highway 133 near Redstone because of heavy rains. Debris depth was 7 to 8 feet with one slide and 3 to 4 feet deep with another. As a result, motorists were stranded until cleanup operations were complete. Estimated property damages were $500,000.
2021	Aspen Airport	A rockslide occurred because of heavy rain along Colorado Highway 82 at Shane Bluffs (mile marker 36).
2021	Aspen	Pitkin County Sheriff reported the closure of Independence Pass along Colorado Highway 82 between mile markers 47 and 72 due to mudslides.
2021	Avalanche Creek Road in Redstone	In July 2021, a mudslide occurred in Pitkin County. Crews were not able to clear the mud and debris due to the risk of further slides overnight, so campers in the area were trapped overnight. Estimated damages totaled $300,000

Sources: Colorado Natural Hazards Mitigation Plan (2018), Pitkin County Hazard Mitigation Plan (2017), The Aspen Times (August 27, 2012), Aspen Daily News (July 8, 2015), CBS Denver (July 22, 2021), and NCEI 1950-2022

Several events that resulted in fatalities have occurred in Pitkin County. A hiker was killed August 25, 2012, in a rockslide on Hagerman Peak, about 11 miles southeast of Aspen. Two people in a party of five were reported injured, one seriously, according to the Pitkin County Sheriff's Office. Mountain Rescue responded through a mutual-aid arrangement with Gunnison County. The rockslide occurred at nearly 13,000 feet. Then, in September of 2013, a deadly rockfall in September 2013 claimed five lives of a family following heavy rains near a popular hiking location near Buena Vista, Colorado in adjacent Chaffee County.

The NCEI dataset also reported several geologic hazard events that resulted in significant monetary losses. On July 22nd, 2021, heavy rain caused a debris flow near Redstone in Pitkin County. The debris, including mud, branches, and rocks resulted in the closure of Avalanche Creek Road. Responders were not able to clear the road due to poor conditions and safety concerns, so motorists and campers were stuck overnight. The debris was cleared the next morning and the road was reopened. Estimated property loss was reported to be $300,000 in damages. One week later, on July 29, 2021, several mudslides occurred near Redstone along Highway 133 due to heavy rain. The debris accumulated up to 8 feet in depth, standing motorists until responders were able to clean the area. The incident resulted in $500,000 of property damages. Figure 4-25 displays the aftermath of the mudslides.

Figure 4-25 Mudslide Near Redstone in Pitkin County, July 30, 2021

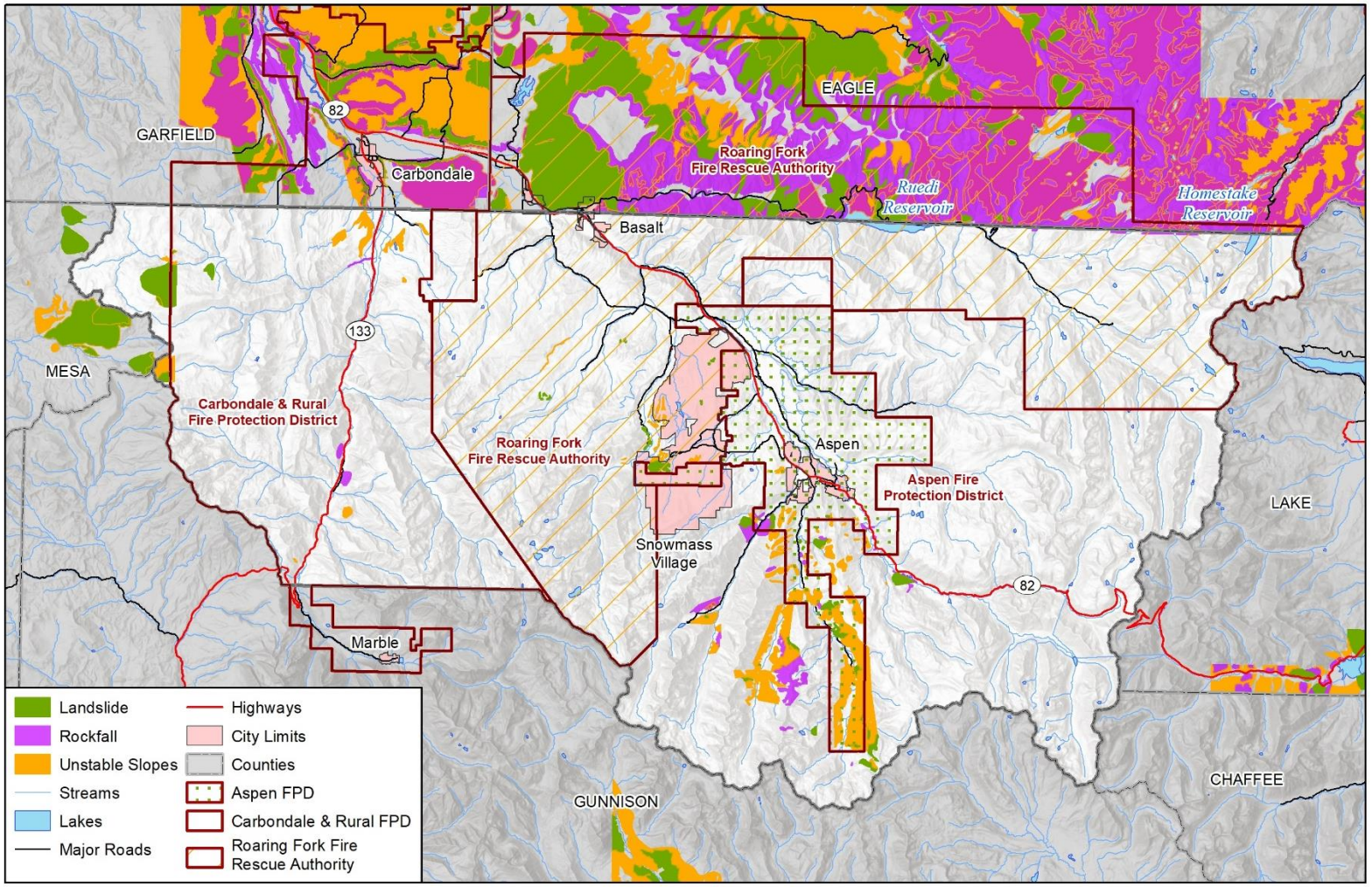
Source: CBS Denver (photo from Carbondale & Rural Fire Protection District)

4.9.3 Location

Debris flow and mudflow hazards are closely related to flash flooding, with heavy rainfall, rapid snowmelt, or both being the common triggering event. Rapid runoff of floodwaters in the drainageway can pick up and carry soil, rocks, vegetation, and other debris downstream with tremendous force. Debris flows and mudflows compound the impacts of flash flooding by increasing the destructive power of the event and by depositing large volumes of accumulated material. In the lower reaches of the channel near the valley floor, the mud and debris slow down and spread out to form a debris fan, or mud deposit. Like flash floods, debris flows, and mudflows occur with little or no warning, cause extensive erosion, and can potentially pose a substantial risk to life and property.

Landslides, debris flows, mudflows and rockfalls are widespread, frequent occurrences in the Rocky Mountain West. Correlated closely with elevation change, landslides and other geologic hazards occur naturally in Pitkin County on a continuous basis and can also be triggered through human activity related to land development, mining, and other disturbances. Due to its topography, most areas of Pitkin County are vulnerable to geologic hazards. Landslides and other geologic hazard events have been recorded at Aspen Mountain, Snowmass Village, Independence Pass, Redstone, and other areas in the Roaring Fork, such as Fryingpan and Crystal River valleys. Major roads and highways are also locations that frequently experience some type of geologic hazard, particularly Highway 82 and Highway 133, and Castle Creek Road. The HMPC also noted that the Highway 170 corridor can have an impact on transportation in Pitkin County. Figure 4-26 displays the areas in Pitkin County likely to experience various geologic hazards. The overall ranking for geographic extent of geologic hazards in Pitkin County is significant.

Figure 4-26 Pitkin County Geologic Hazards



wood.

Map compiled 6/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT, RFFR,
Colorado Geologic Survey

4.9.4 Magnitude/Severity

Saturated soils due to heavy precipitation or melting snowpack are often the determining factors in the frequency and magnitude and frequency of land movements. Landslides can also be triggered by loss of vegetation after a wildfire and erosion of the toe of the slope by rivers, earthquakes, or land development activities.

As noted in the 2018 Colorado Natural Hazards Mitigation Plan, the potential for property and infrastructure damage is considerable: “Landslides occur commonly throughout Colorado, and the annual damage is estimated to be in the millions of dollars.” Transportation infrastructure is typically the most impacted infrastructure from landslides in Colorado, although residential structures have also been impacted.

Although rare, deaths, and injuries can occur from landslides, such as in the several incidents highlighted above. More typically, landslide events are gradual movements in areas of steep topography and where the soil conditions contribute to the movement of the slope. Damages are often limited to cracks in foundations and damage to roads. Individual property owners may experience more or less damage depending on site-specific movement.

Rockfall, on the other hand, is a sudden movement, and could potentially result in significant damages, injuries, or death. Rockfall events are less frequent but remain a constant threat, particularly to Colorado’s mountain roadways. Few hazards exceed the potentially devastating consequences of debris flows, fast-moving, high-density slurries of water, sediment, and vegetative debris with enormous destructive power that generally are triggered in response to periods of intense rainfall or rapid snowmelt on steep hillsides.

The magnitude severity of landslides and other geologic hazards is rated as critical for Pitkin County. Figure 4-27 displays a rockslide that closed Highway 82 near the City of Aspen in Pitkin County.

Figure 4-27 Rockslide on Highway 82 Near Aspen on July 11, 2017

Source: The Post Independent

4.9.5 Probability of Future Events

According to the CGS, landslides do not present an immediate risk to populated areas, transportation systems, public infrastructure, or the economy. Geologic studies can determine the location of historic landslide paths and deposits and instruments can measure activity to determine whether movement is occurring. The HMPC noted that the CDOT has spent millions of dollars to help reduce chances of geologic hazards along Highway 133. Due to the steep terrain in most of Pitkin County, the Planning Team has rated the probability of future landslide occurrences highly likely (near 100 percent chance of occurrence next year or it happens every year).

4.9.6 Climate Change Considerations

Communities in the Roaring Fork Valley have enacted strict development standards for development on slopes and hillsides, but the potential for extreme precipitation events fueled by climate warming may present increased risks to people and property in or near geologically sensitive areas. Heavy rain events reduce slope stability that can result in landslides, debris flows, mudflows, rockfall, rockslides and other types of mass movement of soil and rock. Higher streamflow during these events can transport more sediment downstream, impacting roads, highways, and other infrastructure.

Although uncertainty exists in the evaluation of the impacts of climate change on landslides and the stability of natural and engineered slopes, an increase in the frequency and intensity of severe rainfall events -- a primary trigger of rapid-moving landslides that can cause fatalities -- will result in more people and property exposed to landslide risk.

According to a 2012 special report by the IPCC, “There is high confidence that changes in heat waves, glacial retreat, and/or permafrost degradation will affect slope instabilities in high mountains, 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.”

Communities can address changing landslide and other geologic hazard risks through targeted regulations, climate-informed design, and floodplain infrastructure aimed at mitigating anticipated impacts.

4.9.7 Vulnerability Assessment

People

The overall vulnerability of the population is low. The general population is not overly vulnerable to landslides, but rockfall can cause serious injury or death. According to GIS analysis updated during the 2022 planning process there are an estimated 800 residents potentially exposed to landslide-susceptibility hazard areas. The City of Basalt has the greatest number, 484, of residents exposed. Table 4-32 summarizes the population exposure in the planning area.

Table 4-32 Estimated Population Exposed to Landslide Hazards Areas

JURISDICTION	POPULATION
Aspen	33
Basalt	484
Snowmass Village	229
Unincorporated	54
Total	800

Source: Pitkin County & Eagle County Assessor Data 2022, Colorado Geologic Survey, WSP GIS Analysis

Property

During the 2022 development of this plan update, a GIS analysis of exposure to landslide hazard areas was performed. Table 4-33 summarizes landslide exposure in the county, based on an intersect of improved parcels with landslide hazard areas. This analysis does not necessarily mean these properties are at imminent risk, but it does indicate potential exposure to damage. More site-specific investigations would be needed to determine risk. The greatest potential exposure to risk for general property is in Snowmass Village.

Table 4-33 Geologic Hazards Exposure by County and Jurisdiction

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Aspen	Residential	17	17	$20,295,500	$10,147,750	$30,443,250
	Total	**17**	**17**	**$20,295,500**	**$10,147,750**	**$30,443,250**
Basalt	Residential	211	214	$169,887,880	$84,943,940	$254,831,820
	Vacant	2	2	$635,770	$635,770	$1,271,540
	Total	**213**	**216**	**$170,523,650**	**$85,579,710**	**$256,103,360**
Snowmass Village	Commercial	1	1	$27,900	$27,900	$55,800
	Exempt	1	1	$380,100	$380,100	$760,200
	Mixed Use	1	1	$1,922,300	$1,922,300	$3,844,600
	Residential	101	102	$235,523,400	$117,761,700	$353,285,100
	Total	**104**	**105**	**$237,853,700**	**$120,092,000**	**$357,945,700**
Unincorporated	Agricultural	1	1	$687,800	$687,800	$1,375,600
	Commercial	1	5	$6,021,700	$6,021,700	$12,043,400
	Residential	22	23	$45,835,100	$22,917,550	$68,752,650
	Total	**24**	**29**	**$52,544,600**	**$29,627,050**	**$82,171,650**
Grand Total		**358**	**367**	**$481,217,450**	**$245,446,510**	**$726,663,960**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, Colorado Geologic Survey, WSP GIS Analysis

Critical Facilities and Infrastructure

Transportation networks are the most exposed aspect of the planning area to rockfall, landslide and debris flow incidents. Residents and visitors alike are impacted by landslides when roads are damaged by landslides. This includes Highway 82 and Highway 133, as well as several major roads such as Castle Creek Road. The loss of transportation networks could potentially cause secondary damage to the overall planning area's infrastructure, including revenue, transportation availability, emergency response mechanisms and other essential capabilities by preventing the means of these resources from activating or moving between locations. Safety and security are the second most vulnerable type of critical facility, and every jurisdiction in the planning area has at least one safety and security facility at risk to geologic hazards. Table 4-34 summarizes the results of the GIS analysis. As noted in Section 4.2.3, some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns. A total of 12 facilities were identified as at risk.

Table 4-34 Critical Facilities within Geologic Hazards Areas

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	-	-	-	-	2	**2**
Energy	-	-	-	1	1	2	**3**
Food, Water, Shelter	-	1	-	-	-	1	**1**
Hazardous Material	-	-	-	5	-	-	**5**
Health and Medical	-	-	-	-	-	-	**0**
Safety and Security	-	-	-	-	-	-	**0**
Transportation	-	-	-	1	1	-	**1**
Total	**0**	**1**	**0**	**7**	**2**	**5**	**12**

Source: Pitkin County Assessor Data 2022 & Eagle County Assessor Data 2022, Colorado Geologic Survey, WSP GIS Analysis

Economy

Economic impacts typically center around transportation routes temporarily closed by rockfall, debris flow, mudflow, or landslide activity. These roads may be used to transport goods across the county or provide access by visitors and tourists. Depending on the amount of damage, the road may simply need to be cleaned off, or may need some level of reconstruction and affect the local economy indirectly. Total economic losses due to geologic hazards reported by the NCEI dataset was $1,696,000 in damages from 2003-2022 in Pitkin and surrounding areas.

Historic, Cultural, and Natural Resources

The environment vulnerable to landslide hazard is the same as the environment exposed to the hazard. While typically a natural process, some environmental problems can result from mass movements. Landslides that fall into streams may significantly impact fish and wildlife habitat, as well as affecting water quality. Hillsides that provide wildlife habitat can be lost for prolonged periods of time.

4.9.8 Development Trends

The severity of landslide problems is directly related to the extent of human activity in hazard areas. Human activities such as property development and road construction can also exacerbate the occurrence of landslides. Landslide areas tend to be picturesque and often within mountainous locations and therefore attract development. Development in landslide areas frequently consists of vacation homes and represents a potential risk for injury, loss of life and property.

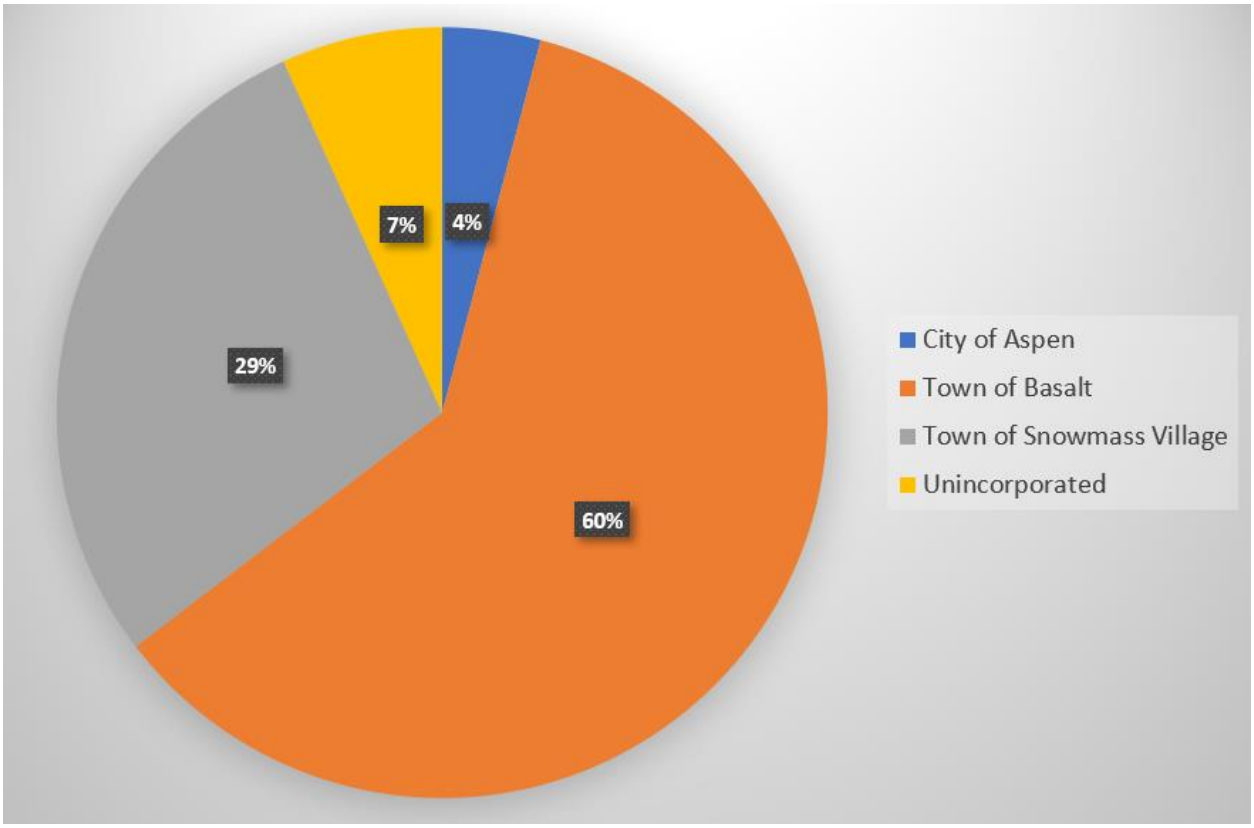
4.9.9 Differences by Jurisdiction

While all jurisdictions in the planning area are rated as highly likely to experience geologic hazards, some jurisdictions are likely to experience greater losses than others. Due to the location of Snowmass Village at high elevation and near steep topography, as well as the total value of existing infrastructure in the town, the possible monetary loss due to geologic hazards is greatest in the Town of Snowmass Village.

It was found that an estimated total of 800 people in Pitkin County are exposed to geologic hazards. Figure 4-28 provides a breakdown of the proportion of exposed people by jurisdiction. The Town of Basalt has the greatest number of exposed people in the planning area, totaling 484 of the 800 exposed persons, or 60%. The jurisdiction with the lowest number of exposed individuals is the City of Aspen. Although the City of

Aspen has around twice the total population as the Town of Basalt and Town of Snowmass Village, the City of Aspen only has an estimated 33 people who are exposed to geologic hazards, or 4% of the total people exposed in the planning area.

Figure 4-28 Estimated Proportion of Population Exposed to Landslide Hazards Areas



Source: U.S. Census Data 2020, Image created by WSP

Within Pitkin County, the City of Aspen has the greatest number of critical facilities exposed to a geologic hazard and the Town of Basalt has the lowest number of critical facilities. Transportation, safety and security, and communication are three of the most vulnerable types of critical facilities. The City of Aspen and the Town of Basalt have the greatest number of safety and security facilities exposed to a geologic hazard. In the Town of Snowmass Village and in the overall County of Pitkin, transportation facilities are the most vulnerable types of critical facilities.

4.9.10 Risk Summary

- Overall, landslides, rockfalls, and debris flows range from medium to high significance hazards in the planning area. Landslides have the potential for direct property impacts including residential structures but more likely infrastructure corridors including roads and highways, power line corridors, and gas lines.
- Landslides, debris flow, and rockfall do occur regularly in Pitkin County and are rated as highly likely for the probability of future occurrence. The direct effect on the populace and infrastructure is rated as limited to critical.
- There is potential for severe injury or death from rockfall.
- The secondary effect of closed roads is a more likely threat, especially if the closed roads cut off emergency personnel from those who need assistance.

- There are numerous homes, businesses, and critical facilities exposed throughout the County. The degree of vulnerability of these structures depends on the codes and standards the structures were constructed to. Information to this level of detail is not currently available.
- As incidents of wildfires increase and hillsides are void of vegetation, rain-soaked hillsides are more likely to slide resulting in increased damage countywide.
- Future development could lead to more homes in landslide risk areas and debris fans.
- Mapping and assessment of landslide hazards are constantly evolving. As new data and science become available, assessments of landslide risk should be reevaluated.
- Climate change may cause warming temperatures, more frequent storms, more droughts, and more wildfires reducing vegetation on steep slopes which would all contribute to increase probability for landslide occurrences.
- Landslides may cause negative environmental consequences, including water quality degradation.
- Related hazards: Avalanche, Drought, Flooding, Wildfire

4.10 Ice Jam Release

ICE JAM RELEASE	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Significant	Moderate	Likely	**Medium**
Aspen	Significant	Moderate	Likely	**Medium**
Basalt	Significant	Moderate	Likely	**Medium**
Snowmass Village	Limited	Moderate	Occasional	**Low**
Aspen Fire	Significant	Moderate	Likely	**Medium**
Roaring Fork Fire	Significant	Moderate	Likely	**Medium**

4.10.1 Description

An ice jam happens when chunks of ice clump together to block the flow of a river. Ice is typically carried within the flow of a stream or river. However, the ice can begin to pile up and accumulate if it encounters an obstruction to the flow, including sharp bends on a river or objects such as a bridge that lies close to the river's elevation. Ice jams can also occur at the mouth of a tributary, or even an area where the river's slope decreases enough to slow the current and allow for the buildup of ice.

Ice jams can significantly reduce the flow of a river and cause upstream flooding—sometimes called ice dams. Ice jam flooding can also occur downstream when the jam releases in a sudden outburst flood. In either case, flooding can cause damage in communities near the river.

Ice jam floods are less predictable and potentially more destructive than open-water flooding and can produce much deeper and faster flooding. Ice jam floods also may occur during freezing weather, and may leave large pieces of ice behind, but they are much more localized than open-water floods. Ice jams can also damage an economy by causing river-side industrial facilities such as hydro-electric generating stations to shut down and to interfere with ship transport. The United States averages 125 million dollars in losses to ice jams per year.

Ice jams on rivers usually occur in the springtime as the river ice begins to break up, but may also occur in early winter during freeze-up. The break-up process is described in three phases: pre-break-up, break-up and final drive. Pre-break-up usually begins with increased springtime river flow, water level, and temperatures fracturing the river ice and separating it from the shore. Changes in river height from dam releases may also affect the pre-break-up. During the break-up, the ice in areas of rapids is carried downstream as an ice floe and may jam on still frozen sections of ice on calm water or against structures in the river. Smaller jams may dislodge, flow downstream and form a larger jam. During the final drive, a large jam will dislodge and take out the remaining jams, clearing the river of ice in a matter of hours. Ice jams usually occur in spring, but they can happen as winter sets in when the downstream part becomes frozen first. Freeze-up jams may be larger because the ice is stronger and temperatures are continuing to cool unlike a spring break-up when the environment is warming, but are less likely to suddenly release water.

Ice jams become a more significant problem when waterways are running at lower than normal water levels, which has been the case in Pitkin County due to recent drought conditions.

4.10.2 Past Events

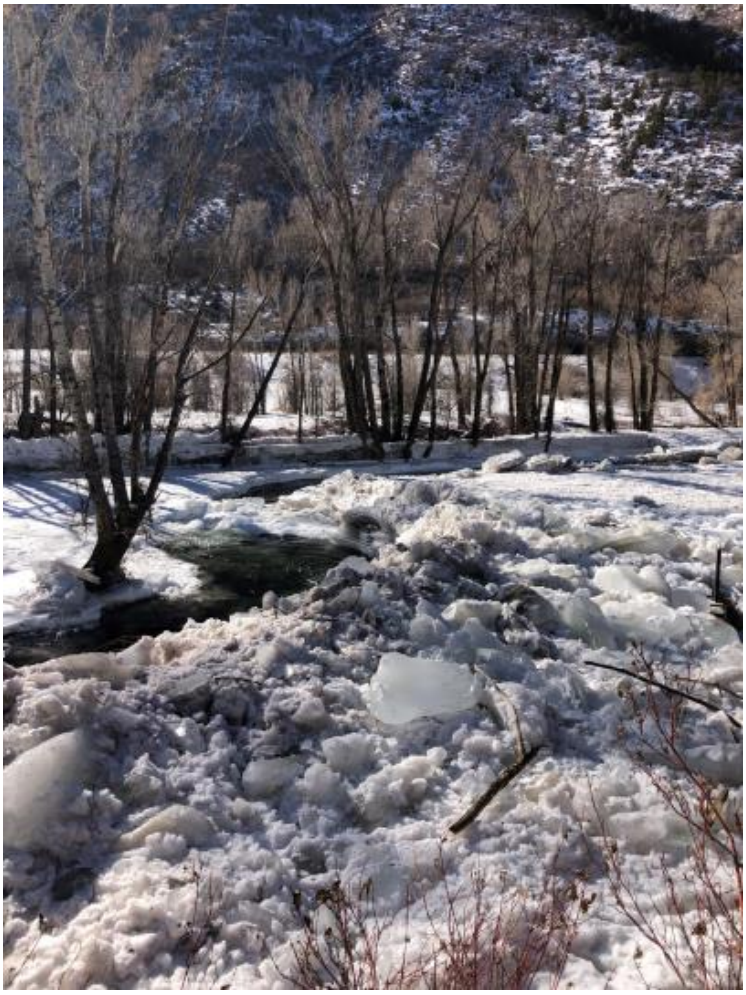
The US Army Corps of Engineers Ice Engineering Research Group maintains a database of reported ice jams throughout the country. This database shows 324 reported ice jams in Colorado since 1919, six of which were located in Pitkin County. An additional jam in December 2020 was identified by the HMPC. These events are listed in Table 4-35 and mapped in Figure 4-30.

Table 4-35 Significant Ice Jams in Pitkin County

DATE	CITY	RIVER
12/28/1954	Thomasville	Lime Creek
11/30/1984	Aspen	Hunter Creek
2/13/2004	Aspen	Roaring Fork River
12/4/2004	Aspen	Roaring Fork River
12/8/2011	Aspen	Roaring Fork River
1/5/2019	Basalt	Roaring Fork River
12/25/2020	Basalt (7 miles upstream)	Roaring Fork River

Sources: USACE Ice Jam Database https://icejam.sec.usace.army.mil/, and Roaring Fork Conservancy

Figure 4-29 Ice Jam on the Roaring Fork River above Basalt, December 25, 2020

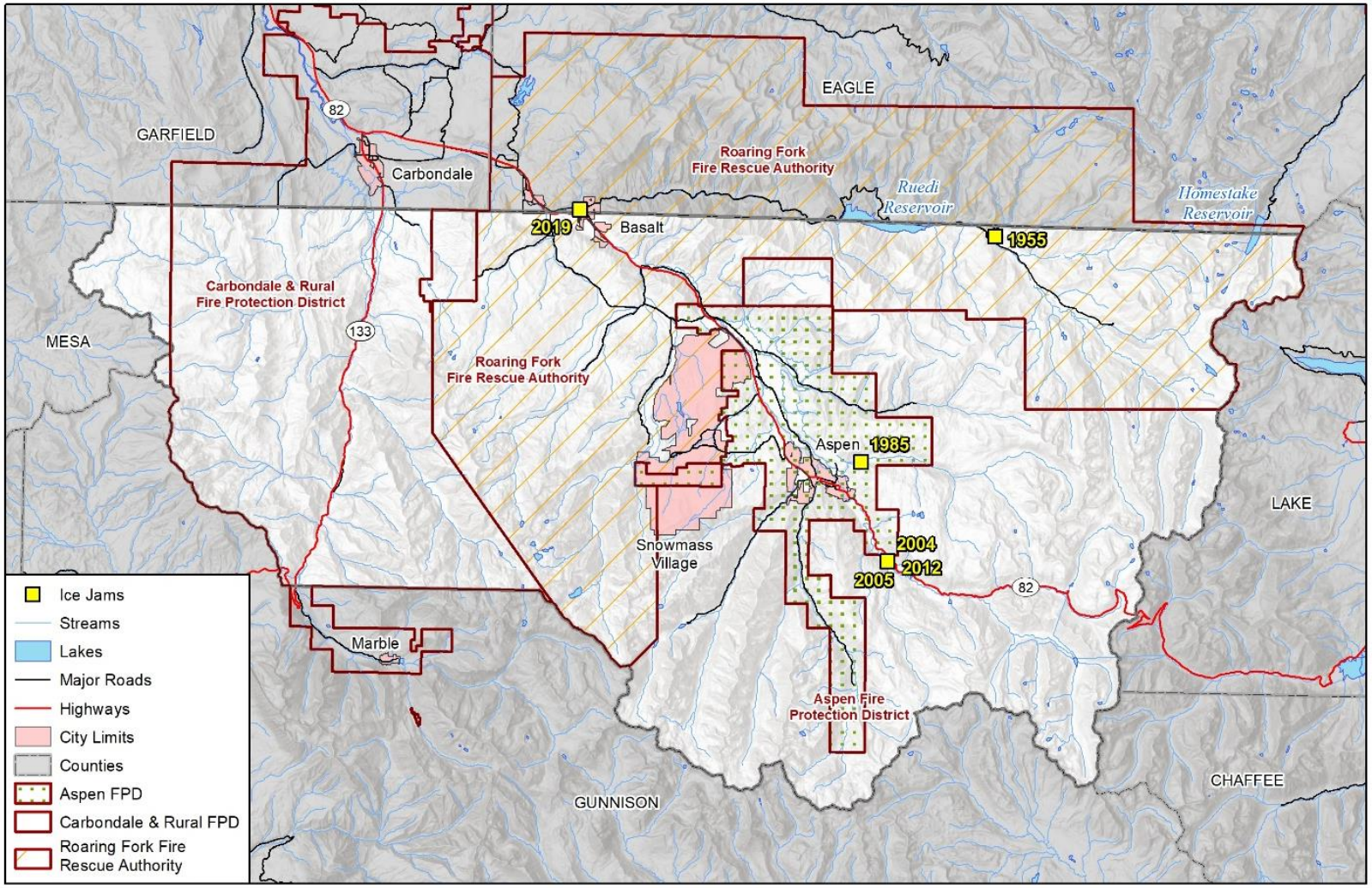


Source: Roaring Fork Conservancy

4.10.3 Location

Ice jams are a potential hazard in all major waterways in the County. The majority of recorded ice jams in the County have been on the Roaring Fork River, with Lime Creek and Hunter Creek each having one jam reported.

Figure 4-30 Significant Ice Jams in Pitkin County



Map compiled 6/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT, RFFR,
USACE Ice Jams

4.10.4 Magnitude and Severity

Ice Jam flooding can cause damage to people and property the same as any flooding. Because ice jam releases occur so sudden, they can involve higher volume and velocities than conventional river flooding, more akin to dam failure incidents. The sudden and localized nature of ice jam releases makes advance warning and notification more difficult, which makes it harder for people to get out of harm's way in time.

The USACE database did not list any damages or injuries associated with these events. However, the HMPC reported that an individual died in ice jam flooding in the 2019 event, while in the 2020 incident two people fishing were barely able to evacuate in time.

There is not any generally acknowledged scale for measuring ice jam flooding aside from measuring the impacts afterwards in terms of water depths and damages. However as noted above, this data is not systematically tracked. The potential danger is greater on faster rivers, but conversely is higher when those rivers are running at low flows.

4.10.5 Probability of Future Events

Pitkin County has experienced five significant ice jams in the last 20 years, which translates to a frequency of one event every four years. However, the relatively small number of incidents and the lack of systematic data makes this frequency an approximation at best. Ice jams are more likely in drought years when waterways are running at lower than normal levels.

4.10.6 Climate Change Considerations

The exact impacts of climate change on ice jams has not been heavily researched. However, climate change is expected to increase the number and severity of drought conditions in the planning area, leading to lower water flows that make ice jams more likely. Climate change can also lead to more rapid warming conditions in the spring, which can also make ice jam breaks more likely.

4.10.7 Vulnerability Assessment

People

People can be injured or killed in flash floods resulting from sudden ice jam releases. The greatest risk is to people recreating on the river in wintertime, such as people fishing; the isolated nature of these visitors makes it difficult to warn them before the flood hits.

Property

Property can be damaged by backup flooding upstream of an ice jam, or by sudden flash flooding downstream when an ice jam breaks up carrying chucks of ice with it.

Critical Facilities and Infrastructure

Critical infrastructure along rivers can be damaged by ice jams, especially bridges and water treatment facilities.

Economy

According to the National Weather Service, the United States averages $125 million in losses to ice jams per year.

Historic, Cultural, and Natural Resources

Ice jams may scour riverbeds, causing damage or benefit to wildlife habitats.

4.10.8 Development Trends

There are no known development trends in the planning area that are likely to affect the risk of this hazard.

4.10.9 Differences by Jurisdiction

Historically, the largest and more damaging ice jams have been along the Roaring Fork River from Aspen to Basalt. There has been no record of significant ice jams in the Town of Snowmass Village, although the possibility exists.

4.10.10 Risk Summary

- The overall significance rating for ice jams in Pitkin County is Medium.
- Ice jams can cause upstream flooding due to water backing up, or flash flooding downstream when the jam releases in a sudden outburst flood.
- There has been one reported death in Pitkin County from ice jam flooding.
- Ice jams are more likely when waterways are running low, such as during drought conditions.
- Nationally, ice jams cause $125 million in losses each year.
- Related hazards: flooding, winter storm, drought.

4.11 LIGHTNING

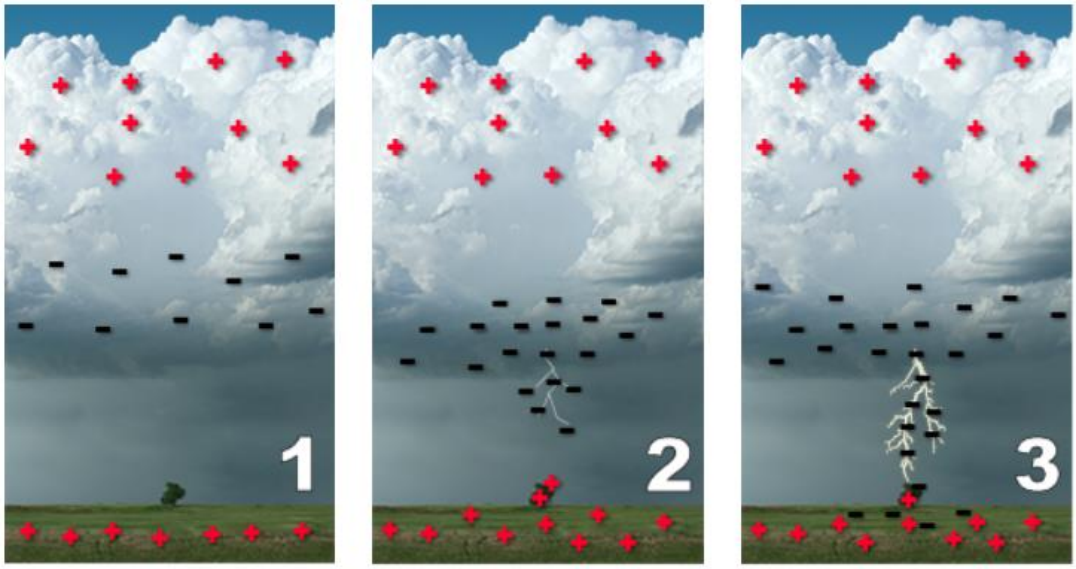
LIGHTNING	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Significant	Minor	Likely	**Low**
Aspen	Significant	Minor	Likely	**Low**
Basalt	Significant	Minor	Likely	**Low**
Snowmass Village	Significant	Minor	Likely	**Low**
Aspen Fire	Significant	Minor	Likely	**Low**
Roaring Fork Fire	Significant	Minor	Likely	**Low**

4.11.1 Description

Lightning is one of the more dangerous weather hazards in Colorado. Each year, lightning is responsible for deaths, injuries, and property damage, including damage to buildings, communications systems, power lines, and electrical systems. According to the National Lightning Safety Institute (NLSI), Colorado ranks third in the nation in deaths due to lightning strikes with 39 fatalities recorded between 1990 and 2003 (behind only Florida and Texas). Over the same period, Colorado also ranks third nationally in deaths per million people (behind only Utah and Wyoming). Nationwide, estimates of property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects exceed $8-10 billion per year.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. It frequently strikes away from the rain core, either ahead or behind the thunderstorm and can strike 5-10 miles from the storm in areas that most people do not consider to be a threat. According to the 2013 Colorado Natural Hazards Mitigation Plan, Colorado averages 529,000 cloud-to-ground lightning strikes per year and deaths and injuries due to lightning occur on a regular basis. Cloud-to-ground lightning formation is illustrated in Figure 4-31 below.

Figure 4-31 Cloud-to-Ground Lightning Formation



Source: National Weather Service

4.11.2 Past Events

According to NCEI data, lightning strikes have been responsible for three fatalities in Pitkin County, in addition to other injuries and minor property damage. The table below describes several notable lightning events that occurred in Pitkin County in the last 28 years.

Table 4-36 Significant Lightning Events in Pitkin County, 1994-2022

DATE	LOCATION	DESCRIPTION
April 23, 1994	Capitol Peak	Lightning struck three climbers near the summit, killing one climber and injuring the other two.
July 24, 1997	Capitol Creek	A man was struck by lightning and fell off a cliff (cause of death ruled lightning, not fall).
July 15, 2000	Conundrum Hot Springs	A hiker was struck by lightning, shredding her clothes, blowing off her boots, and causing serious bleeding and burns.
July 29, 2006	Aspen Mountain	Lightning struck and damaged aviation navigational equipment, resulting in cancelled flights while repairs were made (14 hours).
July 6, 2008	American Lake Trail	A family of five was struck by lightning while hiking, injuring two including 15-yr. old girl needing CPR to be resuscitated.

Source: National Centers for Environmental Information

Additional events include Basalt Mountain in 2009, where several trees were set on fire by lightning strike, and Elk Camp in July of 2022 when lightning damaged a chairlift and knocked a woman off her feet.

4.11.3 Location

Lightning can occur anywhere in Pitkin County and poses a similar risk to all areas within the county.

4.11.4 Magnitude and Severity

People attending large outdoor gatherings (i.e., sporting events, concerts, fairs, festivals, etc.) are particularly vulnerable to death and injury from lightning strikes. Men are notably more likely to die from a lightning strike than women. According to the National Weather Service, during the period 2010-2021, male fatalities outnumbered female fatalities 223-63. Outdoor recreationists generally face a higher risk when hiking or camping in the lightning-prone high country. Wildfires and grassfires are frequently ignited by lightning strikes.

Buildings and equipment exposed to lightning strikes may be damaged and power surges can damage electronic equipment. Direct flash strikes near utility infrastructure can disrupt services. Many critical facilities are equipped with grounding systems. Most lightning events result in only personal property damage and do not significantly impact infrastructure or the delivery of critical services. Disruptions of electrical power due to lightning are generally short in duration (less than 24 hours). The severity of the lightning hazard is rated limited by all four communities, meaning that minor injuries and minor property damages are possible, with minimal disruptions to infrastructure and critical services.

4.11.5 Probability of Future Events

Lightning can occur anywhere there is a thunderstorm. The average number of lightning flashes by month is shown in the table below.

Over 4,000 lightning flashes are expected to occur on any given day during the months of July and August. Most lightning strikes that result in casualties occur between the hours of noon and 5:00 pm, spiking between 2:00 and 4:00 pm. In all four communities, the probability of the lightning hazard is rated likely (10-100 percent chance of occurrence next year or it has a recurrence interval of 10 years or less).

Table 4-37 Average Lightning Flashes in Colorado per Day by Month

MONTH	AVERAGE # OF LIGHTNING STRIKES
January	2
February	5
March	40
April	302

MONTH	AVERAGE # OF LIGHTNING STRIKES
May	1,335
June	2,856
July	5,350
August	4,811
September	1,604
October	292
November	61
December	1
12-month Average	**1,388**

Source: www.weather/gov/pub/LightningFlashCounts

4.11.6 Climate Change Considerations

Since the locations of lightning strikes correlate closely with locations where heavy rainfall and convective activity occur, projections about the effects of climate change on these atmospheric factors can be considered together. Climate researchers at the University of California Berkeley used the relationship of the three factors to predict changes in lightning rates due to climate change.

Two central factors set the atmospheric stage for lightning: the amount of precipitation and the level of instability in the atmosphere, conditions that allow air to rise rapidly. Since both heavy precipitation and storm energy are related to the amount of water vapor available in the atmosphere, and given projections of a moister climate as temperatures rise, more vigorous thunderstorms and more lightning can be expected. The study found that lighting rates will increase 12 percent for every two degrees Fahrenheit rise in global temperatures, an estimated 50 percent increase by the end of the century.

With more water in the atmosphere to fuel convection, thunderstorms are expected to become more explosive. Lightning is already the trigger for more than half of U.S. wildfires, fires that are often the hardest to fight. In Pitkin County, lightning is second to human-caused ignitions, but more wildfire ignitions due to lightning strikes mean greater risks to public health and safety, and more disruptions to ecosystems and the environment.

4.11.7 Vulnerability Assessment

Although the frequency of lightning strikes in Pitkin County is relatively high, damages are usually limited to single buildings and in most cases, personal hazard insurance covers any losses. The greatest threat that lightning presents to community assets is the risk of death or injury, primarily to hikers and climbers who are caught in lightning storms. Many tourists who travel to the Roaring Fork Valley are unaware of the speed with which a thunderstorm can build in the mountains and can easily be caught in a storm while outdoors or traveling in the high country.

Colorado is one of the most lightning-prone states in the nation. People attending large outdoor gatherings (i.e., sporting events, concerts, fairs, festivals, etc.) are particularly vulnerable to death and injury from lightning strikes. In light of this vulnerability, prudent mitigation measures (e.g., building standards, grounding systems, preparedness, guidelines for outdoor events, lightning detection/warning systems) should be considered. While lightning frequently accompanies thunderstorms, the occasion of a thunderstorm is not necessary for lightning to occur. Lightning may strike as far away as ten miles from any precipitation.

The preparation of site-specific emergency procedures for outdoor events by event organizers, response agencies and emergency management can help mitigate the public safety risk, especially when combined with technology that provides adequate early detection, monitoring, and warning of approaching thunderstorms. Communications systems are also at risk. Structure damage is typically limited and covered by insurance.

People

Anyone caught in an exposed area during a thunderstorm could be at risk of getting struck by lightning. Outdoor enthusiasts venturing to high and exposed areas should be especially cautious because rapid thunderstorm development with associated lightning can place even the most experienced persons in jeopardy without warning. Nationwide, 85 percent of lightning victims are children and young men ages 10-35 engaged in outdoor recreation or work. People may often find themselves outside and need to be especially watchful of the weather during the summer months when afternoon thunderstorms are more common. 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 percent 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 percent of lightning strike victims.

Members of the population who rely on constant, uninterrupted electrical supplies may have a greater, indirect vulnerability to lightning. As a group, the elderly or disabled, especially those with home health care services, rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes, Community Based Residential Facilities, or other special needs housing may also be vulnerable if electrical outages are prolonged and there is no available backup power source. For all these populations, there are also concerns regarding these individual's dependence on caretakers, which increases their vulnerability during disaster events such as a power outage. Rural residents and agricultural operations reliant on electricity for heating, cooling, and water supplies are also especially vulnerable to power outages.

In Pitkin County, the injuries to people due to lightning events were to those working outside or who were caught outdoors, generally at higher elevations, during a storm event. Outdoor workers and enthusiasts caught at high elevation during a storm is one reason that deaths due to lightning are so high in Colorado in comparison to the rest of the United States. Educating people on the dangers of lighting can reduce this occurrence in the future.

Property

Lightning strikes cause intense but localized damage. Most reported damages from lightning are fires to private structures, damage to chimneys or steeples, or small grass fires. Property is more vulnerable to lightning than population because of the exposure ratios; while people can take shelter indoors, buildings remain exposed. 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. Mitigation techniques such as choice of building materials or landscaping help reduce the vulnerability of these properties, but there is no data available to segment these properties out of the overall vulnerability assessment.

According to the event details collected in the NCEI database, lightning has resulted in $2,000 in property damages in Pitkin County since 1998. The dataset reported several homes and surrounding trees caught due to a lightning strike, as well as damaged police communications and radio tower equipment.

Critical Facilities and Infrastructure

Different from other hazards, lightning does not commonly create severe disruptions within the planning area. Although critical facilities can still be affected by lightning storms. First responders, hospitals, government services, schools, and other critical public assets are not more exposed to lightning than the other common vulnerabilities distinguished regarding property and population. Although, communications towers and other infrastructure can be disturbed by lightning strikes within Pitkin County. Where radio towers and police communications can be at risk to lightening damage. It is important to mitigate this from occurring. Otherwise, when emergency communication systems are affected, the health and safety of people within Pitkin County could be jeopardized. Like in the event in 2006 that damaged aviation navigation equipment on Aspen Mountain. The resulted in cancelled flights for more than half a day. Situations such as this heightens the vulnerability of the essential functions by delaying response times, hindering interagency communication efforts, or endangering or damaging communication networks.

Economy

The impact to Pitkin County's economy from severe lightning storms is low. With the largest hazard due to severe thunderstorms being the potential loss of power. People rely heavily on electricity and any disruption in the power supply can be hazardous and detrimental to the study area. Usually, longstanding economic impacts are triggered by hazards that can be a by-product from lightning including other hazards such as wildfires.

Historic, Cultural, and Natural Resources

In general, there are low hazardous impacts to cultural or historic resources from lightening. However cultural and historic sites can be indirectly more vulnerable to lightning than as previously accounted for with general structures. Natural resources may be exposed to inadvertent effects of lightning, such as wildfires caused by lightning strikes. The National Interagency Fire Center reports that from between 2008-2012, 9,000 wildfires occurred from lightning strikes. The existence of large areas of water, or of wide, open spaces in natural habitats may increase the danger of lightning strikes to trees, people, or structures, but these vulnerabilities are not directly related to natural resources. Outdoor recreation areas are where lightning strikes have more hazardous impacts, so populations using these areas may have a higher susceptibility.

4.11.8 Development Trends

Any construction built on the ground will be at risk to lightning strikes. New construction should be built with grounding, whenever viable, to help mitigate the eruption of structure fires. New critical facilities such as communications towers should be built with lightning protection measures. Construction of lightning shelters at outdoor venues and increased public awareness campaigns may help minimize increased effects of lightning on growing numbers of visitors recreating outdoors.

4.11.9 Differences by Jurisdiction

In general lightening and severe thunderstorms in Pitkin County are in the portions of the study area with the highest elevation and areas where more people are concentrated outdoors for recreational purposes.

4.11.10 Risk Summary

- The overall significance of lightning in the planning area is Low.
- Lightning is a regular occurrence in Pitkin County, although impacts are typically limited to individuals or individual structures.
- From 1994 to 2022, lightning has caused a reported six injuries and two fatalities in Pitkin County.
- Other impacts from lightning can include power outages and wildfires.
- Related hazards: Wildfires

4.12 WILDFIRES

WILDFIRES	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Extensive	Catastrophic	Likely	**High**
Aspen	Extensive	Catastrophic	Likely	**High**
Basalt	Extensive	Catastrophic	Likely	**High**
Snowmass Village	Extensive	Catastrophic	Likely	**High**
Aspen Fire	Extensive	Catastrophic	Likely	**High**
Roaring Fork Fire	Extensive	Catastrophic	Likely	**High**

4.12.1 Description

A wildfire is any uncontrolled fire occurring on undeveloped land that requires fire suppression. Wildfires can be ignited by lightning or by human activity such as smoking, campfires, equipment use, and arson.

Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and drinking water supply. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as wildland urban interface (WUI) areas, where development is adjacent to densely vegetated areas.

Generally, there are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather.

- **Fuel** – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles, leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Structures such as homes and associated combustibles are also potential fuel sources. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. "Ladder fuels" are fuels low to the ground that can spread a surface fire upward through brush and into treetops. These fires, known as crown fires, burn in the upper canopy of forests and are nearly impossible to control. The volume of available fuel is described in terms of fuel loading. Many parts of the planning area are extremely vulnerable to wildfires, as a result of dense vegetation combined with urban interface living.
- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both the fire intensity and the rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement and types of vegetation throughout a hillside can also contribute to increased fire activity on slopes. In addition, topography impacts the ability of firefighters to combat the blaze by hampering access for equipment, supplies, materials, and personnel.
- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfires. High temperatures and low relative humidity dry out the fuels that feed the wildfire, increasing the odds that fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater the wind, the faster a fire will spread, and the more intense it will be. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or the interaction of wind with topographical features such as slopes or steep hillsides. Lightning also ignites wildfires, which are often in terrain that is difficult for firefighters to reach. Drought conditions contribute to wildfire vulnerability and susceptibility. During periods of drought, low fuel moisture and lack of precipitation increase the threat of wildfire. There are no known effective measures for human mitigation of weather conditions. Careful monitoring of weather conditions that drive the activation and enforcement of fire-safety measures and programs, such as bans on open fires, are ongoing weather-related mitigation activities.

Another contributing factor to fuel loads in the forest are standing trees killed by pine bark beetles, which have been affecting the forests of Colorado since 2002, becoming more widespread and a serious concern.

Increased insect and disease outbreaks among trees are another outcome of the rise in drought conditions in recent decades. Insect infestations can kill trees across wide areas, leading to significant fuel buildup. Dead trees are much more susceptible to burning while the needles are still on the trees; however, once the needles fall off, live trees with needles become a greater hazard than dead needle-free trees.

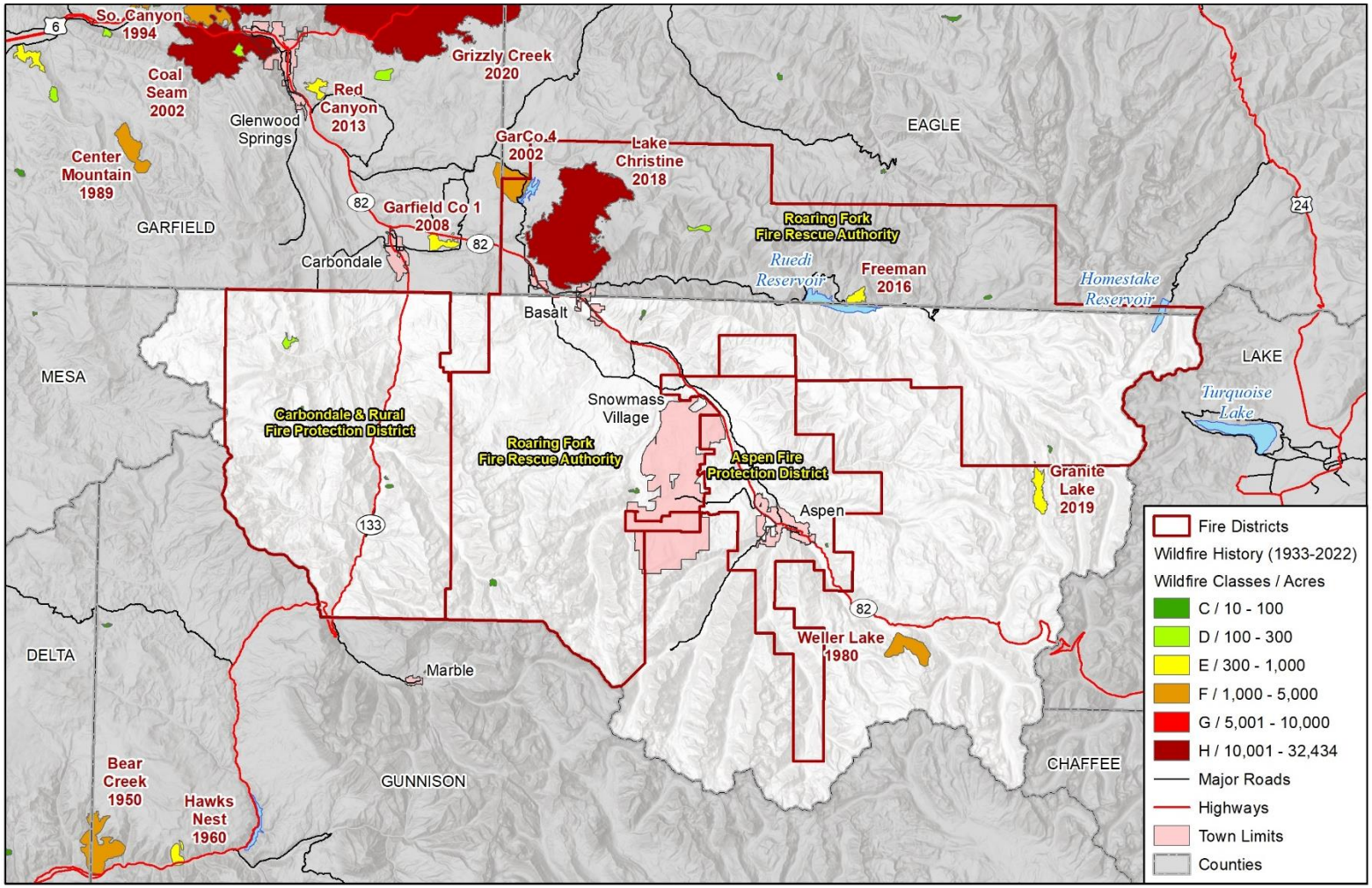
Wildfires are of significant concern throughout Colorado. According to the Colorado State Forest Service, vegetation fires occur on an annual basis; most are controlled and contained early with limited damage. For those ignitions that are not readily contained and become wildfires, damage can be extensive. According to the 2018 State of Colorado Hazard Mitigation Plan, a century of aggressive fire suppression combined with cycles of drought and changing land management practices has left many of Colorado's forests, including those in Pitkin County, unnaturally dense and ready to burn. Further, the threat of wildfire and potential losses is constantly increasing as human development and population increases and the WUI expands. According to the 2022 Pitkin County Hazard Mitigation Community Survey (see Appendix D), Pitkin County residents believe that wildfire is the greatest threat to their safety.

4.12.2 Past Events

Pitkin County has been impacted by multiple wildfire events throughout its history, as well as many much larger wildfires in the nearby vicinity. Historic occurrences of wildfire by county are not well documented, those that are known are shown in Figure 4-32 below. Although most are controlled when they are small (one acre or less), fire protection districts in Pitkin County respond to many wildfire events each year. Fortunately, Pitkin County has been spared to date from large fires like the devastating fires that impacted counties across Colorado in 2012 and 2013.

Wildland fire occurrence in Pitkin County is officially tracked by three agencies: (1) the U.S. Forest Service (USFS)/White River National Forest, (2) the U.S. Bureau of Land Management (BLM), and the Colorado State Forest Service (CSFS). The federal agencies record fire data from federal lands and CSFS keeps records of fires on state and private lands. CSFSs statistics only reflect those wildland fires reported by local fire departments. As in other areas of Colorado, most fires in Pitkin County are started by human-caused (including equipment) ignitions and a small number of fires account for the majority of acres burned.

Figure 4-32 Pitkin County Wildland Fire History, 1933-2022



Map compiled 5/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT,
Interagenc yFire Perimeter History

According to the NCEI database, there have been 20 wildfire events since 2007 which occurred in or around Pitkin County. These wildfires together have caused a reported $14.03 million in property damages. Pitkin County was also included on the federal disaster designation DR-1421 in 2002 for wildfires.

4.12.3 Location

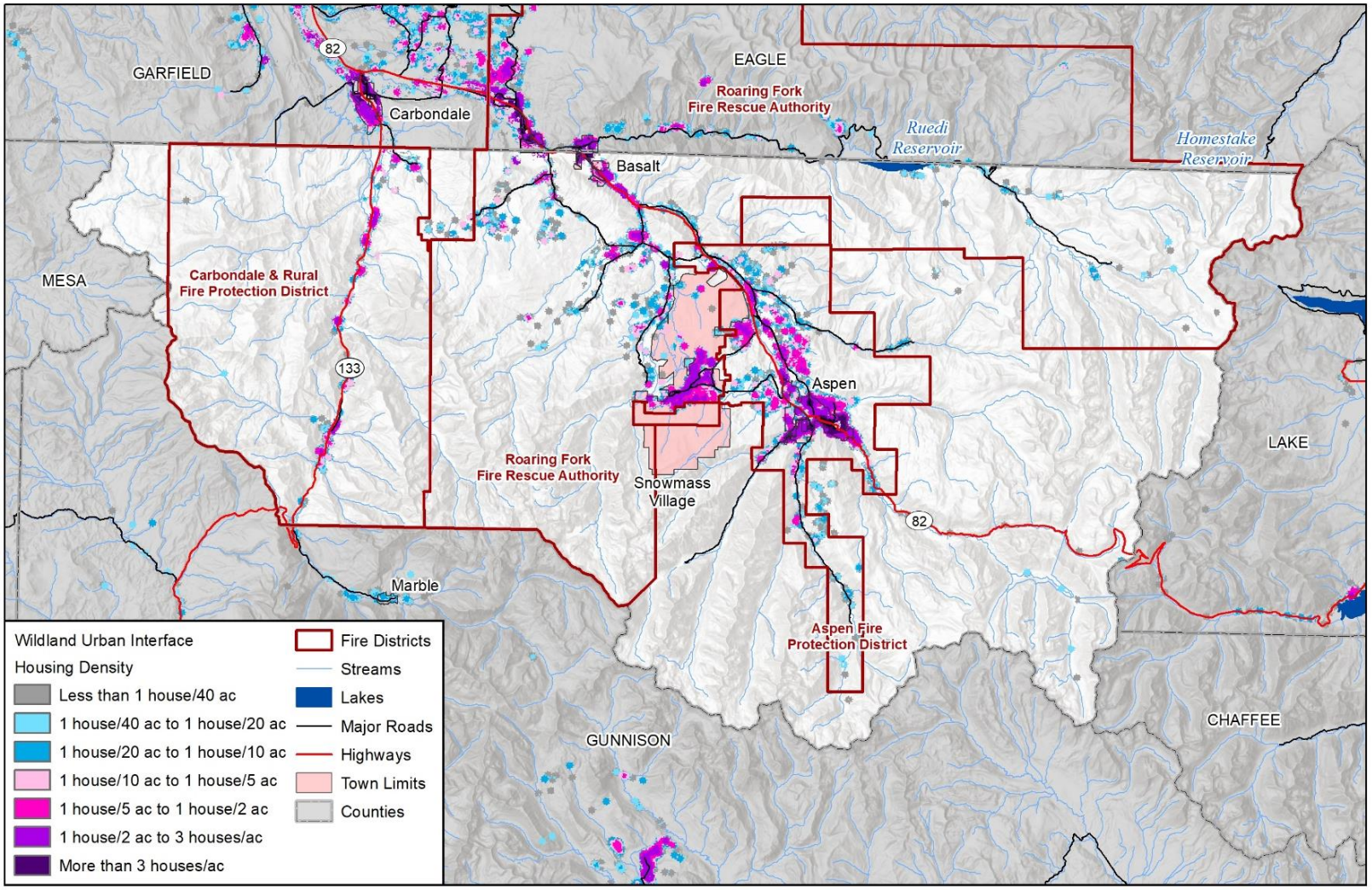
More than half of Pitkin County is forested with much of the remaining vegetation types dominated by pinyon/juniper, alpine meadows, willows and riparian shrublands, gambel oak, sagebrush, and agricultural grasslands. The forested areas are primarily aspen stands with widespread mixed-conifer stands.

The wildfire risk in Pitkin County is primarily associated with the WUI, where development is interspersed or adjacent to landscapes that support wildland fire. Fires in the WUI may result in major losses of property and structures, threaten greater numbers of human lives, and incur larger financial costs. In addition, WUI fires may be more dangerous than wildfires that do not threaten developed areas, as firefighters may continue to work on more dangerous conditions in order to protect structures such as businesses and homes. Colorado overall is one of the fastest growing states in the nation and much of this growth is occurring in the WUI area, where structures and other human improvements meet and mix with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfires. Figure 4-33 shows the Pitkin County housing density within the WUI.

The CSFS's Colorado Forest Atlas (formerly the Colorado Wildfire Risk Assessment Portal, CO-WRAP) report for Pitkin County maps the WUI Risk Index, which is a rating of the potential impact of a wildfire on people and their homes. The location of people living in the WUI and rural areas is essential for defining potential wildfire impacts to people and homes and highlighting the areas most susceptible to damaging fires. The key input reflects housing density (Figure 4-33). By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1. Data is modeled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. Figure 4-34 shows the WUI Risk Index for Pitkin County.

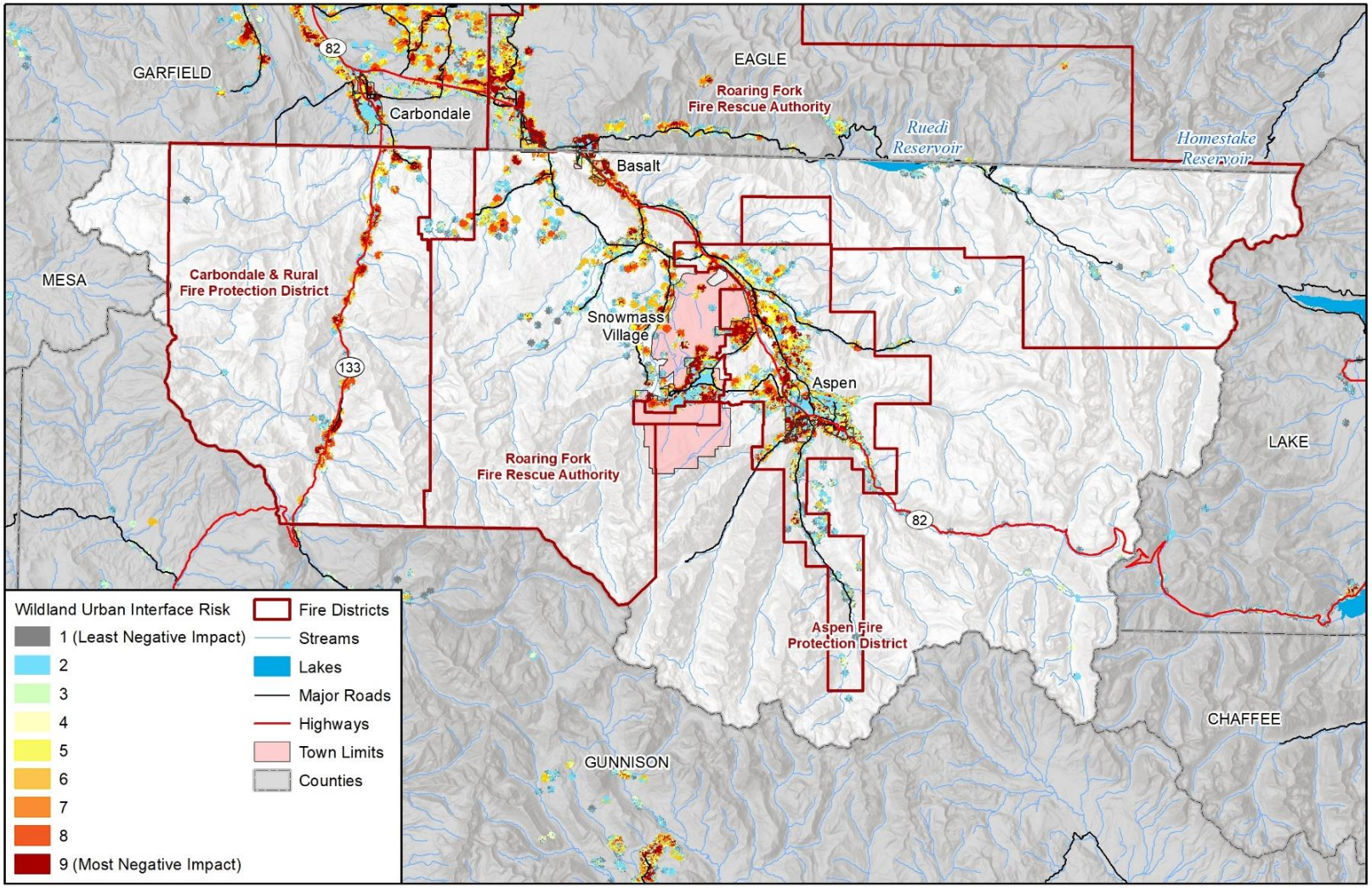
Wildfire risk represents the possibility of loss or harm occurring from a wildfire. Risk is derived by combining the wildfire threat and the fire effects assessment outputs. It identifies areas with the greatest potential impacts from a wildfire. Wildfire risk combines the likelihood of a fire occurring (threat) with those areas of most concern that are adversely impacted by fire to derive a single overall measure of wildfire risk.

Figure 4-33 Pitkin County Housing Density Within the Wildland Urban Interface (WUI)



Map compiled 5/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT,
Colorado Forest Atlas - Colorado State Forest Service

Figure 4-34 Wildland Urban Interface (WUI) Risk Index for Pitkin County



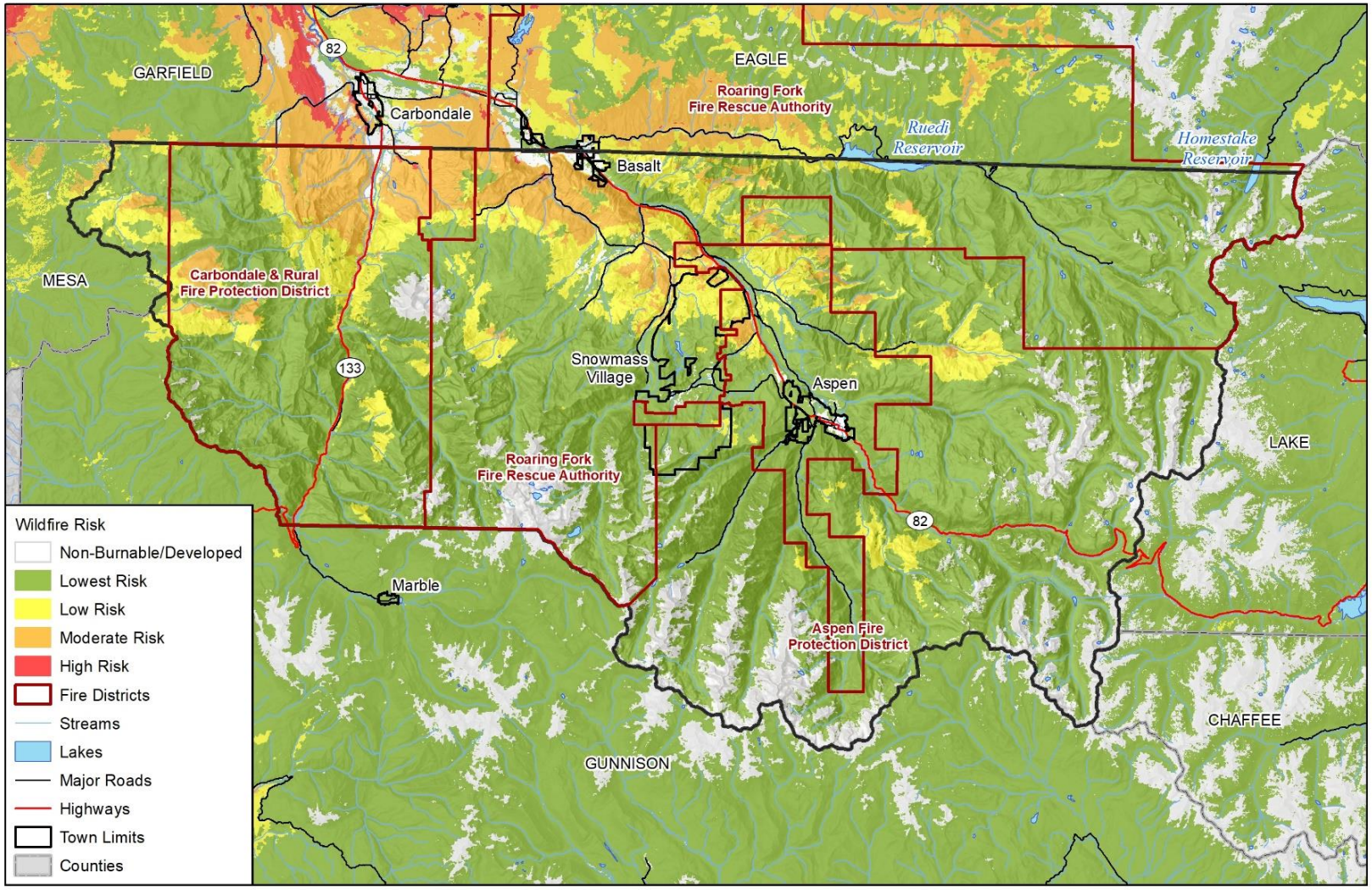
4.12.4 Magnitude and Severity

Wildfires are a natural process and are an important component of the Montane and Subalpine ecosystems that dominate much of Pitkin County. When conditions combine to cause a fast- moving wildfire, potential impacts include destruction of structures, vehicles, signage, and other property, as well as smoke damage to buildings. Wildfires can also impact utilities, watersheds, natural and cultural resources, range and crop lands, and local economies (e.g., fire expenditures/loss of tourism). Smoke and air pollution from wildfires can be a severe health hazard. As climate warming leads to longer, more intense periods of drought, the risks and impacts of wildfires are expected to grow, in turn leading to greater risks from landslides, mudflows and other geologic hazards during heavy rainfall events. The magnitude/severity of the wildfire hazard in Pitkin County, Basalt and Snowmass Village is rated catastrophic, while the hazard is rated critical in and around Aspen.

The Colorado Forest Atlas calculates a composite risk rating, defined as the possibility of loss or harm occurring from a wildfire. It identifies areas with the greatest potential impacts from a wildfire – i.e., those areas most at risk - considering all values and assets combined together – WUI Risk, Drinking Water Risk, Forest Assets Risk and Riparian Areas Risk. This risk index has been calculated consistently for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. The Wildfire Risk Classes for Pitkin County are shown in Figure 4-35.

The Colorado Forest Atlas also conducts a Fire Intensity Scale analysis, which uses fuels, topography, and weather as inputs to determine the relative intensity (from Class 1, lowest to Class 5, highest) of a potential wildfire. According to data from the Fire Intensity Scale, the majority of the County has at least a moderate intensity rating with the highest potential wildfire intensity areas largely concentrated to higher elevations below the tree line and encroaching on the Town of Snowmass Village and the City of Aspen, see Figure 4-36.

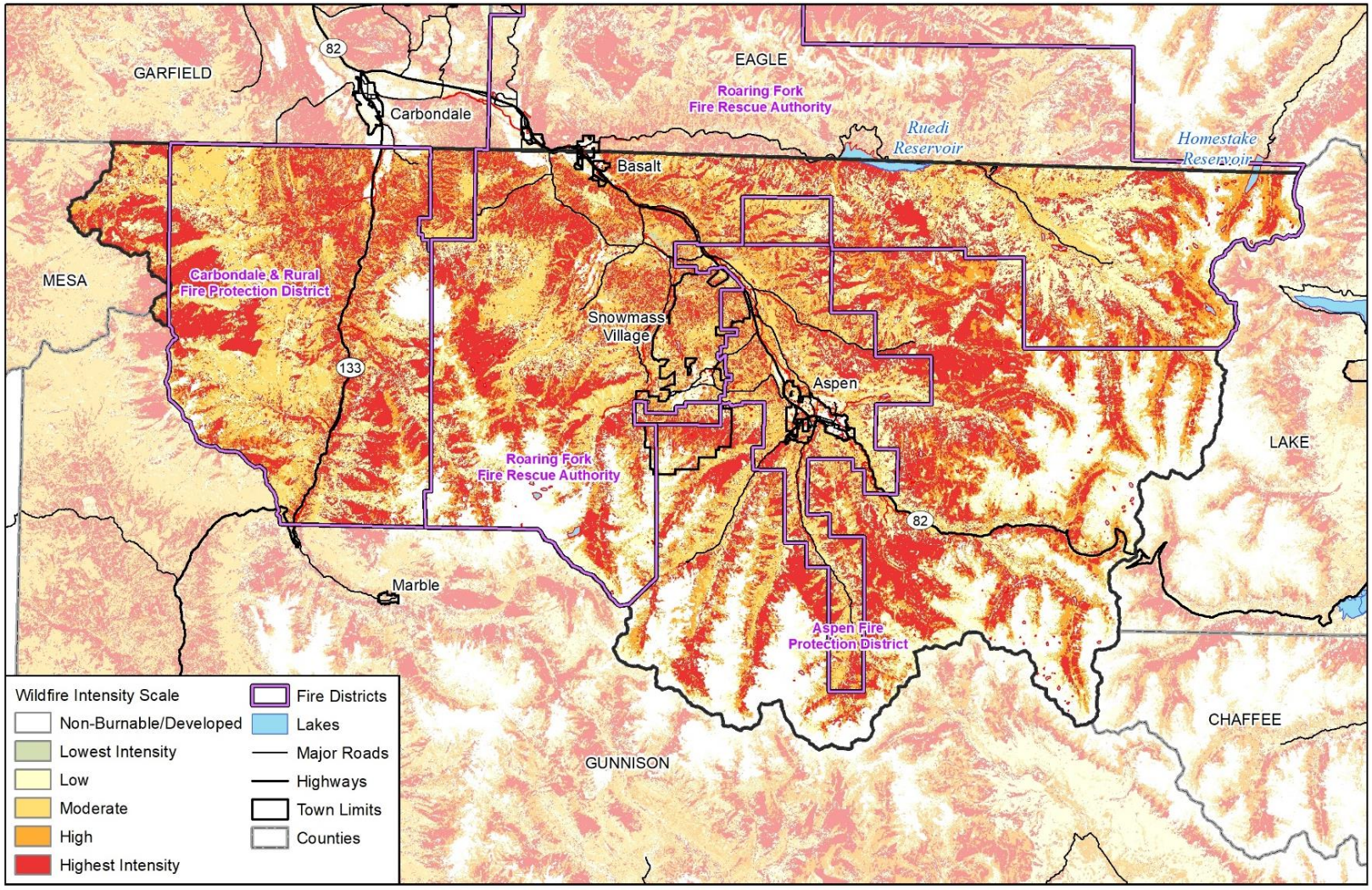
Figure 4-35 Wildfire Risk for Areas in Pitkin County



wood.

Map compiled 5/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT,
Colorado Forest Atlas - Colorado State Forest Service

Figure 4-36 Pitkin County Fire Intensity Scale Map



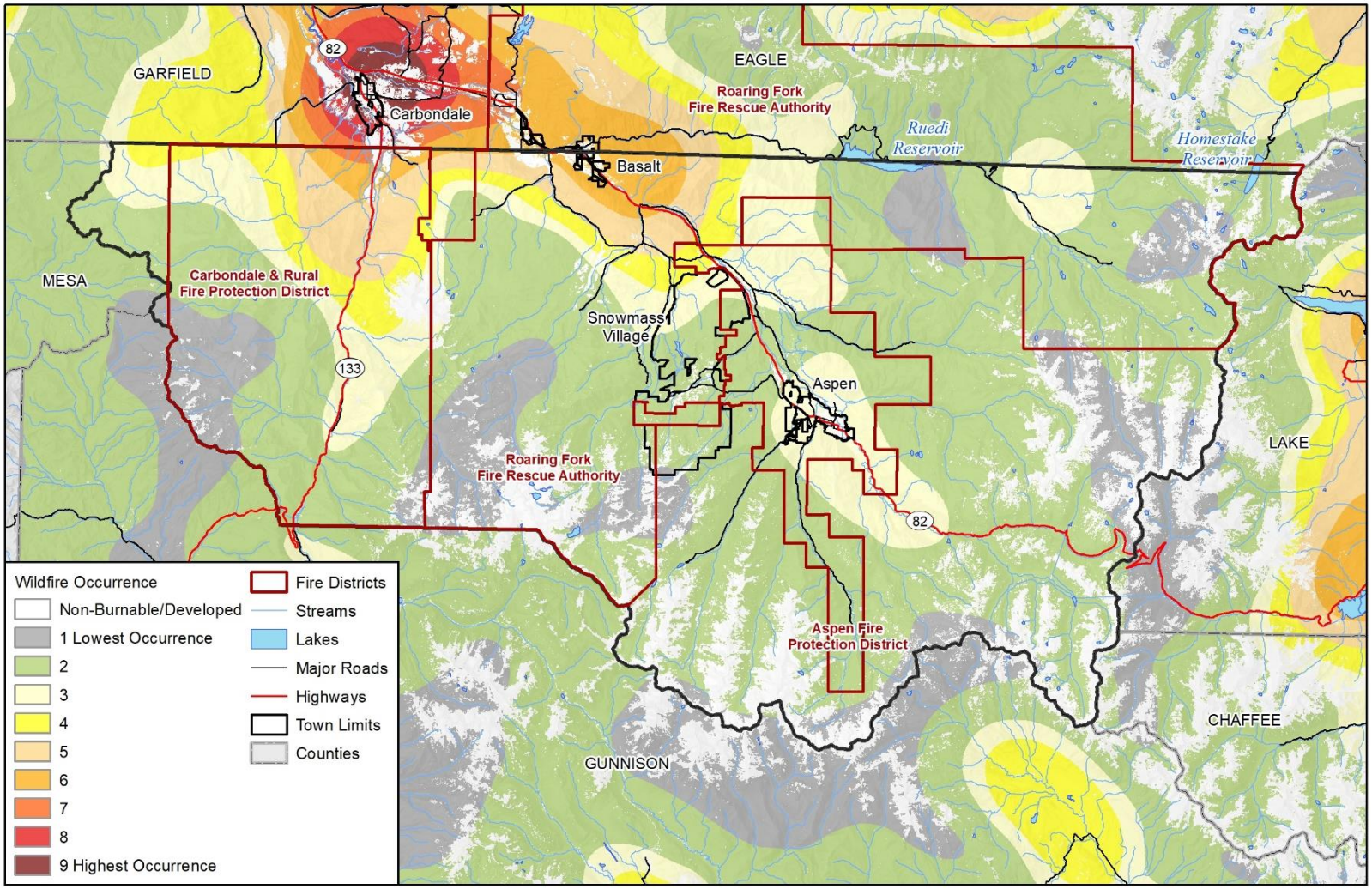
4.12.5 Probability of Future Events

The Planning Team has rated the probability of future wildfire events as likely, with a recurrence interval of 10 years or less (10-100% chance in a given year). The frequency of large wildfires and the total area burned have been increasing in Colorado and the western U.S with climate warming contributing to longer fire seasons, drier conditions, more fuels, and an increased number of lightning strikes.

Probability for fire occurrences, as provided by the Colorado Forest Atlas, has been calculated for the county as the annual probability of any location burning due to a wildfire based on historical ignition patterns. Using this data, fire occurrence was mapped for Pitkin County and is shown in Figure 4-37 below. As shown below, large portions of the County are within areas rated 2 on the fire occurrence class scale. However, the north/central portions of the county and the area including the City of Aspen are rated 3 or higher, with areas around the Town of Basalt and nearby Carbondale in Garfield County reaching occurrence ratings of 7 to 9, the highest occurrence rating. Based on this data large portions of the county have relatively low probability of future occurrences; however, this probability increases near the municipalities.

As noted elsewhere, the effects of climate change are expected to increase both the likelihood and the severity of wildfires throughout the planning area. Thus, the probability of future wildfires is expected to be higher than suggested by the frequency of past events.

Figure 4-37 Pitkin County Wildfire Occurrence



Map compiled 5/2022;
intended for planning purposes only.
Data Source: Pitkin County, CDOT,
Colorado Forest Atlas - Colorado State Forest Service

4.12.6 Climate Change Considerations

Climate is a major determinant of wildfire through its control of weather, as well as through its interaction with fuel availability, fuel distribution and flammability at the global, regional, and local levels. With hotter temperatures, drier soil and worsening drought conditions in the County, wildfires have the potential to become more frequent and more extreme. Currently humans are the main cause of fire ignition globally, although lightning has often been responsible for large fires in Pitkin County and Colorado as a whole. Colorado and the Western United States have seen significant increases in forest area burned in recent years, and the risk of wildfires in the future is expected to increase due to a lengthening fire season and drier conditions. According to the IPCC's 2019 Special Report on Climate Change and Land:

> Fire season has already lengthened by 18.7% globally between 1979 and 2013, with statistically significant increases across 25.3% but decreases only across 10.7% of earth's land surface covered with vegetation; with even sharper changes being observed during the second half of this period. Correspondingly, the global area experiencing long fire weather season has increased by 3.1% per annum or 108.1% during 1979–2013. Fire frequencies under 2050 conditions are projected to increase by approximately 27% globally, relative to the 2000 levels, with changes in future fire meteorology playing the most important role in enhancing global wildfires, followed by land cover changes, lightning activities and land use, while changes in population density exhibit the opposite effects.

Land use, vegetation, available fuels, and weather conditions (including wind, low humidity, and lack of precipitation) are chief factors in determining the number and size of fires in Colorado each year. Generally, fires are more likely when vegetation is dry from a winter with little snow and/or a spring and summer with sparse rainfall. As a result, climate induced hazards in Colorado (specifically, a pattern of extended drought conditions) have contributed to increased concern about wildfire in Pitkin County.

The frequency, intensity, and duration of wildfires have increased across the Western United States since the 1980s. The U.S. Department of Agriculture's "Effects of Climate Variability and Change on Forest Ecosystems" General Technical Report, published in December 2012, found that the Colorado region, among others, will face an even greater fire risk over time. The report expects Colorado to experience up to a five-fold increase in acres burned by 2050. This project trend is apparent with the historic 2020 fire season, during which the state saw three separate fires become the largest in state history. The report's findings are consistent with previous studies on the relationship between climate change and fire risk. Colorado landscapes, including those that characterize Pitkin County, are expected to become hotter and drier as the planet warms, which in turn is expected to increase regional wildfire risk.

The health of forests in Pitkin County and around the state have been under long-term stress as a result of extended periods of drought and disease. Adding a warming climate to already-dangerous wildland fire conditions can only increase the risk of large catastrophic fires in and near mountain communities. As population growth occurs in the WUI, the risk to people and property is compounded.

> Overlaying the climate change context on this already challenging situation adds complexity. As hotter, more damaging, more intense, and more frequent wildfires have become the norm, scientists point to the trend as indicative of a changing planet. It can be difficult to separate the many variables at play, but we know that fire is a participant in the dynamics of climate change. As temperatures increase and snow melts earlier, wildfires begin earlier in the season and have become more frequent. At the same time, those fires release CO2, contributing to the ongoing rise in global temperatures.

A large proportion of Pitkin County's population lives and recreates in and near forested areas and wildfires pose serious risks to residents, visitors, property and wildlife, in addition to increasing the potential for floods and debris flows in and near burn areas.

4.12.7 Vulnerability Assessment

The potential for wildfire-caused damage to structures in Pitkin County is increasing as wildland fuels accumulate and greater numbers of people choose to build homes in wildfire-prone areas. Wildland fuels

are comprised of both live and dead vegetation that are available for combustion. The greatest concern in terms of hazard fuels are the lodgepole pine forests and mixed-conifer stands that surround the WUI and are also subject to insect infestation. A secondary concern is dry/ dead/ overgrown oak brush on south-facing slopes; oil in leaves can create high intensity fire, is often intermixed with light fuel types that spread fire quickly, and often occurs across WUI neighborhoods and along egress routes. Key public safety issues related to wildfire mitigation include evacuation-route planning in "one-way-out" subdivisions, fuel reduction, water storage, and emergency power for pump stations.

People

Direct threat exists to residents exposed to wildfire risk by residing in the WUI areas. The population living in WUI areas was estimated using the structure count of buildings in the WUI area and applying the census value of 2.35 persons per household for Pitkin County, 1.97 persons per household for Aspen, 2.26 persons per household for Basalt, and 2.22 persons per household for Snowmass Village. These estimates are shown in Table 4-38.

Table 4-38 Population Within WUI Risk Areas

	LOW RISK POPULATION	MODERATE RISK POPULATION	HIGH RISK POPULATION
Aspen	3,489	2,742	3,735
Basalt	1,765	457	1,650
Snowmass Village	5,017	211	1,188
Unincorporated County	5,154	1,640	2,799
Grand Total	**15,425**	**5,050**	**9,371**

Source: Pitkin County Assessor 2022, Eagle County Assessor Data 2022, Colorado Forest Atlas, WSP GIS Analysis

Smoke and air pollution from wildfires can also be a severe health hazard, especially for sensitive populations, including children, the elderly, and those with respiratory and cardiovascular diseases. Smoke generated by wildfire consists of visible and invisible emissions that contain particulate matter (soot, tar, water vapor, and minerals), gases (carbon monoxide, carbon dioxide, nitrogen oxides), and toxics (formaldehyde, benzene). Emissions from wildfires depend on the type of fuel, the moisture content of the fuel, the efficiency (or temperature) of combustion, and the weather. Public health impacts associated with wildfire include difficulty in breathing, odor, and reduction in visibility.

Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Property

Property damage from wildfires can be severe and can significantly alter entire communities. Loss estimations for the wildfire hazard were modeled by intersecting the Colorado Forest Atlas wildfire risk data with 2022 county tax assessor data for improved parcels and associated building footprints. Table 4-39 through Table 4-42 summarize the estimated exposed value of improvements in each wildfire risk category. Wildfires typically result in a total building loss, including contents. Content values were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. This includes 100% of the structure value for commercial and exempt structures and vacant improved land, and 50% for residential structures. Improved and contents values were summed to obtain a total exposure value. In all, a total of 5,012 parcels and 5,920 buildings are in areas exposed to wildfire risk areas, with a total value of over $16.99 billion. However, over 90% of those parcels are at low or lowest risk; 424 parcels and 511 buildings worth $841 million are at moderate or high risk. The greatest exposure is in the unincorporated parts of the County.

Table 4-39 Exposure and Value of Structures in the High Wildfire Risk Areas

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Unincorporated County	Agricultural	5	7	$2,492,300	$2,492,300	$4,984,600
	Residential	24	29	$14,893,900	$7,446,950	$22,340,850
	Total	**29**	**36**	**$17,386,200**	**$9,939,250**	**$27,325,450**

Source: Pitkin County Assessor 2022, Eagle County Assessor Data 2022, Colorado Forest Atlas, WSP GIS Analysis

Table 4-40 Exposure and Value of Structures in the Moderate Wildfire Risk Areas

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Basalt	Commercial	1	1	$2,681,400	$2,681,400	$5,362,800
	Residential	22	22	$30,623,210	$15,311,605	$45,934,815
	Total	**23**	**23**	**$33,304,610**	**$17,993,005**	**$51,297,615**
Snowmass Village	Residential	3	3	$12,835,800	$6,417,900	$19,253,700
	Total	**3**	**3**	**$12,835,800**	**$6,417,900**	**$19,253,700**
Unincorporated County	Agricultural	21	33	$14,137,700	$14,137,700	$28,275,400
	Commercial	1	4	$9,104,900	$9,104,900	$18,209,800
	Exempt	7	9	$6,685,500	$6,685,500	$13,371,000
	Residential	339	402	$455,281,200	$227,640,600	$682,921,800
	Vacant	1	1	$127,900	$127,900	$255,800
	Total	**369**	**449**	**$485,337,200**	**$257,696,600**	**$743,033,800**
	Grand Total	**395**	**475**	**$531,477,610**	**$282,107,505**	**$813,585,115**

Source: Pitkin County Assessor 2022, Eagle County Assessor Data 2022, Colorado Forest Atlas, WSP GIS Analysis

Table 4-41 Exposure and Value of Structures in the Low Wildfire Risk Areas

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Aspen	Exempt	1	1	$12,257,700	$12,257,700	$24,515,400
	Residential	15	15	$73,364,000	$36,682,000	$110,046,000
	Total	**16**	**16**	**$85,621,700**	**$48,939,700**	**$134,561,400**
Basalt	Commercial	1	1	$178,800	$178,800	$357,600
	Residential	58	58	$58,722,430	$29,361,215	$88,083,645
	Total	**59**	**59**	**$58,901,230**	**$29,540,015**	**$88,441,245**
Snowmass Village	Exempt	2	3	$1,098,600	$1,098,600	$2,197,200
	Residential	67	67	$103,982,100	$51,991,050	$155,973,150
	Total	**69**	**70**	**$105,080,700**	**$53,089,650**	**$158,170,350**
Unincorporated County	Agricultural	21	45	$32,851,700	$32,851,700	$65,703,400
	Commercial	4	11	$9,546,200	$9,546,200	$19,092,400
	Exempt	9	19	$6,255,500	$6,255,500	$12,511,000
	Mixed Use	8	9	$3,344,300	$3,344,300	$6,688,600
	Residential	433	508	$690,198,900	$345,099,450	$1,035,298,350
	Vacant	1	1	$7,700	$7,700	$15,400
	Total	**476**	**593**	**$742,204,300**	**$397,104,850**	**$1,139,309,150**
	Grand Total	**620**	**738**	**$991,807,930**	**$528,674,215**	**$1,520,482,145**

Source: Pitkin County Assessor 2022, Eagle County Assessor Data 2022, Colorado Forest Atlas, WSP GIS Analysis

Table 4-42 Exposure and Value of Structures in the Lowest Wildfire Risk Areas

JURISDICTION	PROPERTY TYPE	IMPROVED PARCELS	BUILDING COUNT	IMPROVED VALUE	CONTENT VALUE	TOTAL VALUE
Aspen	Agricultural	4	9	$65,763,900	$65,763,900	$131,527,800
	Commercial	43	47	$52,227,800	$52,227,800	$104,455,600
	Exempt	23	57	$110,111,900	$110,111,900	$220,223,800
	Mining	1	1	$13,500	$13,500	$27,000
	Residential	710	762	$2,219,027,900	$1,109,513,950	$3,328,541,850
	Vacant	1	1	$28,400	$28,400	$56,800
	Total	**782**	**877**	**$2,447,173,400**	**$1,337,659,450**	**$3,784,832,850**
Basalt	Commercial	32	32	$38,631,240	$38,631,240	$77,262,480
	Exempt	5	5	$4,345,380	$4,345,380	$8,690,760
	Residential	408	418	$369,724,970	$184,862,485	$554,587,455
	Total	**445**	**455**	**$412,701,590**	**$227,839,105**	**$640,540,695**
Snowmass Village	Agricultural	2	2	$8,683,900	$8,683,900	$17,367,800
	Commercial	10	11	$79,238,600	$79,238,600	$158,477,200
	Exempt	15	19	$18,303,500	$18,303,500	$36,607,000
	Mixed Use	1	1	$1,922,300	$1,922,300	$3,844,600
	Residential	951	990	$1,752,717,100	$876,358,550	$2,629,075,650
	Total	**979**	**1,023**	**$1,860,865,400**	**$984,506,850**	**$2,845,372,250**
Unincorporated County	Agricultural	61	94	$129,673,500	$129,673,500	$259,347,000
	Commercial	38	80	$57,193,100	$57,193,100	$114,386,200
	Exempt	51	107	$73,686,500	$73,686,500	$147,373,000
	Mining	1	1	$26,100	$26,100	$52,200
	Mixed Use	16	23	$17,677,100	$17,677,100	$35,354,200
	Residential	1,593	2,009	$4,531,535,800	$2,265,767,900	$6,797,303,700
	Vacant	2	2	$2,300	$2,300	$4,600
	Total	**1,762**	**2,316**	**$4,809,794,400**	**$2,544,026,500**	**$7,353,820,900**
	Grand Total	**3,968**	**4,671**	**$9,530,534,790**	**$5,094,031,905**	**$14,624,566,695**

Source: Pitkin County Assessor 2022, Eagle County Assessor Data 2022, Colorado Forest Atlas, WSP GIS Analysis

Critical Facilities & Infrastructure

Critical facilities of wood frame construction are especially vulnerable during wildfire events. Most roads, railroads and bridges would not sustain significant damage except in the worst scenarios. Power lines are the most at risk from wildfire because most poles are made of wood and susceptible to burning. Pipelines traversing the county could also provide a source of fuel and lead to a catastrophic explosion. Table 4-43 through Table 4-45 summarize the critical facilities identified as being exposed to wildfire risk. As noted in Section 4.2.3, some facilities may be counted in multiple jurisdictions (i.e., county and fire district) so the Totals column may not match the sum of the individual columns.

Table 4-43 Critical Facilities Exposed to Moderate Wildfire Risk by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	-	-	-	-	1	1
Energy	-	-	-	-	-	-	0
Food, Water, Shelter	-	1	-	-	-	1	1
Hazardous Material	-	-	-	1	-	1	1
Health and Medical	-	-	-	-	-	-	0

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Safety and Security	-	-	-	1	-	1	1
Transportation	-	-	-	1	-	1	1
Total	**0**	**1**	**0**	**3**	**0**	**5**	**5**

Source: Pitkin County, Colorado Forest Atlas, CEPC, HIFLD, NBI, RFFR

Table 4-44 Critical Facilities Exposed to Low Wildfire Risk by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	-	-	-	3	2	1	3
Energy	-	-	-	1	-	1	1
Food, Water, Shelter	-	-	1	-	-	1	1
Hazardous Material	-	-	-	3	1	-	3
Health and Medical	-	-	-	-	-	-	0
Safety and Security	-	-	-	5	3	2	5
Transportation	-	-	-	5	1	3	5
Total	**0**	**0**	**1**	**17**	**7**	**8**	**18**

Source: Pitkin County, Colorado Forest Atlas, CEPC, HIFLD, NBI, RFFR

Table 4-45 Critical Facilities exposed to Lowest Wildfire Risk by Jurisdiction

CATEGORY	ASPEN	BASALT	SNOWMASS VILLAGE	PITKIN COUNTY	ASPEN FIRE PROTECTION DISTRICT	ROARING FORK FIRE RESCUE AUTHORITY	TOTAL
Communications	1	-	4	4	3	8	9
Energy	-	-	1	2	2	3	3
Food, Water, Shelter	1	-	1	2	1	1	4
Hazardous Material	-	1	-	6	2	-	7
Health and Medical	-	-	-	-	-	1	1
Safety and Security	-	2	3	6	5	7	11
Transportation	-	-	7	24	8	17	31
Total	**2**	**3**	**16**	**44**	**21**	**37**	**66**

Source: Pitkin County, Colorado Forest Atlas, CEPC, HIFLD, NBI, RFFR

No critical facilities were identified in very high or high risk areas. Only five were identified in moderate risk areas, 18 in low risk areas, and 66 in areas of lowest risk.

While roads seldom sustain long-term damage from wildfires, fires can cause road closures that create conditions that block or prevent access and can isolate residents and emergency service providers. Wildfire can create conditions in which bridges are obstructed. Many bridges in areas of high to moderate fire risk are important because they provide the only ingress and egress to large areas and in some cases to isolated neighborhoods.

Economy

Tourism is a vital component of Pitkin County's economy. Wildland fires can have a direct impact on the County's scenery and environmental health, adversely affecting the presence of tourism activities and the ability of the County's residents to earn a living from the related industries. Pitkin County's scenic beauty and cultural resources are a main draw for tourism, so the County can suffer economic losses from tourists not coming to the area due to wildfires. Fire suppression may also require increased cost to local and state government for water acquisition and delivery, especially during periods of drought when water resources are scarce. Fires can cause direct economic losses in the reduction of harvestable timber.

Historic, Cultural, and Natural Resources

Fire is a natural and critical ecosystem process in most ecosystems, dictating in part the types, structure, and spatial extent of native vegetation. However, wildfires can cause severe environmental impacts:

- **Damaged Fisheries**—Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Spread of Invasive Plant Species**—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations**—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat**—Catastrophic fires can have devastating consequences for endangered species.
- **Soil Sterilization**—Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

Many ecosystems are adapted to historical patterns of fire occurrence. These patterns, called "fire regimes," include temporal attributes (e.g., frequency and seasonality), spatial attributes (e.g., size and spatial complexity), and magnitude attributes (e.g., intensity and severity), each of which have ranges of natural variability. Ecosystem stability is threatened when any of the attributes for a given fire regime diverge from its range of natural variability.

4.12.8 Development Trends

Throughout Pitkin County, approximately 15,882 structures are located within the WUI (approximately 90% of all structures within the County), with a combined estimated improved value of $27.6 billion. The increased wildfire risks related to climate warming may lead to reclassification of areas from low or medium risk to high or very high risk. Additionally, future growth in Pitkin County will almost certainly lead to growth and increased residential density in the WUI areas. Migration of inhabitants to more remote areas of the county may also increase the probability of human-caused ignitions from vehicles, grills, campfires, and electrical devices.

The Future Avoided Cost Explorer (FACE) tool described in Section 4.7.8 estimates future annual damages from future wildfires. The tool looks at three different climate scenarios (current climate conditions, moderately warmer climate by 2050, and severely warmer climate by 2050) as well as compares current population to low, medium, and high growth population scenarios. The following table compares the estimated annual damages for Pitkin County from wildfires for each of the climate and population scenarios.

Table 4-46 Potential Future Economic Losses from Wildfires in Pitkin County

CLIMATE SCENARIOS	POPULATION SCENARIOS LOW GROWTH (~20,150)	MEDIUM GROWTH (~23,200)	HIGH GROWTH (~26,000)
Current Conditions	Total Damages: $5.0M	Total Damages: $5.0M	Total Damages: $5.0M
	Total Damages per person: $240	Total Damages per person: $220	Total Damages per person: $190
Moderately Warmer Climate by 2050	Total Damages: $16M	Total Damages: $17M	Total Damages: $17M
	Total Damages per person: $780	Total Damages per person: $730	Total Damages per person: $650
Severely Warmer Climate by 2050	Total Damages: $40M	Total Damages: $50M	Total Damages: $50M
	Total Damages per person: $1900	Total Damages per person: $2200	Total Damages per person: $1900

Source: CWCB Future Avoided Cost Explorer: Hazards https://cwcb.colorado.gov/FACE

4.12.9 Differences by Jurisdiction

The wildfire risk for the City of Aspen in shown in Figure 4-38 below. As shown, approximately half of the incorporated area is in the lowest risk zones. Figure 4-39 below shows the WUI risk areas in the City of Aspen. This map shows significant portions of Aspen, including areas near downtown, are in the highest WUI risk areas. There are 3,882 buildings in Aspen within the moderate or high WUI risk areas, which is approximately 57% of the entire building stock in the city. The number of homes within or in proximity to the WUI is likely to continue growing.

In the Snowmass Village area, approximately 70% of the Snowmass-Wildcat Fire Protection District is at higher risk for wildfire. Most of that area is in the Wildcat Ranch area, which has low population density but very high property values. In Snowmass Village proper, about 40% of the area has a “High” wildfire risk, but the area has both high population density and high property values, so the Town is the highest risk area in the district. In addition to residential areas, Town Hall, Snowmass Village Police Department, the Town Maintenance Facility, Post Office, and Snowmass Center business district are located within the incorporated area. Figure 4-40 and Figure 4-41 below show the wildfire risk and WUI risk areas in Snowmass Village.

Brush Creek Road is the primary access to Snowmass Village and is vulnerable to both wildland fire and landslide/mudslide hazards. Owl Creek Rd, the only other access road, is also susceptible to these hazards. The Holy Cross electrical substation is in an area that has moderate wildfire threat but is constructed of materials that reduce its vulnerability.

Like the other communities along the Roaring Fork River valley floor in Pitkin County, the Town of Basalt has experienced residential growth on the valley edges and within the densely forested hillsides outside of town above the valley. The Basalt & Rural Fire Protection District spans parts of both Pitkin and Eagle Counties and its personnel are trained to fight structural fires in the Town of Basalt, urban interface fires in surrounding areas and wildland fires in high terrain and backcountry areas. Figure 4-42 and Figure 4-43 below show the wildfire risk areas and WUI risk areas, respectively, for the Town of Basalt.

Figure 4-38 City of Aspen Wildfire Risk

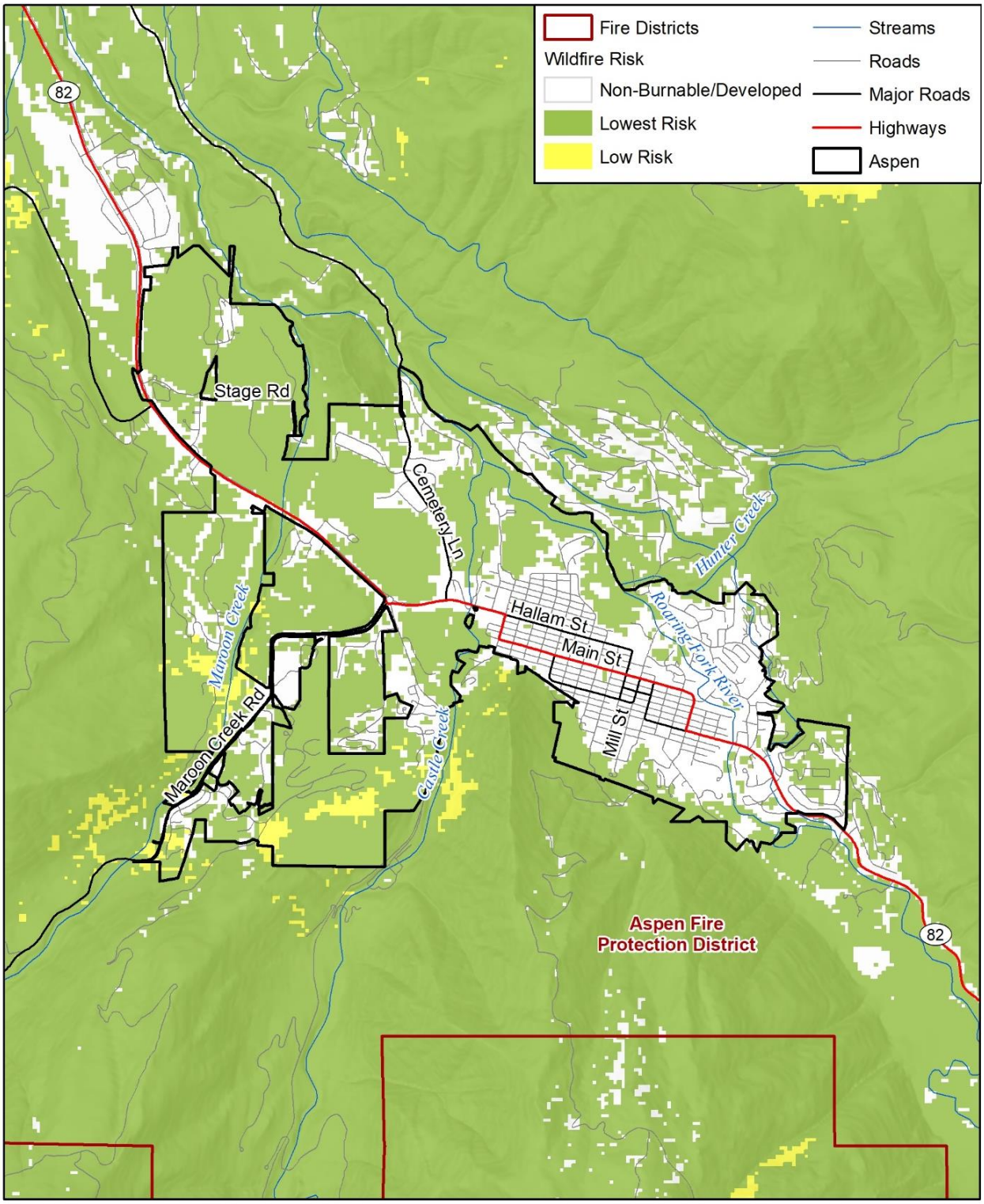


Figure 4-39 City of Aspen WUI Risk Areas

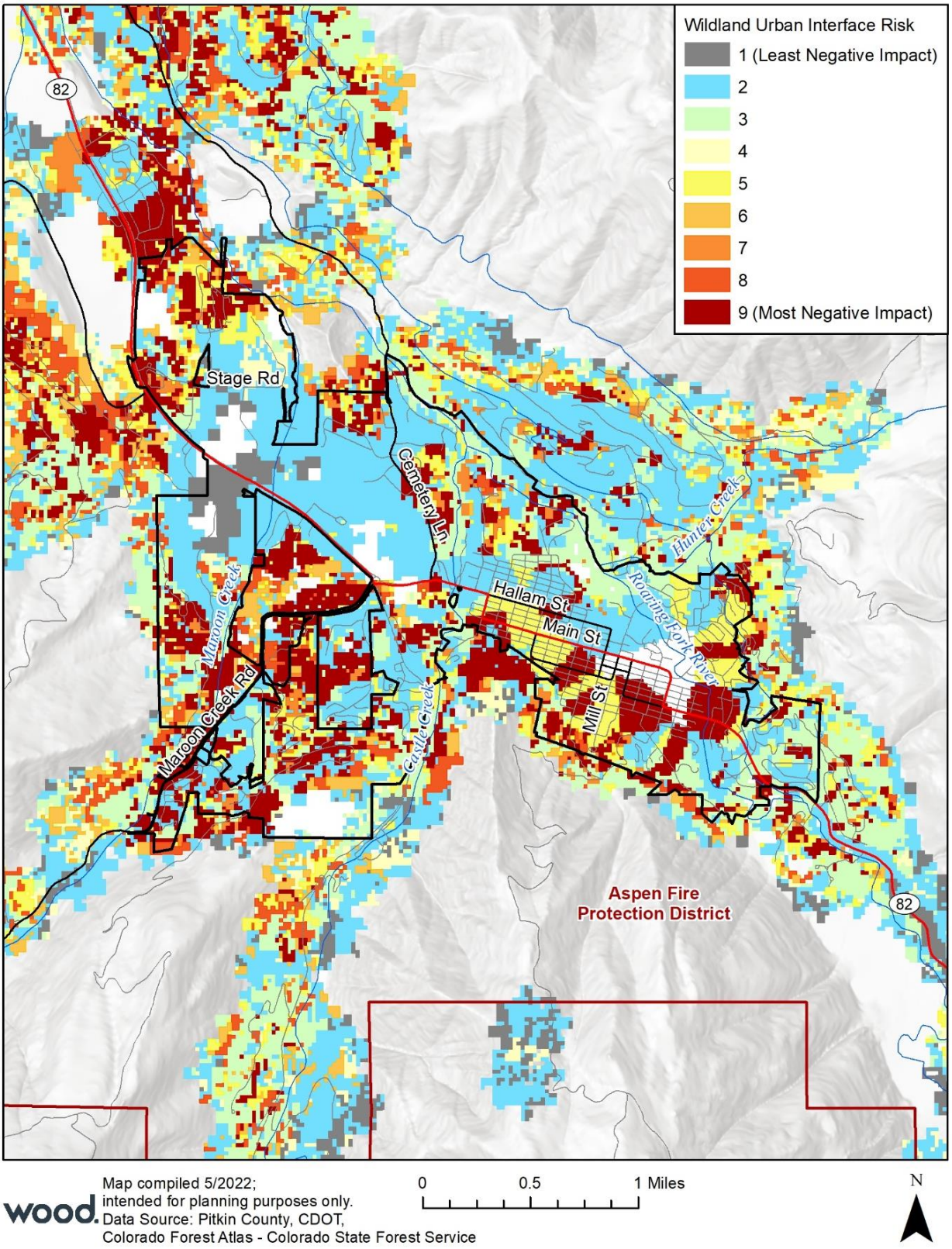


Figure 4-40 Town of Snowmass Village Wildfire Risk

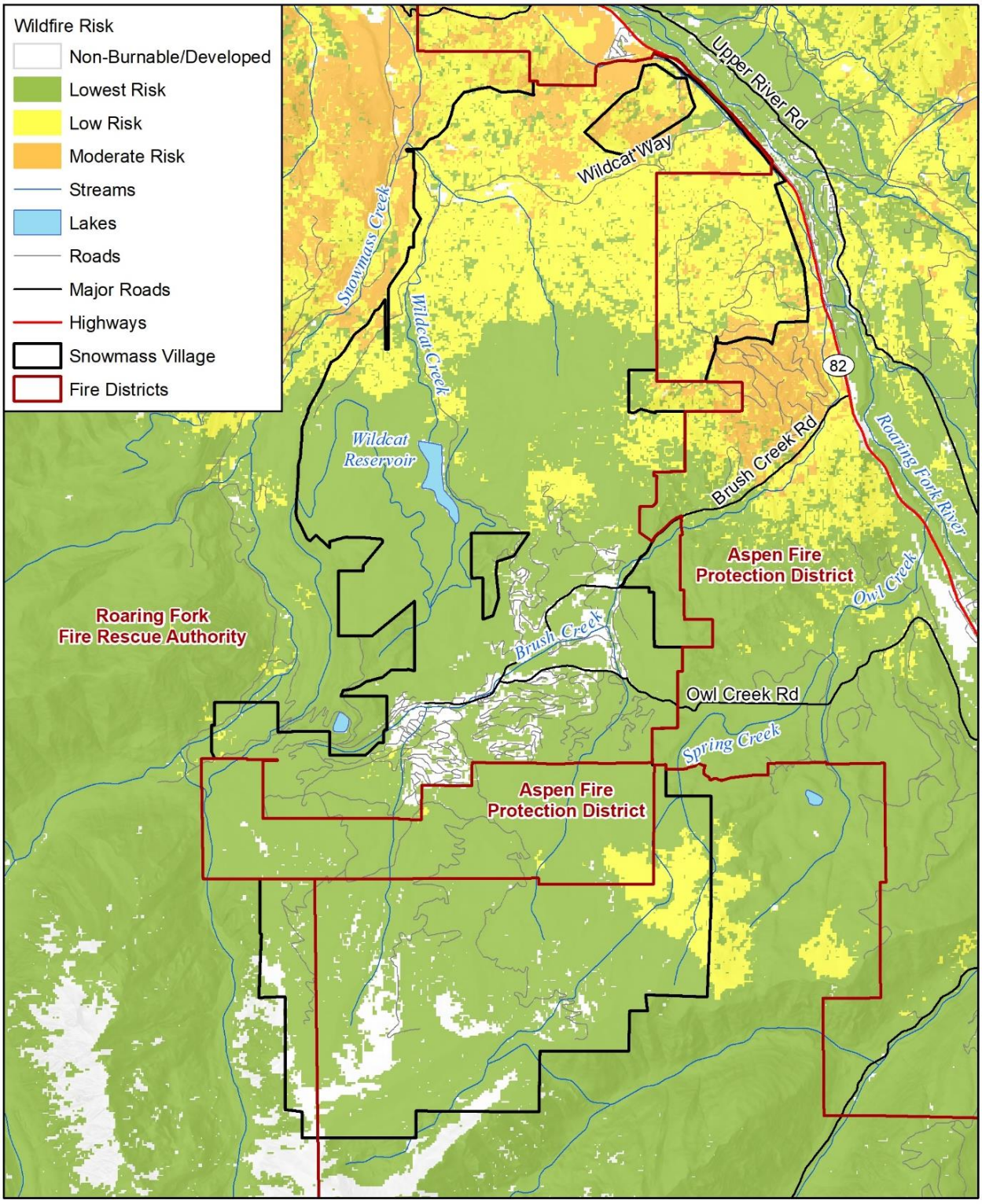


Figure 4-41 Town of Snowmass Village WUI Risk

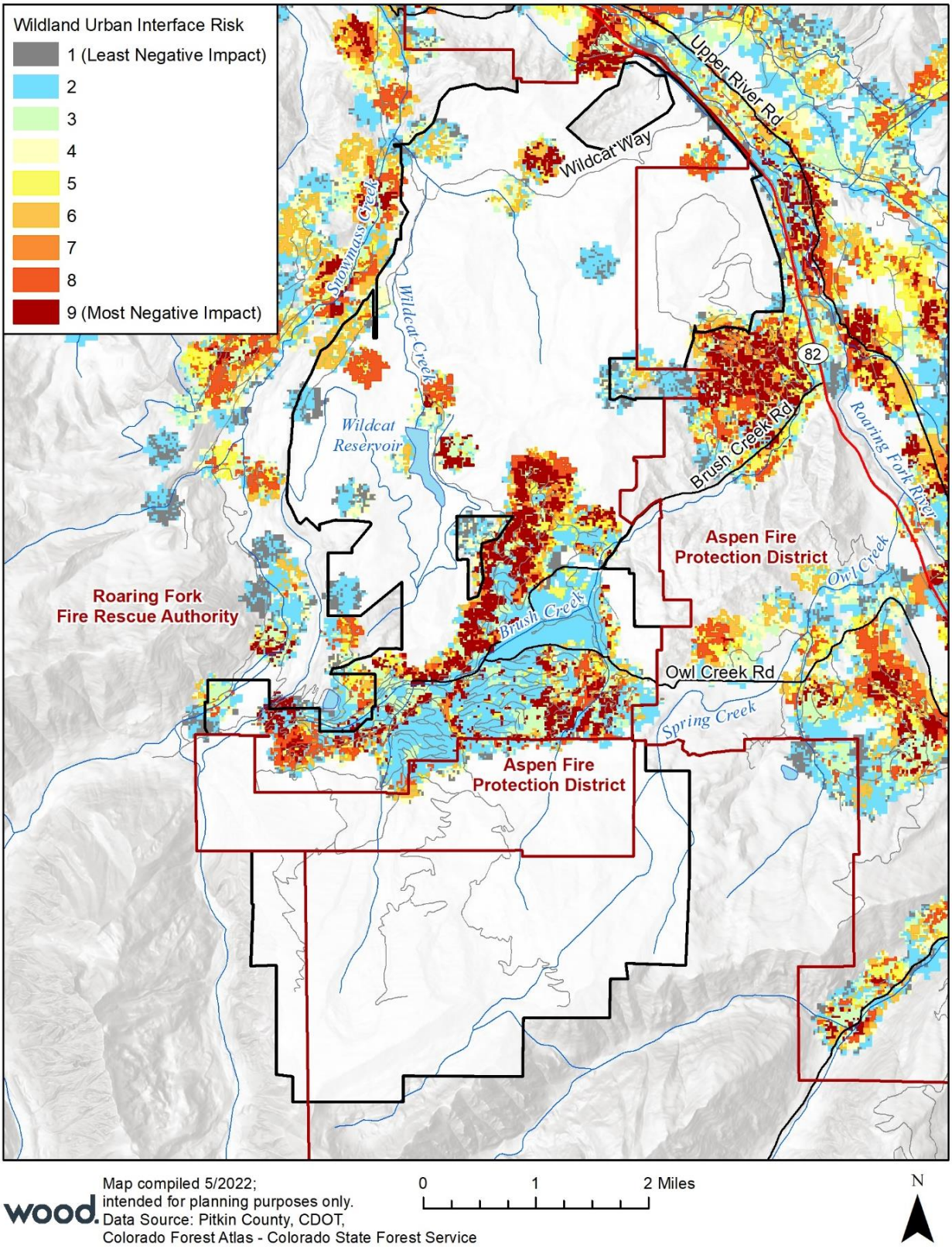


Figure 4-42 Town of Basalt Wildfire Risk

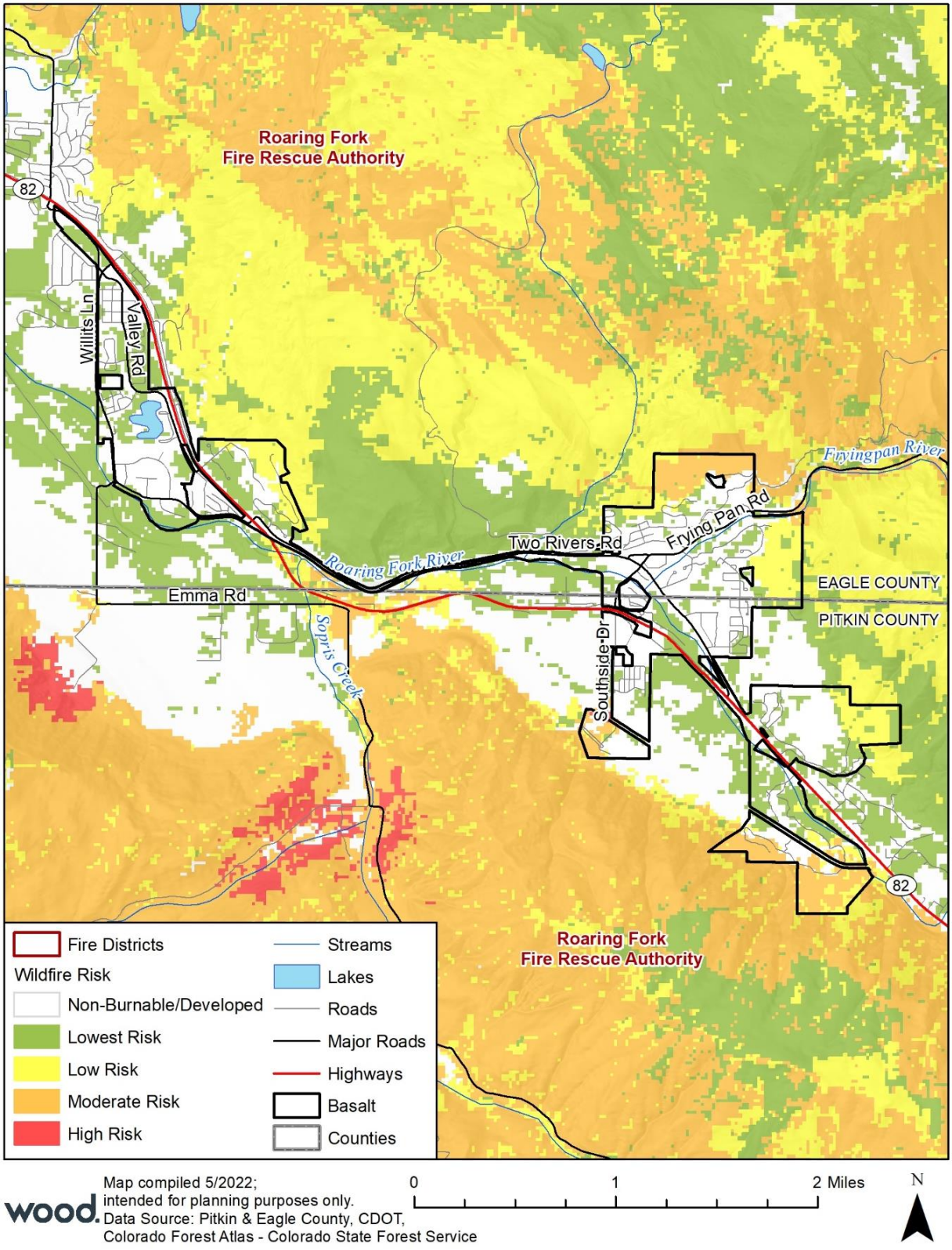
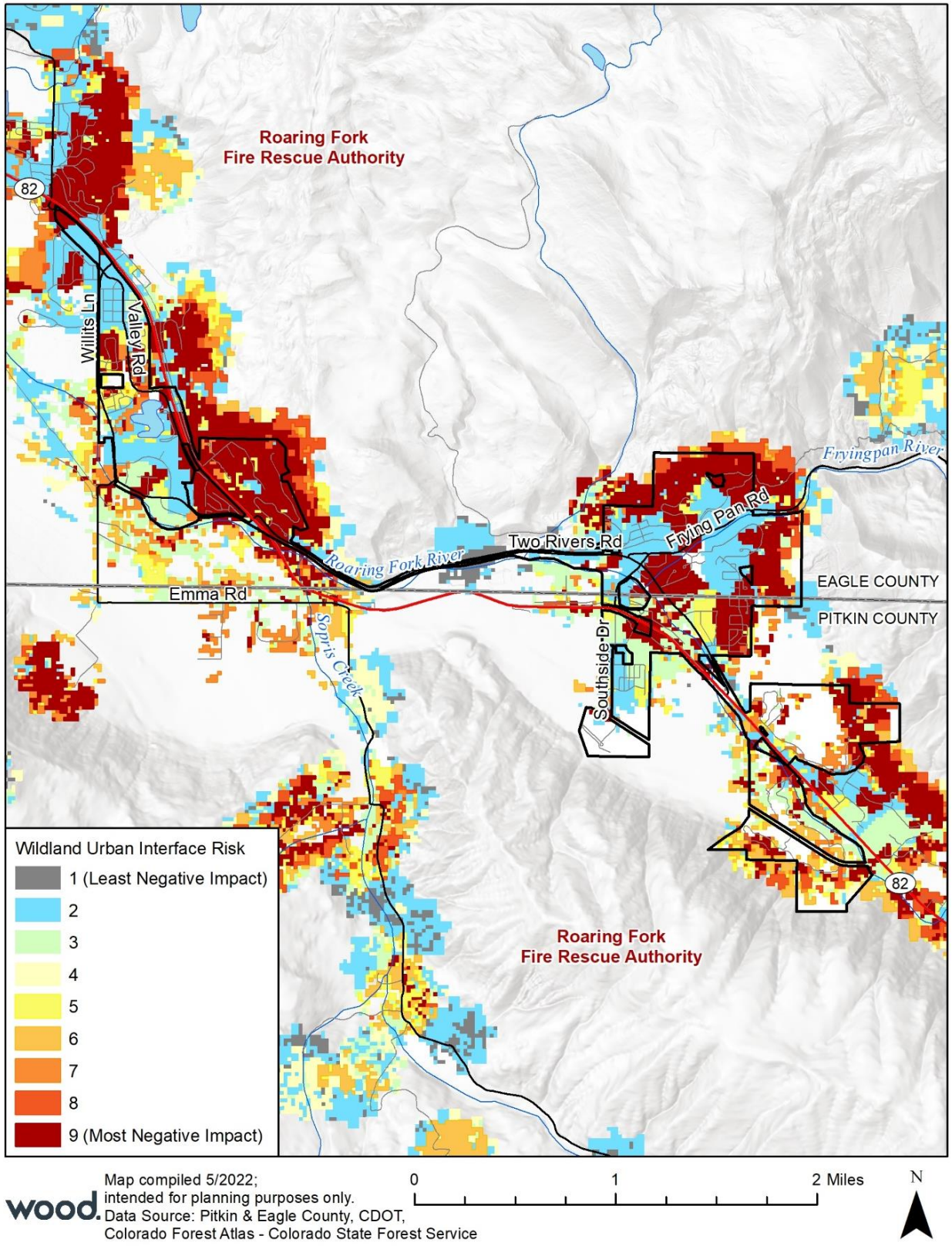


Figure 4-43 Town of Basalt WUI Risk



4.12.10 Risk Summary

- Overall significance of the hazard is high for all jurisdictions.
- A total of 5,012 parcels and 5,290 buildings are located in areas exposed to wildfire risk, with a total value of approximately $17 billion. However, over 90% of those parcels are at low or lowest risk; 424 parcels and 511 buildings worth $841 million are at moderate or high risk.
- The greatest exposure is located in the unincorporated parts of the County.
- Wildfires within Pitkin County and in adjacent counties can deter tourism and affect the local economy and air quality.
- Public education and outreach to people living in or near the fire hazard zones should include information about and assistance with mitigation activities such as defensible space, and advance identification of evacuation routes and safe zones.
- Both the natural and human-caused conditions that contribute to the wildland fire hazard are tending to exacerbate through time.
- Wildfires could cause a range of secondary hazards, such as contamination of reservoirs, destabilized slopes and landslides, increased erosion, and flooding.
- Revisions to the Colorado Revised Statutes exempted properties divided into parcels of 35 acres or more from the statutory definition of a subdivision restricting the county's ability to enforce county regulations and mitigation.
- Related hazards: Drought, Debris Flow, Flooding, Lightning

4.13 Winter Storm

WINTER STORM	LOCATION	MAGNITUDE/ SEVERITY	PROBABILITY OF FUTURE EVENTS	OVERALL SIGNIFICANCE
Pitkin County	Extensive	Critical	Highly Likely	**High**
Aspen	Extensive	Limited	Highly Likely	**Medium**
Basalt	Extensive	Limited	Highly Likely	**Medium**
Snowmass Village	Extensive	Limited	Highly Likely	**Medium**
Aspen Fire	Extensive	Critical	Highly Likely	**High**
Roaring Fork Fire	Extensive	Critical	Highly Likely	**High**

4.13.1 Description

Winter storms can include heavy snow, ice, and blizzard conditions, all of which are common occurrences in Pitkin County. Heavy snow can immobilize a region, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse roofs and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, damage repair, and business losses can have a tremendous impact on cities and towns.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days until damage can be repaired. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Some winter storms are accompanied by strong winds, creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chills. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Blowing snow can reduce visibilities to only a few feet in areas where there are no trees or buildings. Serious vehicle accidents can result in injuries and deaths. The following definitions detail some of the different types of winter storm events that occur in Pitkin County:

- **Blizzards**, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater, and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard does not necessarily indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel treacherous, even on foot. The strong winds may also cause dangerous wind chills. Ground blizzards can develop when strong winds lift snow off the ground and severely reduce visibilities.
- **Heavy snow** may fall during winter storms in large quantities. Six inches or more in 12 hours, or eight inches or more in 24 hours, creates conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves drop from the trees in the fall, or after the trees have leafed out in the spring, may cause problems with broken tree branches and power outages.
- **Ice storms** develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the earth's surface. Extended periods of freezing rain can lead to accumulation of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Thick accumulations can bring down trees and power lines.

The National Weather Service also tracks data on:

- **Winter Storms**, defined as winter weather events that have more than one significant hazard (including falling or blowing snow, ice, and/or sleet) and meet or exceed regional 12- and/or 24-hour warning criteria for at least one of the included elements; and
- **Winter Weather**, defined as events that do not meet regional warning criteria but that cause death, injury, or a significant impact to commerce or transportation.

4.13.2 Past Events

Colorado as a whole and Pitkin County both have a history of significant winter storm events. The NCEI database record a total of 885 winter weather events in Pitkin County between 1996 and July 2022. The event types include a combination of blizzards, cold/wind chill, extreme cold/wind chill, heavy snow, ice storm, winter weather, and winter storms, as shown in Table 4-47. For the purposes of recording these events in the NCEI database, it is important to note that winter events often "stack" on one another, meaning that different winter storm events tracked by the database may occur simultaneously alongside others, which potentially overinflates the number of events. Locations for the records are limited to one of two National Center for Environmental Information-defined zones:

- Central Colorado River Basin
- Gore and Elk Mountains/Central Mountain Valleys

Table 4-47 Winter Storm Events by Event Type, 1996-March 2022

EVENT TYPE	NUMBER OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Blizzard	2	-	-	-	-
Cold/Wind Chill	1	-	-	-	-
Extreme Cold/Wind Chill	1	-	-	-	-
Heavy Snow	117	1	2	-	-
Ice Storm	1	-	-	-	-
Winter Storm	250	-	5	-	-
Winter Weather	513	-	-	$2,000	-
Grand Total	**885**	**1**	**7**	**$2,000**	**-**

Source: NCEI Database

Pitkin County has also received five USDA Secretarial Disaster Designations related to severe winter weather:

1. 2012 (S3307) due to freezing conditions;
2. 2013 (S3583) due to frost and freezing conditions;
3. 2014 (S3760) due to freezing conditions;
4. 2020 (S4696) due to frost and freezing conditions; and
5. 2021 (S5018) due to frost and freezing conditions.

4.13.3 Location

All of Pitkin County is susceptible to occasional blizzard, heavy snowfall, and ice storm conditions. The size of events varies and may range from isolated (impacting only a portion of the area) to statewide. Most severe winter storms are widespread events, impacting multiple counties simultaneously and for extended time periods. Ice and snow accumulation that closes Colorado 82, the most important corridor and only route available in the winter for the transport of people and the provisions in and out of the county, presents the greatest public safety challenges during severe winter storms.

4.13.4 Magnitude and Severity

Although common in Pitkin County, heavy snowstorms can occasionally present major public safety challenges for communities in the Roaring Fork Valley. Severe winter storms can immobilize transportation systems and strand motorists, stop the flow of supplies, halt air traffic, disrupt emergency and medical

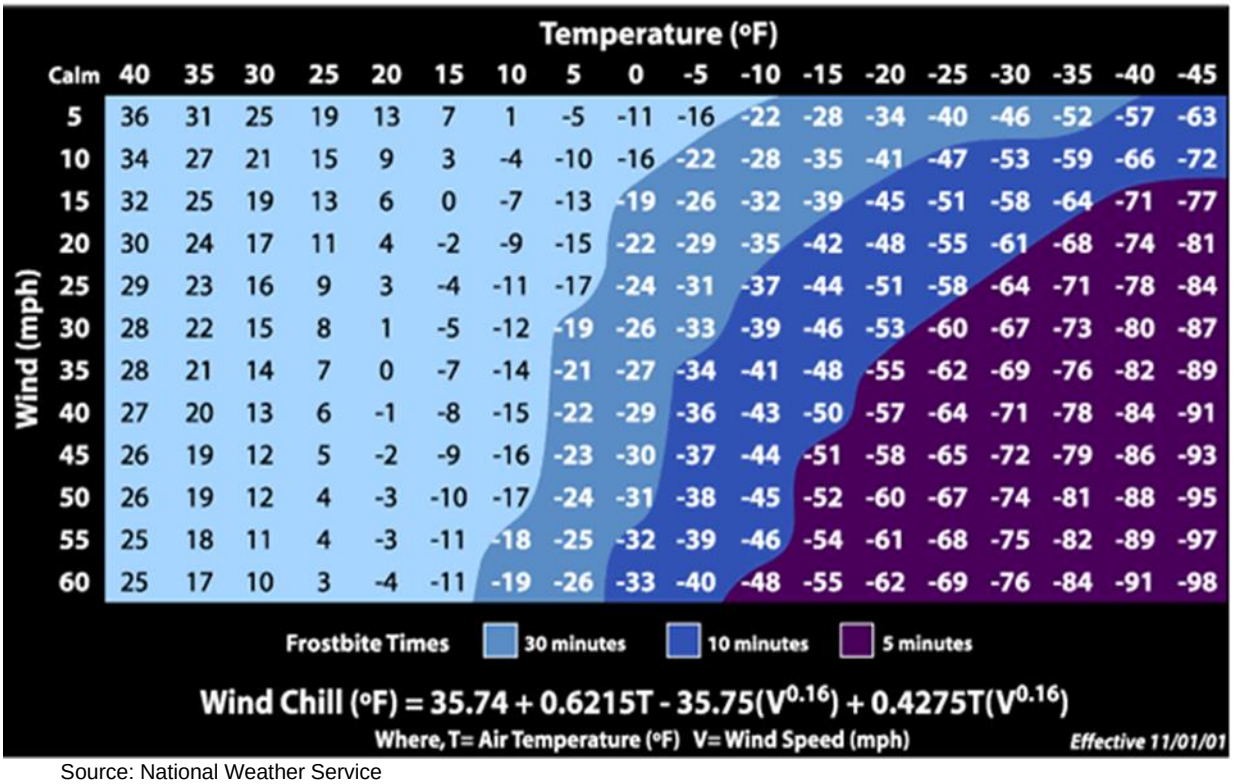
services, and isolate residents and communities. Heavy accumulations of snow and ice and strong winds can collapse roofs and bring down trees, power lines, telephone poles and lines, and communication towers, causing extended communication and power disruptions. Loss of power can impact emergency and medical services without working backup generators and also affects homes, businesses, and water, sewer, and other services operated by electric pumps.

Blowing snow can severely reduce visibility and create icy road conditions that lead to serious, sometimes fatal vehicle accidents. The cost of snow removal, damage repairs, and business losses can be significant. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening, especially for infants and the elderly.

Heavy snowstorms can also lead to more life-threatening avalanches. Each year, Colorado leads the nation in avalanche deaths and more lives are lost due to avalanches in Pitkin County than any other county in the state. Avalanches pose a serious threat to residents, road maintenance crews, and backcountry travelers. The communities of Aspen, Basalt and Snowmass Village have rated the magnitude/severity of the winter storm hazard as limited and Pitkin County rates the magnitude/severity critical.

In 2001, the National Weather Service (NWS) implemented an updated wind chill temperature index (Figure 4-44). This index describes the relative discomfort or danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. A wind chill watch is issued by the NWS when wind chill warning criteria are possible in the next 12 to 36 hours. A wind chill warning is issued for wind chills of at least -25°F on the plains and -35°F in the mountains and foothills.

Figure 4-44 National Weather Service Wind Chill Chart



Source: National Weather Service

4.13.5 Probability of Future Events

Even in a global-warming climate, the atmospheric activity that produces winter weather conditions such as ice, snow, extreme cold, and high winds will continue to occur on a regular basis in Pitkin County for the

foreseeable future. Severe winter weather is a common, and usually welcome, occurrence in Pitkin County, where residents are well- prepared, but newcomers and visitors are often inexperienced and unskilled to handle conditions. Severe winter storms are highly likely in Pitkin County and occur nearly every year.

4.13.6 Climate Change Considerations

As the atmosphere holds more moisture, winter storms may become more intense, producing heavier than normal precipitation, including heavier snowfall. But winter has become increasingly unpredictable in recent decades due to climate change, scientists and ski industry experts say. As mid-winter temperatures increase, warmer oceans may fuel stronger winter storms, but snow cover may not stay around as long. Shorter winters are sure to have significant impacts for the local economy and snow sports industry, including resorts, hotels, restaurants and ski shops and the individuals they employ.

While climate researchers cannot determine if climate change caused a specific extreme winter storm, or even a specific seasonal change, climate warming will continue to cause a decrease in annual snowfall amounts overall and a shortening of the length of the snow season. However, when severe winter storms do occur, there may be added moisture in the air to generate more intense rates of snowfall. Fortunately, communities in the Roaring Fork Valley are well accustomed and prepared to deal with extreme winter weather and provide for the safety of residents and visitors.

The effects of climate change in Colorado have already been observed. The following climate change observations are noted in the 2018 Colorado State Hazard Mitigation Plan:

- Snowpack, as measured by April 1, 2018, snow-water equivalent (SWE), has been mainly below average since 2000 in all of Colorado's river basins, but long-term (30-year, 50-year) declining trends have been detected.
- The timing of snowmelt and peak runoff has shifted earlier in the spring by 1 to 4 weeks across the state's river basins over the past 30 years, due to the combination of lower SWE since 2000, the warning trend in spring temperatures, and enhanced solar absorption from dust-on-snow.

4.13.7 Vulnerability

Winter storms will continue to occur with high frequency throughout Pitkin County and occasionally cause widespread impacts. The greatest risk is to the safety of the public, including travelers on the county's highways and roads. Highway closures and power outages can present a need to open and manage public shelters and provide mass care services. Winter storms can occasionally lead to school and business closures, road closures, and extraordinary requirements to remove snow and maintain critical emergency services.

Fortunately, structural damage from severe winter storms is typically minimal and covered by property insurance. New structures and facilities built to code should be able to withstand snow loads associated with winter storms. Future development, particularly in more isolated areas, will create emergency access issues and increase demand on road crews and emergency services.

People

Vulnerable populations include the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life-threatening to those dependent on electricity for life support. According to the U.S. Department of Health and Humans Services emPOWER Map, there are 441 electricity dependent Medicare beneficiaries in Pitkin County. These populations face isolation and exposure during severe winter weather events and could suffer more secondary effects of the hazard. Commuters who are caught in storms may be particularly vulnerable. Stranded commuters may be vulnerable to carbon monoxide poisoning or hypothermia. Additionally, individuals engaged in outdoor recreation during a severe winter event may be difficult to locate and rescue.

Property

High snow loads can cause damage to buildings and roofs. Most property damages with winter storms are related to the heavy snow loads and vehicle accidents. Older buildings are more at risk, as are buildings with large flat rooftops (often found in public buildings such as schools). Vulnerability is influenced both by architecture and type of construction material and should be assessed on a building-by-building basis.

Critical Facilities & Infrastructure

Roads are especially susceptible to the effects of a severe winter storm, which can temporarily hinder transportation and require resources for snow removal. As noted under the people section, heavy snow accumulation may also lead to downed power lines not only causing disruption to customers but also have potentially negative impacts on critical facilities in the county which may have cascading impacts on the local governments' ability to operate.

Economy

Roads may become impassable due to ice or snow. Ice accumulation on roadways can create dangerous driving conditions. Colorado 82 is the major transportation route that transports goods and people throughout the county, and it is also the only passable route out of Pitkin County for the incorporated jurisdictions. Closure of this route in extreme weather would lead to a total shutdown of goods entering the county and lead to delays in emergency response time. Beyond Colorado 82, there are limited county roads that are available to move people and supplies throughout the region. Many of the smaller side roads are narrow and curved.

Historic, Cultural, and Natural Resources

Winter storms can cause significant environmental impacts. High winds and heavy accumulations of ice during storms can damage vegetation and bring down trees and tree limbs. Severe cold and sudden changes in temperature can also damage or kill vegetation and crops. Secondary impacts, such as flooding from rapidly melting snow after a storm, can overwhelm both natural and constructed drainage systems. Additionally, the storms may result in closed highways and blocked roads. It is not unusual for motorists and residents to become stranded. Late season heavy snows will typically cause some plant and crop damage.

4.13.8 Development Trends

Future residential or commercial buildings built to current building codes should be able to withstand snow loads from severe winter storms. Population and commercial growth in the County will increase the potential for complications with traffic and commerce interruptions associated winter storms, as well as increased exposed populations vulnerable to the impacts of a severe winter storm such as power outages or delays in vital services. Future power outages or delays in power delivery to future developments may be mitigated by construction considerations such as buried power lines. Future development will also require future considerations for snow removal capacity including equipment, personnel, logistical support, and planning for snow storage areas. Adequate planning will help establish the cost-effective balance.

Public education efforts may help minimize the risks to future populations by increasing knowledge of appropriate mitigation behaviors, clothing, sheltering capacities, and decision-making regarding snow totals, icy roads, driving conditions, and outdoor activities (all of which are contributors to decreased public safety during severe winter storms.) New establishments or increased populations who are particularly vulnerable to severe winter storms (such as those with health concerns or those who live in communities that may be isolated for extended periods of time due to the hazard) should be encouraged to maintain at least a 72-hour self-sufficiency as recommended by FEMA. Encouraging contingency planning for businesses may help alleviate future economic losses caused by such hazards while simultaneously limiting the population exposed to the hazards during commuting or commerce-driven activities.

4.13.9 Differences by Jurisdiction

Severe winter storm events are more regional in nature, likely impacting the entire county with similar intensity and severity. Because of this and the relative proximity of each jurisdiction in the county to one another, as well as their similar geographic settings, the impacts of a winter storm are not likely to vary greatly between jurisdictions.

4.13.10 Risk Summary

- The overall significance of winter storms is High in the unincorporated areas and Medium in the incorporated cities/towns.
- Winter storms of varying severity can be expected to impact the planning area multiple times each year.
- Winter storms are typically regional events, and future events can be expected to impact the entire county simultaneously.
- Winter storms have not historically caused significant damage or casualties in Pitkin County, however the potential for these issues exists.
- There is a significant risk for vehicle accidents and stranded motorists, who may be unprepared to protect themselves from exposure, during winter storms.
- The largest impacts typically involve utility and transportation disruptions.
- Private businesses and residences may not have adequate access to safe sources of backup power in the event of a prolonged utility outage.
- Future efforts should be made to identify populations at risk and determine special needs during winter storm events.
- Related hazards: avalanche, ice jams.

5 MITIGATION STRATEGY

DMA Requirement §201.6(c)(3):

[The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This section shall include:

(i) A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

(ii) A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

(iii) An action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This chapter describes the mitigation strategy developed by the Pitkin County Hazard Mitigation Planning Committee (HMPC), based on the risk assessment that was updated at both planning workshops, survey feedback, and interviews with key staff and stakeholders. It explains how the participating jurisdictions accomplished Phase 3 of FEMA's 4-phase guidance, Develop the Mitigation Plan, and includes the following from the 10-step planning process:

- Planning Step 6: Set Goals,
- Planning Step 7: Review Possible Activities, and
- Planning Step 8: Draft an Action Plan.

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the HMPC led to the mitigation strategy and mitigation action plan for this HMP update. As part of the plan update process, a comprehensive review and update of the mitigation strategy portion of the plan was conducted by the HMPC. As part of this process the original goals and objectives from the 2017 Plan were reviewed and reaffirmed. The HMPC thought the goals and objectives are still valid and were kept as originally written. The mitigation actions from the 2018 Plan were also reviewed and revised for this plan update.

5.1 MITIGATION GOALS

Mitigation goals are broad-based public policy statements that:

- Represent basic desires of the community.
- Encompass all aspects of the community, public and private.
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome.
- Are future-oriented, in that they are achievable in the future.
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard for implementation, that is, implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that the goals are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals.

Based upon the risk assessment review and goal setting process, the HMPC re-assessed the goals from the 2018 Plan. The HMPC determined they were still largely valid with some re-wording. The HMPC also decided to add three new goals focused on public education, equity and inclusivity, and resiliency.

The goals for the 2023 Pitkin County Hazard Mitigation Plan are:

1. **Reduce the potential for impacts on human life and safety, property loss and damage to critical facilities and the natural environment by natural and human-caused hazards.**

2. **Increase the public's awareness of our hazard vulnerabilities and promote hazard mitigation activities by residents.**

3. **Increase Pitkin County's resiliency to hazards by integrating mitigation into all planning initiatives, to enable faster recovery from disasters.**

4. **Recognizing the common issues and mutual goals of hazard mitigation and climate adaptation, promote collaborative planning and identify opportunities to dovetail actions that reduce risks from both natural hazards and climate warming.**

5. **Promote equity by ensuring vulnerable populations and under-served communities are included in mitigation planning and activities.**

Objectives are optional strategies to attain the goals and are more specific and measurable. After discussion, the HMPC decided not to adopt any objectives for this Plan.

5.2 Progress on Previous Mitigation Actions

A review of mitigation actions from the 2018 HMP shows that Pitkin County and the participating jurisdictions have been successful in implementing mitigation activities. The 2018 HMP contained 54 separate mitigation actions. As of November 2022, six of these actions have been completed. The remaining 48 actions are continuing into 2023. Many of the ongoing actions include actions that are implemented on a regular or annual basis that contribute to the goals of this plan that will continue to be needed into the future. The following table lists the 2018 actions completed and deleted.

Table 5-1 Completed and Deleted Actions

ID	HAZARDS	MITIGATION ACTION	ACTION STATUS NOTES
PC 1.7	Flood	Adopt New Digital Flood Insurance Rate Maps (DFIRMs) following approval by FEMA.	Completed. New Floodplain maps adopted August 15th, 2019.
PC 1.13	All Hazards	Obtain Integrated Public Alert & Warning System (IPAWS). Obtain IPAWS Wireless Emergency Alert (WEA) users license and pre-build notification lists and subscription groups for priority hazards for emergency notification.	Completed. County now has IPAWS and Everbridge.
PC 1.14	Flood, Dam Failure	Improve coordination with owners and operators of High- and Significant-Hazard dams within Pitkin County.	Completed. County OEM has working relationships and communication channels with all dam operators in county
A 1.4	Mudslides	Conduct risk study at Buttermilk ski area. Conduct a study at Buttermilk ski area to analyze drainage, mud, and vegetation conditions and risks and potential damages from mudslides.	Completed. The City of Aspen reviewed Buttermilk for mudslide and damage potential and found the area low risk, except below those areas where snow is stored and molded for ski terrain.
B 1.3	Flood	Monitor Southside Floodplain mapping. Monitor implementation of new Southside Floodplain mapping and determine next steps.	Completed. Town of Basalt reassured assumptions made in original floodplain modeling and processed LOMR.
BRF 1.4 / SWF 1.4	Wildfire	Develop, implement, and maintain wildfire codes. Including brush management, weed abatement, building codes, construction types.	Completed. Building codes for wildfire hardened structures built new. Adopted ordinance 13 TOSV Municipal 2019.

5.2.1 Continued Compliance with the National Flood Insurance Program

The National Flood Insurance Program (NFIP) makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities. For most participating communities, FEMA has prepared a detailed Flood Insurance Study (FIS). The FIS presents water surface elevations for floods of various magnitudes, including the 1% annual chance flood (also known as a 100-year flood) and the 0.2% annual chance flood (also known as a 500-year flood). Base flood elevations and the boundaries of the 1% and 0.2% floodplains are shown on Flood Insurance rate Maps (FIRMs), which are the principal tool for identifying the extent and location of the riverine flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a floodplain, participating jurisdictions must ensure that three criteria are met:

- New buildings and those undergoing substantial improvements must, at a minimum, be elevated to protect against damage by the 1% annual chance flood.
- New floodplain development must not aggravate existing flood problems or increase damage to other properties.
- New floodplain development must exercise a reasonable and prudent effort to reduce its adverse impacts on threatened salmonid species.

As referenced in Table 3-10, Pitkin County, the City of Aspen, and the Towns of Basalt and Snowmass Village joined the NFIP in 1987, 1985, 1980, and 1987, respectively. Structures permitted or built in the County before the jurisdictions joined the NFIP are called pre-FIRM structures, and structures built afterwards are called post-FIRM. Post-FIRM structures built in compliance with the floodplain regulations are mitigated to withstand floods up through the 100-year event. The insurance rate is different for the two types of structures, as pre-FIRM are at higher risk of flooding.

The County and participating communities are all currently in good standing with the provisions of the NFIP. Compliance is monitored by FEMA regional staff. Maintaining compliance with the NFIP is an important component of flood mitigation and risk reduction.

Given the flood hazard and risk in the planning area and recognizing the importance of the NFIP in mitigating flood losses, an emphasis is placed on continued compliance with the NFIP by Pitkin County and the NFIP participating jurisdictions Aspen, Basalt, and Snowmass Village. As NFIP participants, these communities have and will continue to make every effort to remain in good standing with NFIP. This includes continuing to comply with the NFIP's standards for updating and adopting floodplain maps and maintaining and updating the floodplain zoning ordinance.

5.3 Identification and Analysis of Mitigation Actions

To identify and select mitigation measures to support the mitigation goals, each hazard identified in Chapter 4 was evaluated. The HMPC analyzed a comprehensive set of viable mitigation alternatives for both new and existing buildings and infrastructure that would support identified goals and objectives. Each HMPC member was provided with the following list of categories of mitigation measures, which originate from the Community Rating System (CRS) program:

- **Prevention:** Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural:** Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services:** Actions that protect people and property during and immediately after a disaster or hazard event.

- **Public information/education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

The HMPC members were also provided with several lists of alternative multi-hazard mitigation actions for each of the above categories via email and at the mitigation strategy meeting.

Another reference handout document titled “Mitigation Ideas” developed by FEMA was distributed to the HMPC via an online link. This reference provides four categories of mitigation actions that were discussed at the HMPC meeting in addition to the NFIP/CRS categories. These include:

Other alternatives discussed in the meeting include the four ‘A’s’ of mitigation:

- **Alter** the physical nature of the hazard: wildfire defensible space and fuels treatments, snow fences etc.
- **Avert** the hazard away from people, buildings, and infrastructure: engineered solutions, drainage, and channel improvements, floodproofing, fuel breaks.
- **Adapt** to the hazard: land use planning, building codes and design standards, warning systems etc.
- **Avoid** the hazard: natural systems protection, open space, acquisition, or relocation of properties out of hazardous areas.

To facilitate the brainstorming process, the HMPC referred to a matrix of typical mitigation alternatives organized by CRS category for the hazards identified in the plan, in addition to a handout that explains the categories and provided examples. HMPC members were encouraged to develop mitigation alternatives that would protect future, as well as existing, development from hazards per the DMA 2000 regulations. A facilitated discussion then took place to examine the existing actions in the 2018 plan and analyze the other possible mitigation alternatives. With an understanding of the alternatives, a brainstorming session was conducted to generate a list of preferred mitigation actions. The result was new and updated project ideas with the intent of meeting the identified goals and mitigating identified hazards.

5.3.1 Prioritization of Mitigation Actions

The Planning Team discussed a wide range of possible mitigation actions and employed the STAPLEE methodology (see description below) to evaluate and prioritize each proposed action. For each recommended action, the Planning Team developed a project summary that included a description of the action, the department or agency responsible for implementing it, and an estimated timeframe for completion. While STAPLEE provided a template for the Planning Team to evaluate a range of specific mitigation actions and projects, the results of the risk assessment were also considered (i.e., probability and severity of impacts for each hazard). Planning Team members also weighed the pros and cons of proposed actions based on their judgement, subject matter expertise and experience with local hazards.

The STAPLEE evaluation tool was used as one method for evaluating the effectiveness of each action item. STAPLEE considers social, technical, administrative, political, legal, economic, and environmental constraints and benefits of a proposed activity.

- **S**ocial: Does the measure treat people fairly?
- **T**echnical: Will it work? Does it solve the problem? Is it feasible?
- **A**dministrative: Is there capacity to implement and manage the project?
- **P**olitical: Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- **L**egal: Does your organization have the authority to implement? Is it legal? Are there liability implications?
- **E**conomic: Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- **E**nvironmental: Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority (the 'economic' factor of STAPLEE). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does the action protect lives?
- Does the action address hazards or areas with the highest risk?
- Does the action protect critical facilities, infrastructure, or community assets?
- Does the action meet multiple goals or address multiple hazards?

At the mitigation strategy meeting, the HMPC reviewed and discussed the STAPLEE considerations to determine which of the identified actions were most likely to be implemented and effective. Prioritization of previous mitigation actions identified in the 2018 HMP that are continuing in the updated plan were revisited during a HMPC meeting. New actions identified for 2023 also were prioritized based on discussions and review with the STAPLEE considerations in mind.

5.4 Mitigation Action Plan

This section outlines the development of the updated mitigation action plan. The action plan consists of the specific projects, or actions, designed to meet the plan's goals. As noted in Section 5.2, a number of mitigation activities are already in progress or have been completed. Over time the implementation of new and continuing projects will be tracked as a measure of demonstrated progress on meeting the plan's goals.

As noted in Section 2, there were two additional fire districts participating in the 2018 HMP: Basalt Rural Fire and Snowmass-Wildcat Fire. These two districts have since been combined to create the Roaring Fork Fire Rescue Authority, and as such condensed their mitigation actions from 2018. The total number of actions identified by each jurisdiction is summarized in Table 5-2, including those actions completed, deleted, or continued from the 2018 HMP.

Table 5-2 Mitigation Actions Summary by Jurisdiction

JURISDICTION	# OF ACTIONS IN 2018 HMP	# OF ACTIONS COMPLETED	# OF ACTIONS DELETED	# OF ACTIONS CONTINUED	NEW ACTIONS ADDED	# OF ACTIONS IN 2023 HMP
Pitkin County	24	3	0	21	17	38
Aspen	7	1	0	6	2	8
Basalt	6	1	0	5	4	9
Snowmass Village	5	0	0	5	13	8
Aspen Fire	6	0	0	6	4	10
Roaring Fork Fire	6	1	0	5	6	11
Total	**54**	**6**	**0**	**48**	**36**	**84**

The results of the project identification and prioritization exercise for each participating jurisdiction are summarized in Table 5-3 through Table 5-8 below. These projects detail specific actions for reducing future hazard-related losses within Pitkin County. The projects are organized by jurisdiction and include notes about the department and partners necessary to implement the project, estimated cost, potential funding sources, timeline, which goal(s) that the projects support, and their relative level of priority high, medium, and low. The tables also provide status/implementation notes that describe progress made on the actions so far, using the following categories, and, where applicable, notes if there were changes in the priority level from the previous plan:

- **Not Started:** Work has not begun.
- **In Progress:** Work has begun but not completed.
- **Annual Implementation:** Ongoing with no specific end date.
- **Completed:** The action has been finished.
- **Deleted:** The action is no longer relevant due to changing priorities, lack of funds, etc.

Many of these mitigation actions are intended to reduce impacts to existing development. Those that protect future development from hazards are indicated by an asterisk '*' in the action identification number. These actions include those that promote wise development and hazard avoidance, such as building code, mapping, and zoning improvements, and continued enforcement of floodplain development regulations.

Actions that protect critical infrastructure note which lifeline category is protected using the following abbreviations:

- **COM:** Communications
- **ENG:** Energy
- **FWS:** Food, Water, Shelter
- **HAZ:** Hazardous Waste
- **H&M:** Health & Medical
- **S&S:** Safety & Security
- **TRN:** Transportation
- **NA:** Not Applicable

Table 5-3 2023 Pitkin County Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
P 1*	Continue Public Safety Council, which provides multi-agency and multi-jurisdictional coordination for hazard planning and incident management.	All hazards	1, 2; NA	Public Safety Council, Emergency Management	< $10,000; Supporting public safety agencies pay	High	2023-2028	Annual Implementation. Public Safety Council meets quarterly.
P 2	Provide training to improve communications between different agencies and remote locations and interoperability with statewide 800 MHz radio system.	All hazards	1, 3; COM	Pitkin County Radio	< $10,000; existing budgets	Medium	2023-2028	Annual Implementation.
P 3	Provide training and drills for EOC staff and conduct, at a minimum, one annual EOC tabletop exercise and tri-annual airport exercises.	All hazards	1, 3; TRN	Emergency Management	< $10,000; Public Safety Council and EM Budget	High	2023-2028	Annual Implementation.
P 4	Ensure that mutual aid agreements are current and establish new intergovernmental agreements for Law and Public Works.	All hazards	1, 3; NA	Agencies and Departments Involved, Public Safety council	< $10,000	Medium	2023-2025	In Progress.
P 5*	Enforce Land Use Code regulations and policies related to natural hazard mitigation.	Geologic, Avalanche, Flood, Wildfire	1, 3; NA	Community Development; Code Enforcement, Fire Marshals	Staff Time, Existing Budget	Medium	Ongoing	Annual Implementation.
P 6*	Continue the policy and process of inter-agency communication regarding proposed development that could be impacted by natural hazards, and inform policy- and decision-makers of potential risks.	Geologic, Avalanche, Flood, Wildfire	1, 3, 4; NA	County, Community Development; City of Aspen, Towns of Basalt and Snowmass	Staff Time, Existing Budget	Medium	Ongoing	Annual Implementation.
P 7*	Update/maintain records on annual hazard occurrences and display impacts on maps.	All hazards	1, 2, 3, 4; NA	GIS	Staff Time, Existing Budget	Medium	2023-2024	Not Started. Working on project plan including methodology to keep current.
P 8*	Continue to maintain access to ownership and property-value information for properties in identified hazard areas.	All hazards	1, 3; NA	GIS, Assessor's Office	Staff Time, Existing Budget	High	2023-2028	Annual Implementation. This is an ongoing maintenance work task by GIS Staff.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
P 9*	Continue to enhance web map application with property information, including hazards.	All hazards	1, 3; NA	GIS	Staff Time, Existing Budget	Medium	2023-2028	Annual Implementation. 2021 completed the conversion and integration hazard mapping into the ComDev Maps and More site. This includes floodplain, geologic, avalanche, slope, and aspect data.
P 10*	Create useable flood- and debris- flow mapping including dry gulch and alluvial fan.	Geologic hazards	1, 3; NA	GIS, Engineering, Public Works, Community Development	$5,000, existing budget	High	2023-2025	In Progress. Discussions with Colorado Geologic Survey to map these hazards from newly acquired LiDAR data.
P 11	Continue to use and market various means of communicating early warnings and alerts using multimedia. Improve ability to communicate with non-English speakers. Review and improve process quarterly.	All hazards	1, 2, 3; COM	Communications, Public Safety Council, Community Relations	Staff Time, Existing Budget	High	2023-2028	Annual Implementation. IPAWS and Everbridge available to use by County.
P 12	Work with the Roaring Fork Valley Wildfire Council to implement physical mitigation actions and review/update annually.	Wildfire	1, 2, 3, 4; NA	Pitkin County Wildfire Council	$100,000 annual; BOCC and grants	High	2023-2028	Annual Implementation. The PCWC has been rolled into the newly created Roaring Fork Valley Wildfire Council.
P 13	Reduce hazards and improve forest health in locations where residential areas interface with public-use areas by downing and removing trees killed by insect infestations.	Wildfire	1, 3, 4; NA	Open Space, BLM, USFS	$50,000; existing budget	Medium	2023-2028	Annual Implementation. Douglas fir beetle and Pine beetle mitigation work is ongoing.
P 14	Continue to design and install mitigation measures (concrete barriers) in areas along roadways that are susceptible to mud and rockslides, in cooperation with CDOT maintenance schedules.	Geologic hazards	1, 3; TRN	Public Works, CDOT	$100,000; CDOT operations & maintenance grants	Medium	2023-2028	Annual Implementation. Work has started, but no specific end date has been identified.
P 15	Continue to develop comprehensive, proactive, ongoing public and business outreach program to improve awareness. Educate citizens about seasonal and other hazards encourage community members to mitigate their risks.	All hazards	2; NA	Emergency Management; Public Safety Council, Community Relations	$50,000 annually; existing budget	High	2023-2028	Annual Implementation. Work is underway and will be continued for the foreseeable future.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
P 16	Utilize various messaging systems (e.g., Pitkin Alert) as needed for public safety, including warning information about wildfires, flooding, mudflows, rockslides and other natural hazards.	All hazards	1, 2; COM	Public Safety Council, Public Works, City of Aspen, Towns of Basalt and Snowmass Village	$12,000; Road and Bridge Fund	High	2023-2028	In Progress. Public information through variable message boards for mudslides, warnings to I-70 detour traffic onto high clearance county roads
P 17	Utilize all-hazard team from Public Safety Council membership to address ongoing planning and recovery needs.	All hazards	1, 3; NA	Emergency Management, Pitkin County Incident Management Team (IMT), Public Safety Council	$10,000, Public Safety Council	High	2023-2028	In Progress.
P 18	Update the Pitkin County Continuity of Operations Plan (COOP) and work with municipalities to develop COOP plans.	All hazards	1, 3; S&S	Emergency Management, Administration	Staff Time, Existing Budget	High	2023-2024	In Progress. New COOP is currently being developed by Pitkin County IT.
P 19	Initiate planning process to develop warning system for alerting campers in campgrounds and dispersed- camping areas downstream of Grizzly Reservoir to move to higher ground in case of dam failure or other problems at the Class I dam (incorporate signage/Pitkin Alert).	Flood	1, 2, 3; FWS	Emergency Management (Planning Lead), USFS (Project Lead), City of Aspen		Medium		Not Started. No progress from USFS.
P 20	Implement new Addressing Program to name roadways and assign addresses to properties along such roadways to ensure that emergency services are able to locate structures and respond quickly.	All hazards	1, 3; S&S	GIS (Address Services)	Staff Time, Existing Budget	High	2023-2028	In progress. GIS has a dedicated staff member working on new address assignments and identifying areas of non-compliant addresses. An administration guide to addressing is currently under development. We are working to improve communications of new road names with response agencies.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
P 21	Implement the 2017 Pitkin County Climate Action Plan by developing work programs for departments within the County organization to facilitate greenhouse gas emissions reduction.	All hazards impacted by climate change	3, 4; NA	Community Development	$50,000; Grant funds	Medium	2023-2028	In Progress. Climate action plan adopted October 25th, 2017 and department work programs developed.
P 22	Secondary Egress for Population Centers. Identify and develop secondary egress routes for various population centers, mainly the core of Aspen. Currently the only "real" secondary egress is directly under the primary egress route. A failure of one could very easily be a failure of both.	All hazards	1, 2, 3; TRN	Pitkin County Sheriff, Multiple Support agencies	Staff Time, Existing Budget	High	5-10 Years	New in 2023.
P 23	Ice Jam Release Siren. Ice formations in Roaring Fork River develop during drought years/low flows in winter months. Anchor ice releases on sunny and/or warm days forming dams/hams that can break/release sending wall of water and big slave of ice downstream. Year-round fishery puts anglers downstream at high risk, especially within areas downstream that may not have ice buildup.	Flood, Ice Jam Release	1, 2, 3; FWS	Pitkin County Emergency Management, Basalt Police, NWS, Pitkin County Sheriff, Roaring Fork Conservancy	$10,000-$50,000	Medium	2023-2028	New in 2023.
P 24	Update 2008 Pitkin County Map Book. Update to printed and digital countywide map book that illustrates each road, address point, "common places", water features, driveways, subdivisions etc.	Dam incidents, geologic, weather, wildfire, avalanche	1, 3; NA	GIS, Fire Districts, Sheriff	$50,000, Staff Time, Existing Budget	Medium	2025	New in 2023.
P 25	Develop accurate Spanish translation of recorded phone messages for emergencies. Pitkin County dispatch uses Google Translate for its recorded phone messages about emergencies. The translation is often poor and hard to understand for Spanish speaking people.	All Hazards	2, 3; NA	Community Relations, Engineering Management, 911 Dispatch	Staff Time, Existing Budget	High	2023	New in 2023.
P 26	Alternate start times for public and private sector. Changing thinking about traffic flow not being predictable. We cannot control when it will snow, but we can influence how people respond/drive to destinations.	Winter Storm, Wildfire	1, 2, 3, 4; TRN	Emergency Management	Depends on incentives offered	Low	2023-2028	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	Providing incentives for delayed work start or alternative work locations during anticipated winter storms. Later in the storm allows maintenance operations to remove snow and not have the additional impact of traffic crashes taking response resources and compounding the traffic problem. At the very least, technology to alert drivers via reverse notifications of hazardous driving. (Overall goal to change traffic flow overall.)							
P 27	Communication in remote County Area. Placement of communication sites in remote areas of the county to facilitate early warning of an emergency. Some of the most highly traveled areas of county are the most remote and have the worst communication coverage. Possible locations include Indy Pass, Lenado, Maroon Bells, and Ashcroft.	Wildfire, Flood	1, 2, 3; COM	Pitkin County Communications	$25,000	Low	2023	New in 2023.
P 28	Develop evacuation infrastructure. Infrastructure to facilitate evacuations from Aspen. Possible egress road over Marolt open space.	Wildfire, Flood	1, 3, 4; TRN	Pitkin County, City of Aspen, CDOT	Over $1 billion; DOT grants, CIP budgets	High	2023-2028	New in 2023.
P 29	Identify and implement cross jurisdictional fire mitigation projects in Pitkin County as identified by the Roaring Fork Valley Wildfire Collaborative.	Wildfire	1, 3; NA	Roaring Fork Valley Wildfire Collaborative, Jurisdictions	Over $1 million; grants to be identified by project type	High	2023-2028	New in 2023.
P 30*	New policy for permitting wildfire mitigation. Encourage private landowners to implement wildfire mitigation and streamline the permit process	Wildfire	1, 2, 3, 4; NA	Community Development	$50,000; CIP	High	2023	New in 2023.
P 31*	Adopt 2021 IRC and IBC building codes.	Wildfire, Flood	1, 2, 3, 4; NA	Emergency Management	Staff Time, Existing Budget	High	2023	New in 2023.
P 32	Work with local utility companies (Holy Cross, Black Hills) to identify areas of concern and opportunities to improve resiliency.	Wildfire, Winter Storms	1, 2, 3, 4; ENG, COM	Emergency Management	$50,000; utility budgets, FEMA grants	Medium	2023	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
P 33	AABC Integrated Microgrid. The AABC Integrated Clean Energy Project is an innovative implementation of the tried technology of microgrids by integrating the key facilities of three distinct public entities: Holy Cross Energy (HCE), the Roaring Fork Transportation Authority (RFTA), and Pitkin County (which also oversees the Aspen/Pitkin County Airport). These facilities provide for regional transportation, the upkeep and maintenance of the community, staging points for emergency services, and the backbone of the regional electric grid. The project provides the opportunity to dramatically increase the resiliency of the Upper Roaring Fork Valley electrical grid. As was made abundantly clear during the Lake Christine Fire, when the fire nearly burned down the sole transmission line to the upper valley, the electrical grid is vulnerable to catastrophic failure due to the single point of failure in the mid-valley region. As a result of the geography of the Roaring Fork Valley, there is only one pathway for transmission lines to feed the upper valley from the down-valley area. Because of this singular avenue of electrical transmission, improving the grid resiliency in the upper valley region is vital. The project allows for the mitigation of greenhouse gas emissions and for the facilities contained within the microgrid to become net-zero facilities in a manner that minimizes service disruptions and ensures long-term viability. This is done in two manners: through the creation of a system that allows for locally generated renewable energies to be used during times of peak load demand and through the provision of a storage center	Wildfire, Cyber, Winter Storm, Debris Flow, Lightning, Flooding, Dam Inundation	3, 4; ENG	Pitkin County (general fund and airport), Roaring Fork Transit Agency, Holy Cross Energy	$24 M; BRIC, IRA, BBB, Local, State	High	2023-2028	New in 2023. Feasibility Study nearly completed, 30% design on Phase 1a of 5 phase project is being completed currently. Phase 1a to be completed in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	that can act as an accumulation and distribution hub for the surrounding region.							
P 34	Implement cybersecurity enhancements, to include: • Implementing Two-Factor Authentication our Public Safety VPN (Netmotion) • Continue with KnowBe4 Quarterly Cyber Security Training, which includes simulated phishing tests, at random. Efforts in the next year will include attending New Hire Orientation each month, with Cybersecurity Information as well as "Lunch 'n Learn" opportunities throughout the year. • Engage with CISA on the following service offerings: o Penetration Testing o Vulnerability Scanning o Tabletop Exercises (e.g. Ransomware Attack) • Move County domains from .com and .org to .gov.	Cyber-Attack	1,3; COM, S&S	County Information technology	Staff time, existing budget	Medium	2023-2025	New in 2023.
P 35	Work with the Colorado Rural Water Association to implement best management practices for protecting water infrastructure, to include: 1. Create defensible space around critical water infrastructure. 2. Retrofit facility exteriors with fire-resistant materials. 3. Adapt facilities with fire-fighting capabilities (ex. Fire Hydrants/Hose fittings at well-houses)	Wildfire	1,3,4; FWS	Water Departments, Colorado Rural Water Association	Unknown, costs will vary with specific sites and projects TBD.	Medium	2023-2028	New in 2023.
P 36	Update Contagious Disease Emergency Operations Plan and conduct an annual exercise with partners and stakeholders.	Contagious Disease	1,3,5; H&M	Public Health	Staff time, existing budget	Medium	2023-2025	New in 2023.
P 37	Post wildfire debris flow mitigation. Post-fire rainfall events generating sediment-laden flows have been experienced in the Lake Christine burn area, among other locations.	Flooding, Geologic Hazards, Wildfire	1, 2, 3, 5; COM, ENG, FWS, HAZ,	Pitkin County Community Development	Cost will vary with specific measures adopted;	Medium	2023-2028	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	The hydrologic changes in the rainfall-runoff relationship and significantly increased sediment availability pose risks to developed areas from mudflows. The 2020 report "Pre-Fire Evaluation of Potential for Post-Fire Mudflows in Pitkin County, Colorado" presents a pre-fire evaluation of post-fire risks of mud and debris flows for selected watersheds in Pitkin County. The report recommends a number of possible mitigation measures to lessen the impacts of post-fire mudflows. Structural mitigation activities include Sediment Control Measures, Conveyance Treatments, Watershed Treatments, and Floodproofing. Non-structural measures may include Pre-fire Hazard Planning, Public Education and Outreach, and Evacuation and Warning. Pitkin County will work with other participating jurisdictions to implement appropriate mitigation actions before and after future wildfires.		H&M, S&S, TRN		FEMA HMA grants			
P 38	Adopt translation app to improve translation of Pitkin Alerts into languages other than English.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire, Winter Storm	1, 2, 5; S&S	Pitkin County Regional Emergency Dispatch, OEM	$5,000; existing budget	High	2023	New in 2023.

Table 5-4 2023 City of Aspen Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
A 1*	Designate office/staff to conduct inspections and enforce regulations and policies related to natural hazard mitigation, including roof covering inspections in identified high fire hazard areas.	All Hazards	1, 3; NA	Building Department, AFPD, Engineering; Administration, Community Development	Staff Time, Existing Budget	High	2023-2028	In Progress
A 2	Continue the policy and process of inter-agency communication regarding proposed development that could be impacted by natural hazards and inform policy- and decision-makers of potential risks.	All Hazards	1, 3; NA	Community Development; Pitkin County, Town of Basalt, Town of Snowmass Village	No Cost, existing staff time	High	2023-2028	Annual Implementation.
A 3	Implement Stormwater Capital Improvement Plan (estimated cost $17 million).	Flooding	1, 3, 4; FWS, TRN	Engineering	$17 million. ARPA, IIJA, BIL, IRA	High	2035	In Progress. The City has spent approximately $13 million since 2008 installing regional water quality treatment areas and replacing aging or undersized infrastructure.
A 4	Evaluate and identify appropriate measures for hardening the City of Aspen Water System, including steps related to water storage, groundwater well development, backup power generators, and access to hydroelectric power.	Flooding, Drought	1, 3, 4; FWS, S&S	Water, Community Development	$500M+, Utility rate payers, federal grants, debt service	High	2070	In Progress. One backup generator at Tiehack pumpstation installed, one in planning and design phase.
A 5*	Implement the following mitigation actions recommended in the 2017 Mud and Debris Flow Study: - Install a weather monitor on Aspen Mountain and connect with emergency communications to alert community when conditions are ripe for potential mudslide. - Construct obstructions in and around Ute Ave, Original, and Glory Hole Pond to direct and detain mudflow from progressing throughout City.	Geologic Hazards	1, 3; TRN	Engineering/ Stormwater Development	$200K, City and County Budgets	High	2030	In Progress. Some actions have been implemented. New requirements for mudflow modeling. Other actions will be implemented as opportunity presents.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
A 6	Implement recommendations of Aspen's Climate Action Plan (see Section 3.10.1 page 3-18) to include: • Complete city-wide review of building energy/water use • Introduce building performance standards to reduce commercial and residential building emissions • Continue to install additional electric vehicle charging station infrastructure to support transition to zero emission vehicles (improve air quality) • Electrify the city of Aspen municipal fleet and support greater community electrification • Ban organic material in the trash and introduce construction and demolition and plastic waste to limit the amount of trash headed to the landfill.	All Hazards	3, 4; NA	Climate Action, Community Development, Utilities, Streets	Unknown cost of implementing entire plan; City of Aspen budget, Federal/State Grants	High	2023-2028	In progress.
A 7	Water Resources Planning. Long and short-term water resources planning and management including snowpack and stream flow modeling and monitoring and forecasting to make wise water use decisions.	Drought	3, 4; FWS, S&S	Aspen Utilities	Unknown cost. Federal USBR Watersmart, EPA, FEMA, State funding	High	2023-2028	New In 2023
A8	Implement enhanced cybersecurity measures, to include: 1. Implement two-factor authentication on single sign-on portal when in-network. 2. Consolidate all employee VPN access to a single VPN solution (NetMotion). 3. Mitigate any vulnerabilities discovered during current in-progress security penetration testing and audit. 4. Move from an endpoint XDR solution to a full MDR solution. 5. Implement policies and procedures for device and VPN access for staff working out of country.	Cyber-Attack	1,3; COM, S&S	City Information technology	Staff time, existing budget	Medium	2023-2025	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	6. Develop a microsegmentation strategy as the city moves towards to a zero-trust model. 7. Continue advancing implementation group progress for the CIS Critical Security Controls framework. 8. Continue KnowBe4 quarterly cybersecurity awareness trainings and monthly simulated phishing tests. 9. Purchase upgraded cybersecurity insurance.							

Table 5-5 2023 Town of Basalt Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
B 1*	Designate office/staff to conduct inspections and enforce regulations and policies related to natural hazard mitigation where they exist. For hazards that do not have regulations or policies in place, explore what new regulations, policies, or voluntary guidelines could be developed.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Drought, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire; Winter Storm	1, 3; NA	Administration, Building, Planning Manager	$10,000; town budget	High	2023-2028	Annual Implementation. Basalt has conducted wildfire mitigation in conjunction with the fire district and assessed and mitigated mudflows. Emergency Management Committee meets regularly to assess potential hazards such as river flooding. The police department and Roaring Fork Fire Rescue annually review and update the "Flood and Debris Flow Incident Action Plan". The plan was last updated in the spring of 2022.
B 2	Continue the policy and process of inter-agency communication regarding proposed development that could be impacted by natural hazards, to include impacts on water usage, and inform policy- and decision-makers of potential risks and potential mitigation measures.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Drought, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire; Winter Storm	1, 3; NA	Planning; Pitkin County, City of Aspen, Town of Snowmass Village	$50,000; town budget	High	2023-2028	Annual Implementation. Basalt provides referrals to Pitkin County, Eagle County, and other applicable emergency response providers on significant development applications.
B 3	Implement flood conveyance improvements identified in the River Master Plan, as listed in Section 3.10.1 (page 3-19). • Maintain zero-rise criteria for new construction. • Protect Wastewater Treatment Plant from flood flows. • Reconstruct Upper Basalt Bypass Bridge over Highway 82 to provide clear span, without support structures in river channel. • Develop implement a long-term plan for structural bank stabilization to protect Two Rivers Road.	Flood, Ice Jam	1, 3; TRN	Public Works, Engineering	$25,000; town budget	High	2020-2025	In progress. LOMR has been completed on Basalt River Park and improvements are currently under construction

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	• Acquire confluence area for the public open space. • Develop plan for relocating residences in mobile home park to hazard-free area.							
B 4	Develop and implement a system for monitoring mudflows and mudflow- impacts to infrastructure in the Two Rivers Road area.	Mudslides	1, 3; TRN	Public Works, Basalt Rural Fire Protection District	$50,000; town budget	High	2023-2028	Annual Implementation. Basalt is in frequent communication with Colorado Parks and Wildlife regarding Lake Christine Dam area adjacent to Two Rivers Road. During rain events the police department monitors Two Rivers Road for rock and debris. If found, Public Works is called out to remove obstructions. Bi-annual inspection of flood mitigation infrastructure, above Basalt, is completed. Three live feed rain gauges have been installed in years 2019, 2021 and 2022. Contributing partners have collectively decided to not deploy gauges in 2023.
B 5	In cooperation with Pitkin and Eagle Counties, assess downstream impacts of a failure of Ruedi Reservoir dam and prepare plan for warning the public.	Dam Failure	1, 2, 3; FWS	Basalt, Pitkin County, Eagle County	$50,000; BoR, Pitkin & Eagle Counties, town budget	High	2023-2028	Not Started. Basalt to remain a support agency. The Town, Pitkin County and Eagle County Emergency Management has met with Ruedi Water and Power Authority and Bureau of Reclamation to explore the possibility of creating flood inundation mapping in the event of high-water releases. This idea is still in the discussion phase to determine organizational capacity to create mapping.
B 6*	Lower Frying Pan Stream Gauge. Install stream gauge at town boundary and Frying Pan River. No gauges exist on the river below Ruedi Reservoir.	Flooding	1, 3; NA	Basalt; Bureau of Reclamation, NOAA	$30,000, town budget	High	2023-2025	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
B 7	Reduce ice and debris impacts to bridges. Ice and trees plug bridges and flood the area. Need to raise and open the flow channel below the bridges. Bottom line - new bridges with design in mind.	Flooding	1, 3, 4; TRN	Basalt, State and County support	$100 million, FEMA, CDOT	Medium	2023-2028	New in 2023.
B 8*	Soil and rock stabilization on Tow Rivers and Frying Pan Road. Stabilize, cut back steep edges, improve drainages from private property that drains down hillsides. Remove larges rocks, install retaining walls, and rock fencing. Replace undersized culverts and add additional storm drains.	Flooding, Geologic	1, 3, 4; TRN	Engineering, Public Works	$5 million, FEMA grants	Medium	2023	New in 2023.
B 9	Develop and implement water use restrictions during periods of drought.	Drought	1, 2, 3, 4; FWS	Public Works	Staff time; town budget	Medium	2023-2025	New in 2023.

Table 5-6 2023 Town of Snowmass Village Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
SV 1	Evaluate natural hazards and determine priorities for mitigation.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Drought, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire; Winter Storm	1, 3, 4; NA	Community Development, Public Works	$15,000, existing budget	High	2023-2028	Annual Implementation.
SV 2	Continue the policy and process of inter-agency communication regarding proposed development that could be impacted by natural hazards, to include impacts on water usage, and inform policy- and decision-makers of potential risks and potential mitigation measures.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Drought, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire; Winter Storm	1, 3; NA	Community Development, Pitkin County, City of Aspen, Town of Basalt	Staff time, existing budget	High	2023-2028	Annual Implementation.
SV 3*	In cooperation with Snowmass-Wildcat FPD and local homeowners' associations, complete wildfire mitigation projects in 2017 to include right-of-way tree removal, public chipping programs, and hazard fuel removal.	Wildfire	1, 2, 3; ENG, TRN	Town of Snowmass Village, SWFPD, HOAs	$15,000, existing budget	High	2023-2028	Annual Implementation.
SV 4	Develop new stormwater management master plan to evaluate current capacity and infrastructure needs.	Flooding	1, 3, 4; FWS, TRN	Public Works, Community Development	$100,000, existing budget	High	2022-2028	In Progress.
SV 5	Improve network cabling at various locations to connect municipal buildings and enhance communication and redundancy in case of power outages.	Cyber-Attack, Dam Inundation, Flooding, Geologic Hazards, Lightning, Wildfire; Winter Storm	1, 3; S&S	Town of Snowmass Village, Pitkin County, City of Aspen, Town of Basalt	$3.6 million, Grants, General fund	Medium	2022-2028	In Progress.
SV 6*	Stormwater culvert replacement program. Establish replacement program and funding source for aging infrastructure.	Flooding	1; TRN	Public Works Department	$4 million, grant funding	High	2024	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	Specifically, Brush Creek Road - 72" culvert - major roadway in TOSV.							
SV 7	Develop and implement water use restrictions during periods of drought.	Drought	1, 2, 3, 4; FWS	Public Works	Staff time; town budget	Medium	2023-2025	New in 2023.
SV 8	Work with County EM to develop comprehensive, proactive, ongoing public and business outreach program. Educate citizens about seasonal and other hazards, and encourage community members to mitigate their risks.	Avalanche, Contagious Disease, Cyber-Attack, Dam Inundation, Drought, Flooding, Geologic Hazards, Ice Jam Release, Lightning, Wildfire; Winter Storm	2; NA	Town Administration; County Emergency Management; Public Safety Council	Staff time; town budget	Medium	2023-2028	New in 2023.

Table 5-7 2023 Aspen Fire Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
AF 1	Implement recommended actions identified in the Pitkin County Community Wildfire Protection Plan (2014), including ongoing efforts to reduce fuel loads, coordinate open burns, and create defensible and survivable spaces.	Wildfire	1, 3; NA	Aspen Fire, CSFS, USFS	$60,000 - $200,000	High	2023-2028	Annual Implementation. Currently coordinating fuel break on Willoughby Way and survivable spaces on Red Mountain.
AF 2*	Prioritize and develop needed Community Wildfire Protection Plans for subdivisions, as identified in the Pitkin County Community Wildfire Protection Plan.	Wildfire	1, 3, 4; NA	City of Aspen, CSFS	$11 million	Low	2023-2025	Not Started. Community interest and required funding are barriers to participation.
AF 3	Continue to conduct voluntary wildfire hazard inspections and disseminate wildfire mitigation and preparedness information to property owners.	Wildfire	1, 2, 3, 4; NA	Aspen Fire, Pitkin County, Community Development, City of Aspen	$40,000	High	2023-2028	Annual Implementation. Curbside assessments refreshed every 5 years (1/5 re-assessed every year).
AF 4*	Develop, implement, and maintain wildfire codes (including brush management, weed abatement, building codes, construction types).	Wildfire	1, 3, 4; NA	Aspen Fire, Pitkin County, Community Development, City of Aspen	Staff Time, Existing Budget	Medium	2023-2028	Annual Implementation. Additional WUI code sections could be adopted by city and county. Currently discussing code with city and county regarding tree removal as it relates to fire mitigation.
AF 5	Continue to identify cross-boundary fuel reduction projects within wildland urban interface areas, in accordance with the Pitkin County Community Wildfire Protection Plan.	Wildfire	1, 3, 4; NA	Aspen Fire, Snowmass-Wildcat FPD, Basalt Rural FPD	$50,000 - $100,000/ year	High	2023-2028	Annual Implementation. Hired Director of Community Wildfire Resilience to help prioritize this. Should add, "Identify, prioritize, and implement."
AF 6*	Work with the Aspen Pitkin County Housing Authority (APCHA) to ensure that owners and tenants are aware of wildfire danger and mitigation strategies.	Wildfire	1, 2, 3; NA	Pitkin County Emergency Management	Staff Time, Existing Budget	High	2023-2028	Not Started. Outreach beginning Fall 2022

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
AF 7	Proactive Forest Health Measures. Continue proactive evaluation and treatment of forest pests (bank beetles, etc.) as general forest health measures for preemptive wildfire mitigation.	Wildfire	1, 3, 4; NA	Aspen Fire	>$100,000; Federal Grants, local agency partnerships, public donations	High	2023-2028	New in 2023.
AF 8	Continue to participate in Public Safety Council, which provides multi-agency and multi-jurisdictional coordination for hazard planning and incident management.	All hazards	1, 2; NA	Aspen Fire; County Emergency Management	Staff time, existing budget	Medium	2023-2028	New in 2023.
AF 9	Work with the County and municipalities to implement actions from the 2017 Pitkin County Climate Action Plan and 2020 City of Aspen Climate Action Plan that are relevant to Aspen Fire. (see Section 3.10.1 page 3-18)	Drought, all hazards impacted by climate change	3,4; NA	Aspen Fire; County and Municipalities	TBD but most likely <$50,000; existing budget, grants	Medium	2023-2028	New in 2023.
AF 10	Work with local utility companies (Holy Cross, Black Hills) to identify areas of concern and opportunities to improve resiliency.	Winter Storms, Wildfire	1, 2, 3, 4; ENG, COM	Aspen Fire; County Emergency Management	Staff time, existing budget	Medium	2023-2028	New in 2023.

Table 5-8 2023 Roaring Fork Fire Rescue Authority Mitigation Action Plan

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
RF 1	Conduct mitigation actions to reduce fuel loads, coordinate open burns, and create defensible and survivable spaces in the Roaring Fork valley as recommended by the Roaring Fork Valley Wildfire Collaborative.	Wildfire	1, 3; NA	Roaring Fork Fire Rescue Authority	$100,000	High	2023-2028	Annual Implementation. Wildfire mitigation as ongoing wildfire assessments continue.
RF 2	Prioritize needed Community Wildfire Protection Plans for subdivisions, as identified in the Pitkin County Community Wildfire Protection Plan.	Wildfire	1, 2, 3, 4; NA	Roaring Fork Fire Rescue Authority	Staff Time, Existing Budget	High	2023-2028	
RF 3	Continue to conduct required and voluntary wildfire hazard inspections and disseminate wildfire mitigation and preparedness information to property owners.	Wildfire	1, 2, 3; NA	Roaring Fork Fire Rescue Authority	Staff Time, Existing Budget	High	2023-2028	Annual Implementation. Implemented Severity Crew summer wildland crew does wildland property assessments.
RF 4	Continue to identify cross-boundary fuel reduction projects within wildland urban interface areas, in accordance with the Pitkin County Community Wildfire Protection Plan.	Wildfire	1, 3, 4; NA	Roaring Fork Fire Rescue Authority	Staff Time, Existing Budget	High	2023-2028	Annual Implementation.
RF5*	Work with the Aspen Pitkin County Housing Authority (APCHA) to ensure that owners and tenants are aware of wildfire danger and mitigation strategies.	Wildfire	1, 2; NA	Roaring Fork Fire Rescue Authority	Staff Time, Existing Budget	High	2023-2028	Annual Implementation.
RF 6*	Protect Critical Facilities and Infrastructure from Wildfire. Develop plan to increase mitigation of fuels, provide for suppression access to protect facilities. Harden facilities and infrastructure.	Wildfire	1, 3; COM, FWS, S&S	Roaring Fork Fire Rescue Authority	$200,000, Federal/ State Grants	High	2030	New in 2023.
RF7	Equitable Public Education and Outreach for Wildfire Hazard. Ensure underrepresented community members (Hispanic/Latino etc.) receive equitable public education related to wildfire risks and mitigation options and timely and effective notifications during wildfire emergencies.	Wildfire	1, 2; NA	Roaring Fork Fire Rescue Authority	Staff time, marketing budget ~ $100,000, Pitkin County Public Safety Council	High	2023	New in 2023.
RF 8	Continue to participate in Public Safety Council, which provides multi-agency	All hazards	1, 2; NA	Roaring Fork Fire Rescue Authority;	Staff time, existing budget	Medium	2023-2028	New in 2023.

ID	TITLE AND DESCRIPTION	HAZARDS	GOALS & LIFELINES	LEAD AGENCY & PARTNERS	COST ESTIMATE & FUNDING	PRIORITY	TIMELINE	STATUS & IMPLEMENTATION NOTES
	and multi-jurisdictional coordination for hazard planning and incident management.			County Emergency Management				
RF 9	Work with the County and municipalities to implement actions from the 2017 Pitkin County Climate Action Plan that are relevant to Roaring Fork Fire.	Drought, all hazards impacted by climate change	3,4; NA	Roaring Fork Fire Rescue Authority; County and Municipalities	TBD but most likely <$50,000; existing budget, grants	Medium	2023-2028	New in 2023.
RF 10	Work with local utility companies (Holy Cross, Black Hills) to identify areas of concern and opportunities to improve resiliency.	Winter Storms, Wildfire	1, 2, 3, 4; ENG, COM	Roaring Fork Fire Rescue Authority; County Emergency Management	Staff time, existing budget	Medium	2023-2028	New in 2023.
RF 11	Work with the County to implement recommendations of the 2020 report "Pre-Fire Evaluation of Potential for Post-Fire Mudflows in Pitkin County, Colorado." The report recommends a number of possible mitigation measures to include Sediment Control Measures, Conveyance Treatments, Watershed Treatments, Floodproofing, Pre-fire Hazard Planning, Public Education and Outreach, and Evacuation and Warning.	Flooding, Geologic Hazards, Wildfire	1, 2, 3, 5; COM, ENG, FWS, HAZ, H&M, S&S, TRN	Roaring Fork Fire Rescue Authority; County Community Development	Cost will vary with specific measures adopted; FEMA HMA grants	Medium	2023-2028	New in 2023.

6 PLAN IMPLEMENTATION AND MAINTENANCE

DMA Requirement §201.6(c)(4)(ii):

[The plan shall include] a plan maintenance process that includes:

(i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

(ii) A process by which local governments incorporate the requirements of the mitigation plan into other planning process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

(iii) Discussion on how the community will continue public participation in the plan maintenance process.

6.1 PLAN ADOPTION & IMPLEMENTATION

The purpose of formally adopting this Plan is to secure buy-in from Pitkin County and the participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes planning step 9 of the 10-step planning process: Adopt the Plan. The governing board for each participating jurisdiction has adopted this local HMP by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix E: Plan Adoptions and Approval.

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile projects, the Hazard Mitigation Planning Committee (HMPC) will need to decide which action(s) to undertake first. Two factors will help with making that decision: 1) the priority assigned to the actions in the planning process; and 2) funding availability. Low or no-cost projects most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each action (see Section 5.4) and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits of each project to the Pitkin County community and its stakeholders. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. The three main components of implementation are:

- **Implement** the action plan recommendations of this plan;
- **Utilize** existing rules, regulations, policies, and procedures already in existence; and
- **Communicate** the hazard information collected and analyzed through this planning process so that the community better understands what can happen where, and what they can do themselves to be better prepared. Also, publicize the "success stories" that are achieved through the HMPC's ongoing efforts.

Simultaneously to these efforts, the HMPC will constantly monitor funding opportunities that could be leveraged to implement some of the costlier actions. This will include creating and maintaining a bank of ideas on how to meet required local match or participation requirements. When funding does become available, the HMPC will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

6.1.1 Implementation and Maintenance of the 2018 Plan

The maintenance and evaluation process described in the 2018 HMP was generally followed over the past five years. Hazards and mitigation actions are discussed quarterly at every Pitkin County Public Safety Council meeting if not sooner if needed. In addition, the County has annual mud/flood/wildfire planning groups every spring. Mitigation actions are reviewed and updated within the group as necessary.

As one example of how the 2018 HMP was used, the RFFR Fire Chief was able to get the new wildfire building codes approved for Basalt and Snowmass Village because it was listed as a mitigation action in the last plan update that was adopted by the Snowmass Village and Basalt Town Council. The action was part of a strategic plan.

6.1.2 Role of the Hazard Mitigation Committee in Implementation and Maintenance

With adoption of this plan Pitkin County, the City of Aspen, Towns of Basalt and Snowmass Village, Aspen Fire Protection District, and the Roaring Fork Fire Rescue Authority will be tasked with plan implementation and maintenance. The participating jurisdictions agree to:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low/no-cost recommended actions;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Maintain a monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the Board of County Commissioners, municipal councils, and other partners; and
- Inform and solicit input from the public.

Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the jurisdictions' websites and in the local newspaper.

6.2 Plan Maintenance and Evaluation

The Pitkin County HMP is a living document that may be adjusted or updated as conditions change, actions progress, or new information becomes available. This section describes the method and schedule the participating jurisdictions will follow for monitoring, evaluating, and updating the Plan over the next five years. All participating jurisdictions will follow the process and schedule described below.

6.2.1 Monitoring

Monitoring refers to tracking the implementation of the plan over time. The Pitkin County Emergency Manager will be responsible for reaching out to lead and supporting agencies identified in the mitigation actions table for status on those mitigation actions. OEM will coordinate with HMPC members at least annually to identify and track any significant changes in their agencies' mitigation efforts.

The Pitkin County Emergency Manager will use the following process to track progress, note changes in vulnerabilities, and consider changes in priorities as a result of project implementation:

- A representative from the responsible entity identified in each mitigation action will be responsible for tracking and reporting to the HMPC when project status changes. The representative will provide input on whether the project as implemented meets the defined goals and objectives and is likely to be successful in reducing vulnerabilities.
- If the project does not meet identified goals and objectives, the HMPC may select alternative projects for implementation.
- Projects that were not ranked high priority but were identified as potential mitigation actions will be reviewed periodically to determine feasibility of future implementation.
- New mitigation projects identified will require an individual assigned to be responsible for defining the project scope, implementing the project, and monitoring the success of the project.
- Mitigation activities not identified as actions in this plan will also be tracked to ensure a comprehensive hazard mitigation program, and to assist with future updates.

As part of this coordination, the Pitkin County Emergency Manager and the HMPC will also monitor repetitive losses; evaluate changes in hazards, vulnerabilities, or the distribution of risk across the County; and seek to identify new and ongoing mitigation opportunities.

6.2.2 Evaluation

Evaluating refers to assessing the effectiveness of the plan at achieving its stated purpose and goals. Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan, such as:

- Decreased vulnerability because of implementing recommended actions;
- Increased vulnerability because of failed or ineffective mitigation actions; and/or
- Increased vulnerability because of new development (and/or annexation).

The HMPC will meet annually to evaluate the implementation of the plan and consider any changes in priorities that may be warranted. The annual evaluation will not only include an investigation of whether mitigation actions were completed, but also an assessment of how effective those actions were in mitigating losses. A review of the qualitative and quantitative benefits (or avoided losses) of mitigation activities will support this assessment. Results of the evaluation will then be compared to the goals established in the plan and decisions will be made regarding whether actions should be discontinued or modified in any way in light of new developments in the community. Progress will be documented by the HMPC for use in the next plan update. Finally, the Planning Team will monitor and incorporate elements of this Plan into other planning mechanisms, as detailed in Subsection 6.3.

The Pitkin County Emergency Manager will coordinate with all participating jurisdictions to facilitate an effective maintenance and implementation process. Completed projects will be evaluated to determine how they have reduced vulnerability. Changes will be made to the plan to accommodate for projects that have failed or are not considered feasible after a review for their consistency with established criteria, the time frame, priorities, and/or funding resources.

Annual Progress Report

The minimum task of each planning partner will be the evaluation of the progress of its individual action plan during a 12-month performance period. Completion of the annual progress report is the responsibility of each planning partner, not solely the responsibility of the Pitkin County Emergency Manager. The HMPC will review the annual progress reports in an effort to identify issues needing to be addressed by future plan updates. This review will include the following:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area.
- Review of mitigation success stories.
- Review of continuing public involvement.
- Brief discussion about why targeted strategies were not completed.
- Re-evaluation of the action plan to evaluate whether the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term one because of new funding).
- Recommendations for new projects.
- Changes in or potential for new funding options (grant opportunities).
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The HMPC has created a template to guide the planning partners in preparing a progress report (see Appendix G). HMPC members will provide feedback on items included in the template. The HMPC will then prepare a formal annual report on the progress of the plan. This report should be used as follows:

- Posted on the Pitkin County website.
- Provided to the local media through a press release.
- Presented to planning partner governing bodies to inform them of the progress of initiatives implemented during the reporting period.

6.2.3 Updates

The Pitkin County HMP will be reviewed and revised at least every five years in accordance with the DMA 2000 requirements and latest FEMA and Division of Homeland Security and Emergency Management (DHSEM) hazard mitigation planning guidance. Updates to this plan will consider:

- Has the nature or magnitude of hazards affecting the County and jurisdictions changed?
- Are there new hazards that have the potential to impact the County and jurisdictions?
- Have growth and development changed the County's or jurisdictions' vulnerabilities?
- Do the identified goals and actions still address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?

The HMPC members and those entities identified in Appendix B, will be reconvened for this process by the Pitkin County Emergency Manager. The updated plan will document success stories where mitigation efforts have proven effective, as well as areas where mitigation actions were not effective, and will include re-adoption by all participating entities following DHSEM/FEMA approval.

6.3 Incorporation into Other Planning Mechanisms

The information on hazards, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. The comprehensive plans, zoning and subdivision regulations, and ordinances of Pitkin County and the partner jurisdictions are considered to be integral parts of this Plan. The County and jurisdictions, through adoption of comprehensive plans and zoning ordinances, can plan for the impact of natural hazards. The HMP development process provided the jurisdictions with the opportunity to review and expand on policies contained within these planning mechanisms. The plan update provides an opportunity to incorporate hazard information and mitigation principles and practices into other existing planning mechanisms.

6.3.1 Comprehensive Plans

Integrating hazard mitigation into the jurisdiction's comprehensive or general plan is considered a best practice by both FEMA and the American Planning Association. Pitkin County and participating jurisdictions will work to integrate hazard information from this plan into future comprehensive and general plan updates. Other planning processes and programs to be coordinated with the recommendations of the HMP include the following:

- Municipal codes.
- Community design guidelines.
- Water-efficient landscape design guidelines.
- Stormwater management programs.
- Water system vulnerability assessments.
- Community wildfire protection plans.

6.3.2 Threat and Hazard Identification and Risk Assessment (THIRA)

Pitkin County completed a County-level THIRA in 2020.

CPG201 THIRA establishes Step 1 of the THIRA process as "Identify the Threats and Hazards of Concern" and lists HIRAs and HMPs as possible sources of threat/hazard information.

The criteria for selecting which threats/hazards are "of concern" are defined as:

- **Factor #1:** Likelihood of a Threat or Hazard Affecting a Community.
- **Factor #2:** The Impacts of a Threat or Hazard.

Each natural and human-caused hazard profiled in the HIRA (Chapter 4) contains a section analyzing the probability of future events, which provides a data-driven answer to Factor #1. Similarly, the vulnerability assessment section of the hazard profiles address what impacts can realistically be expected from both routine and extreme events of each hazard, which specifically addresses Factor #2.

Step 2 of CPG 201 is to "Give the Threats and Hazards Context" by creating a scenario for each hazard of concern, with specifics like time of day, area, and magnitude of the event, which are then used to establish

capability targets for each of the 32 core capabilities. All the hazards profiled in the HIRA contain detailed information to ensure the hazard scenarios are plausible. For some hazards, such as flooding, detailed GIS analysis has been done that can easily be incorporated as THIRA scenarios. Other hazards include details on the most extreme historical events on record that can quickly be updated to modern scenarios.

6.3.3 Response Plans

While the Pitkin County EOP is an all-hazards document, it also contains hazard-specific information and concerns. Hazard information from this HMP update should be incorporated into the next EOP update. At a minimum, all high significance hazards identified in this Plan should be addressed in future EOP updates.

Several other operational or functional response plans are also influenced by information contained in the HMP. These plans include but are not limited to:

- **Damage Assessment Plan**: A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas to initially prioritize following a hazard event. Similarly, a review of Section 4.2 can help identify what critical facilities need to be assessed following a hazard event.
- **Evacuation & Sheltering Plan**: A review of the vulnerability and estimated losses detailed in the hazard profiles can help identify what areas are more likely to need evacuation in different hazard scenarios. The Community Profile in Section 3.10 can help identify not only how many people would potentially be impacted by disasters, but how many are likely to need assistance with transportation, special medical or sheltering needs, etc. This review can also help evaluate the impacts of multiple or cascading hazards, so that evacuees are not relocated into an area that puts them at risk from other hazards.

6.3.4 Recovery Plan

If the County develops a recovery plan, it should do so using the 2-year state Recovery Roadmap process. The risk and vulnerability data in the HMP will help inform the post-disaster recovery planning process, especially by ensuring that the recovery elements of those plans fully account for the dangers posed by other hazards, rather than focusing exclusively on the most recent hazard event. The HMP in turn will be revisited during recovery to help identify opportunities to incorporate mitigation in the recovery and rebuilding process, including maximizing FEMA Public Assistance (PA) and HMGP funding where applicable.

The FEMA publication “Pre-Disaster Recovery Planning Guide for State Governments” notes:

> *“…much of the research involved in the development of mitigation plans can be used to inform the pre-disaster recovery planning effort.*
>
> *“The pre-disaster recovery planning process will benefit from and build upon hazard mitigation as:*
>
> - *The mitigation planning process identifies local hazards, risks, exposures, and vulnerabilities;*
> - *Implementation of mitigation policies and strategies will reduce the likelihood or degree of disaster-related damage, decreasing demand on resources post-disaster;*
> - *The process will identify potential solutions to future anticipated community problems; and*
> - *Mitigation activities will increase public awareness of the need for disaster preparedness.”*
>
> *“Pre-disaster recovery planning efforts also increase resilience by:*
>
> - *Establishing partnerships, organizational structures, communication resources, and access to resources that promote a more rapid and inclusive recovery process;*
> - *Describing how hazard mitigation will underlie all considerations for reinvestment;*
> - *Laying out a process for implementation of activities that will increase resilience; and*

- *Increasing awareness of resilience as an important consideration in all community activities."*

6.3.5 Continuity of Operations Plan (COOP)

All participating jurisdictions are required to maintain a COOP that details that agency's critical functions and how they will protect those functions in order to continue to provide essential services during a disaster or interruption. The County has just finished updating its COOP Plan, and is working with the municipalities to help them develop their own COOP Plans.

By defining and describing the hazards facing the County, including frequency and severity, the HIRA informs agency COOP plans by giving context to what types of disasters or interruptions are most likely to occur. Critical facilities and assets located in hazard areas in Section 4.2 should be prioritized for COOP planning. Hazards that can impact personnel or delivery of services, such as a pandemic, should also be a focus.

6.3.6 Training and Exercise Plan

Training on hazard mitigation principles and procedures should be included in the jurisdictions' training and exercise planning. Any training and exercise needs identified in the Capabilities Assessment (Chapter 3.10) and Mitigation Strategy (Chapter 5) should also be included in the County's training and exercise planning.

6.3.7 Public Awareness and Education Programs

The jurisdictions' ongoing public education and outreach efforts should reflect the hazards and vulnerabilities described in this Plan. In addition to preparing for disasters, public education should include ways in which the public can reduce their vulnerability to natural and human-caused hazards. Furthermore, mitigation activities and success stories should be communicated to the public to show the benefits of effective mitigation planning.

6.3.8 Critical Infrastructure Protection Plan

Critical facilities and assets identified in Section 4.2 should be included in a Critical Infrastructure Protection Planning (CIPP), with prioritization given to assets located in hazard-prone areas. Hazardous materials facilities in particular should be viewed both as critical assets in need of protection, and as potential hazards in their own right.

6.3.9 Capital Improvements Plan

High-cost mitigation actions listed in Chapter 5 or identified in the future may be added to the Capital Improvements Plan (CIP) to ensure that hazard mitigation projects continue to receive funding. The prioritization of actions listed in 5.3.1 while not binding on capital improvement planning, can be used to inform the prioritization of those actions. Even projects for which the jurisdictions intend to seek grant funding may also need to be addressed in the CIP, given that most mitigation grants require significant local matching funds.

6.3.10 Sustainability Plans

Sustainability is a separate area of concern from hazard mitigation, but there are areas where the two fields overlap and influence one another positively or negatively.

Sustainability plans should be reviewed to identify where there may be synergy between sustainability and mitigation/resiliency. For example, sustainability efforts aimed at increasing the County's adaptability to climate change can also make the County more resilient to drought and severe weather. Increasing the percentage of food obtained locally could make the County more resilient to supply-chain interruptions or the impacts of disasters in other states. Adding more trees and grass to urban areas to reduce the heat island effect could help mitigate the impact of extreme weather events, as well as reducing flood risk by increasing the amount of permeable surfaces. This may help raise the priority of some sustainability efforts, as well as suggest complimentary mitigation efforts.

It is equally important to identify areas where sustainability efforts may work to reduce the County's resilience to hazards. For example, a sustainability goal of promoting use of public transit and reducing private car ownership could potentially make it harder to evacuate the public during a disaster if public transit is damaged and offline (as was observed during Hurricane Sandy). Similarly, reduced production of solid waste could lead to a reduction in the number of public resources such as dump trucks, which means that in a disaster those resources would not be available for debris removal and similar tasks. The intent of this review is not to say that sustainability goals should not be pursued, but rather to identify areas of concern that should be considered during implementation of these goals. For example, evacuation plans may need to be revised to reflect a larger percentage of families without cars; or contracts may need to be put in place to obtain additional dump trucks in a disaster.

6.4 Continued Public Involvement

The public will continue to be apprised of the plan's progress through the Pitkin County OEM's website and by providing copies of annual progress reports to the media. Pitkin County OEM will maintain the HMP on the County's website. This site will not only house the final plan, but also become the one-stop shop for information regarding the plan, the partnership and plan implementation. The other participating jurisdictions will link to this page from their own websites. Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance and input from the HMPC. This strategy will be based on the needs and capabilities of the planning partnership at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

The update process provides an opportunity to publicize success stories from the Plan implementation and seek additional public comment. When the HMPC reconvenes for the five-year plan update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. The Plan maintenance and update process will include continued public and stakeholder involvement and input through participation in designated committee meetings, town halls and virtual public information sessions, surveys, web postings, and press releases to local media.

APPENDIX A: Plan Adoption and Approval

RESOLUTION OF THE BOARD OF COUNTY COMMISSIONERS ("BOCC") OF PITKIN COUNTY, COLORADO ADOPTING AN UPDATED HAZARD MITIGATION PLAN

RESOLUTION NO. 021-2023

RECITALS

WHEREAS, Pursuant to Section 2.8.3 (Actions) of the Pitkin County Home Rule Charter ("HRC") official action by formal resolution shall be required for all actions of the Board not requiring ordinance power on matters of significant importance affecting citizens, and;

WHEREAS, A Federal Emergency Management Agency ("FEMA") approved Hazard Mitigation Plan ("HMP") is a requirement of the Disaster Mitigation Act of 2000 for communities to remain eligible for future funding for pre disaster mitigation grants, or should there be a Presidential Disaster Declaration, post disaster mitigation grants, and;

WHEREAS, On May 9, 2018 by Resolution No.034-2018, the Board of County Commissioners ("BOCC") adopted the 2018 HMP, and;

WHEREAS, For the past two years' stakeholders representing Pitkin County, Aspen, Basalt, Snowmass, Roaring Fork Fire Rescue Authority and the Aspen Fire Protection District have been working through the Department of Homeland Security and Emergency Management and the FEMA process to identify the types of hazards that threaten our community resulting in updates to the Pitkin County HMP, and;

WHEREAS, Identifying, prioritizing, and developing mitigation strategies for natural disasters will reduce the potential impacts of those hazards, with the ultimate goal of preventing or minimizing loss of life, property damage, and harm to the environment, and;

WHEREAS, The BOCC finds that it is in the best interests of the citizens of Pitkin County to approve this Resolution.

NOW, THEREFORE, BE IT RESOLVED by the Board of County Commissioners of Pitkin County, Colorado that it hereby adopts our updated HMP. This plan will replace our plan from 2018.and authorizes the Chair to sign the Resolution and upon the satisfaction of the County Attorney as to form, execute any other associated documents necessary to complete this matter.

INTRODUCED AND FIRST READ ON THE 22ND DAY OF MARCH, 2023 AND SET FOR SECOND READING AND PUBLIC HEARING ON THE 11TH DAY OF APRIL 2023.

NOTICE OF PUBLIC HEARING AND TITLE AND SHORT SUMMARY OF THE RESOLUTION PUBLISHED IN THE ASPEN DAILY NEWS ON THE 30TH DAY OF MARCH, 2023.

NOTICE OF PUBLIC HEARING AND THE FULL TEXT OF THE RESOLUTION POSTED ON THE OFFICIAL PITKIN COUNTY WEBSITE (www.pitkincounty.com) ON THE 30TH DAY OF MARCH 2023.

ADOPTED AFTER FINAL READING AND PUBLIC HEARING ON THE 11TH DAY OF APRIL 2023.

POSTED BY TITLE AND SHORT SUMMARY ON THE OFFICIAL PITKIN COUNTY WEBSITE (www.pitkincounty.com) ON THE 13TH DAY OF APRIL 2023.

PUBLISHED BY TITLE AND SHORT SUMMARY, AFTER ADOPTION, IN THE ASPEN DAILY NEWS ON THE 20TH DAY OF APRIL, 2023.

ATTEST:

By Julia Ely
Julia Ely
Deputy County Clerk

APPROVED AS TO FORM:

John Ely
John Ely, County Attorney

BOARD OF COUNTY COMMISSIONERS

By: Francie Jacober
Francie Jacober, Chair

Date: Apr-12-2023

MANAGER APPROVAL

Rich Englehart
Rich Englehart for Jon Peacock, County Manager

Attachment "A"

RESOLUTION #044
(Series of 2023)

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF ASPEN, COLORADO, ADOPTING AN UPDATED PITKIN COUNTY HAZARD MITIGATION PLAN WITH THE CITY OF ASPEN AND PITKIN COUNTY AUTHORIZING THE CITY MANAGER TO EXECUTE SAID PLAN ON BEHALF OF THE CITY OF ASPEN, COLORADO.

WHEREAS, there has been submitted to the City Council an updated Pitkin County Hazard Mitigation Plan, a true and accurate copy of which is attached hereto as Exhibit "A";

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF ASPEN, COLORADO,

That the City Council of the City of Aspen hereby approves the updated Pitkin County Hazard Mitigation Plan, a copy of which is annexed hereto and incorporated herein, and does hereby authorize the City Manager to execute said plan on behalf of the City of Aspen.

INTRODUCED, READ AND ADOPTED by the City Council of the City of Aspen on the 11th day of April 2023.

TORRE
Torre, Mayor

I, Nicole Henning, duly appointed and acting City Clerk do certify that the foregoing is a true and accurate copy of that resolution adopted by the City Council of the City of Aspen, Colorado, at a meeting held, April 11th 2023.

Nicole Henning, City Clerk

A RESOLUTION OF THE TOWN COUNCIL OF BASALT, COLORADO, ADOPTING THE 2023 PITKIN COUNTY HAZARD MITIGATION PLAN

Town of Basalt, Colorado
Resolution No. 16
Series of 2023

RECITALS

A. The Town of Basalt recognizes the threat that natural hazards pose to people and property within our community.

B. Identifying, prioritizing and undertaking hazard mitigation actions will reduce the potential harm to people and property from future hazard occurrences.

C. The Federal Disaster Mitigation Act of 2000 requires jurisdictions to prepare and adopt a Hazard Mitigation Plan (HMP) every five years to remain eligible for Federal Emergency Management Agency (FEMA) pre and post disaster mitigation grant programs.

D. The Town of Basalt, Pitkin County, City of Aspen, Town of Snowmass Village, Aspen Fire Department, and Roaring Fork Fire Rescue Authority all fully participated in the creation of the 2023 Pitkin County HMP.

E. The State of Colorado Department of Homeland Security – Emergency Management and FEMA have completed their review of the Pitkin County HMP and have determined it meets the requirements established by Title 44 C.F.R. 201.6.

F. April 24, 2018, the Town of Basalt adopted the 2018 Pitkin County Hazard Mitigation Plan (the "2018 Plan).

G. The Town Council now wishes to adopt the 2023 Pitkin County Hazard Mitigation Plan to supersede and replace the previously approved 2018 Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town Council of the Town of Basalt, Colorado as follows:

1. Recitals. The foregoing recitals are incorporated herein as findings of Town Council.

2. Professional Services. The Town Council hereby adopts the 2023 Pitkin County Hazard Mitigation Plan as this jurisdictions Multi-Hazard Mitigation Plan, repeals the 2018 Plan, and resolves to execute the actions of the Plan.

READ AND ADOPTED on April 11, 2023, by a vote of 6 to 0.

TOWN OF BASALT, COLORADO

By: _____
William G. Kane, Mayor

ATTEST

By: _____
Pamela K. Schilling, Town Clerk

TOWN OF BASALT, COLORADO
SEAL

TOWN OF SNOWMASS VILLAGE
TOWN COUNCIL

RESOLUTION NO. 12
SERIES OF 2023

A RESOLUTION ADOPTING THE 2023 PITKIN COUNTY HAZARD MITIGATION PLAN UPDATE.

WHEREAS, the Town of Snowmass Village recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, Identifying, prioritizing, and undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, The Federal Disaster Mitigation Act of 2000 requires jurisdictions to prepare and adopt a Hazard Mitigation Plan (HMP) every five years to remain eligible for multiple FEMA pre and post disaster mitigation grant programs; and

WHEREAS, The Town of Snowmass Village, Pitkin County, City of Aspen, Town of Basalt, Aspen Fire, Basalt Fire, and Snowmass Fire all fully participated in the 2023 HMP update; and

WHEREAS, FEMA Region V111 has completed its review of the Pitkin County HMP and has determined that it meets the requirements established by Title 44 CFR 201.6:

NOW, THEREFORE BE IT RESOLVED by the Town Council of the Town of Snowmass Village, Colorado:

1. That the Town of Snowmass Village hereby adopts the Pitkin County Hazard Mitigation Plan update and authorizes the Mayor to sign the Resolution and upon the satisfaction of the Town Attorney as to form, execute any other associated documents necessary to complete this matter.

INTRODUCED, READ AND ADOPTED as amended by the Town Council of the Town of Snowmass Village, Colorado, on the 3rd day of April 2023 with a motion made by Councilmember Marolt and seconded by Councilmember Gustafson and by a vote of 4 in favor to 0 opposed. Councilmember Shenk absent.

TOWN OF SNOWMASS VILLAGE

Bill Madsen, Mayor

ATTEST:

Megan Harris Boucher, Town Clerk

APPROVED AS TO FORM:

Jeffrey J. Conklin, Town Attorney

RESOLUTION OF THE BOARD OF DIRECTORS OF THE ASPEN FIRE PROTECTION DISTRICT ("AFPD") ADOPTING UPDATED PITKIN COUNTY HAZARD MITIGATION PLAN (HMP) FOR 2023. THIS HMP WILL REPLACE HMP FROM 2018.

RESOLUTION NO. 2023-04-01

RECITALS

WHEREAS, The Aspen Fire Protection District (AFPD) is a Special District and subdivision of the State of Colorado established pursuant to C.R.S. § 32-1-1002.

WHEREAS, A FEMA approved HMP is a requirement of the Disaster Mitigation Act of 2000 for communities to remain eligible for future funding for pre disaster mitigation grants, or should there be a Presidential Disaster Declaration, post disaster mitigation grants. Our updated HMP will replace our 2018 plan.

WHEREAS, Identifying, prioritizing, and developing mitigation strategies for natural disasters will reduce the potential impacts of those hazards, with the ultimate goal of preventing or minimizing loss of life, property damage, and harm to the environment.

WHEREAS, AFPD finds that it is in the best interests of the residents of the AFPD to approve this Resolution.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of Aspen Fire Protection District that it hereby adopts the updated Pitkin County HMP for 2023. This plan will replace the 2018 plan and authorizes the President to sign the Resolution and upon the satisfaction of the District's Attorney as to form, execute any other associated documents necessary to complete this matter.

RESOLVED, APPROVED and ADOPTED this 11th day of April 2023, by the Board of Directors of the Aspen Fire Protection District

ASPEN FIRE PROTECTION DISTRICT

By _____
John Ward, President

ATTEST:

_____
Secretary

RFFRA
Resolution No 2 Series of 2023

Roaring Fork Fire Rescue Authority
1089 JW Drive
Carbondale, CO 81623
970.340 7040
roaringforkfire org

ROARING FORK FIRE RESCUE

SCOTT THOMPSON
FIRE CHIEF

ROARING FORK FIRE RESCUE AUTHORITY

RESOLUTION N0.2
SERIES OF 2023

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE ROARING FORK FIRE RESCUE AUTHORITY IS UPDATING THE PITKIN COUNTY HAZARD MITIGATION PLAN (HMP). THIS HMP WILL REPLACE THE HMP FROM 2018.

WHEREAS, A FEMA-approved HMP is a requirement of the Disaster Mitigation Act of 2000 for communities to remain eligible for future funding for pre-disaster mitigation grants, or should there be a Presidential Disaster Declaration, post-disaster mitigation grants. The updated HMP will replace the 2018 plan.

WHEREAS, Identifying, prioritizing, and developing mitigation strategies for natural disasters will reduce the potential impacts of those hazards, with the ultimate goal of preventing or minimizing loss of life, property damage, and environmental harm.

WHEREAS, Roaring Fork Fire Rescue Authority finds that it is in the best interests of the citizens of the Authority to approve this Resolution.

NOW, THEREFORE, BE IT RESOLVED by the Roaring Fork Fire Rescue Authority in Colorado that it hereby adopts our updated HMP. This plan will replace the plan from 2018 and authorizes the President to sign the Resolution.

ADOPTED. this 18 day of April 2023.

ROARING FORK FIRE RESCUE AUTHORITY

By: _____
Ed VanWalraven, President

U.S. Department of Homeland Security
Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

FEMA

R8-MT

April 14, 2023

Pitkin County Board of County Commissioners
530 E. Main Street
Aspen, Colorado 81611

Dear Pitkin County Commissioners:

We are pleased to announce the approval of the Pitkin County Hazard Mitigation Plan as meeting the requirements of the Stafford Act and Title 44 Code of Federal Regulations 201.6 for a local hazard mitigation plan. The plan approval extends to Pitkin County, the Town of Basalt, and the Town of Snowmass Village.

The jurisdictions are hereby eligible for FEMA Hazard Mitigation Assistance grant programs. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular programs under which the application is submitted. Approved mitigation plans may be eligible for points under the National Flood Insurance Program Community Rating System.

The plan is approved through April 13, 2028. A local jurisdiction must revise its plan and resubmit it for approval within five years to continue to be eligible for mitigation project grant funding. We have provided recommendations for the next plan update on the enclosed Plan Review Tool.

We wish to thank the jurisdictions for participating in the process and commend your continued commitment to mitigation planning. Please contact Mark Thompson, State Hazard Mitigation Officer, Colorado Division of Homeland Security and Emergency Management at markw.thompson@state.co.us or (720) 630-0770 with any questions on the plan approval or mitigation grant programs.

Sincerely,

Nicole M. Aimone
Acting Mitigation Division Director

Enclosure
cc: Mark Thompson, State Hazard Mitigation Officer, Colorado Division of Homeland Security and Emergency Management

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Pitkin County, CO	**Title of Plan:** 2023 Pitkin County Hazard Mitigation Plan	**Date of Plan:** January 2023
Local Point of Contact: Valerie MacDonald	**Address:** Pitkin County Emergency Management 530 E. Main Street Aspen, CO 81611	
Title: Director		
Agency: Pitkin County Emergency Management		
Phone Number: 970-920-5234	**E-Mail:** valerie.macdonald@pitkinsheriff.com	

State Reviewer:	**Title:**	**Date:**
Emily Palmer	Hazard Mitigation Planning Specialist	1/20/2023; 1/31/2022

FEMA Reviewer: Parker Crowe, IR Rob Pressly, QC	**Title:** Community Planner Community Planner	**Date:** 2/15/2023 3/2/2023
Date Received in FEMA Region VIII	1/31/2023	
Plan Not Approved		
Plan Approvable Pending Adoption	3/2/2023	
Plan Approved	4/14/2023	

SECTION 1:
MULTI-JURISDICTION SUMMARY SHEET

MULTI-JURISDICTION SUMMARY SHEET									
#	Jurisdiction Name	Jurisdiction Type	Jurisdiction Contact	Email	Requirements Met (Y/N)				
					A. Planning Process	B. HIRA	C. Mitigation Strategy	D. Update Rqtms.	E. Adoption Resolution
1	Pitkin County	County	Valerie MacDonald	valerie.macdonald@pitkinsheriff.com	Y	Y	Y	Y	Y
2	City of Aspen	Statutory City	Bill Linn	bill.linn@aspen.gov	Y	Y	Y	Y	N
3	Town of Basalt	Statutory Town	Greg Knott	greg.knott@basaltpolice.com	Y	Y	Y	Y	Y
4	Town of Snowmass Village	Statutory Town	Brian Olson	bolson@tosv.com	Y	Y	Y	Y	Y
5	Aspen Fire Protection District	Special District	Rick Balentine	rick.balentine@aspenfire.com	Y	Y	Y	Y	N
6	Roaring Fork Fire Rescue Authority	Special District	Scott Thompson	sthompson@roaringforkfire.org	Y	Y	Y	Y	N
7									
8									
9									
10									

SECTION 2:
REGULATION CHECKLIST

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 2 (p2-1 to 2-8); Appendices B & C	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 2.2 to 2.3 (p2-1 to 2-7); Appendices B & C	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2.3.1 (p2-4 to 2-5); Appendices C & D	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2.3.1 (p2-6 to 2-7) Appendix E	X	
A5. Is there discussion of how the community (ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 6.3.7 (p6-6), Section 6.4 (p6-7)	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 6.2, (p6-2 to 6-4)	X	
ELEMENT A: REQUIRED REVISIONS			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section 4.1 (p 4-1 to 4-7), Sections 4.3 to 4.17 (p4-24 to 4-159)	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section 4.1.1 (p4-2 to 4-3), Sections 4.3 to 4.13 (p4-15 to 4-128)	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Sections 4.3 to 4.13 (p4-15 to 4-128)	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 4.8.7 (p4-73)	X	

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 3.10 (p3-15 to 3-22)	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 3.10.1 (p3-8); Section 4.8.7 (p4-73); Section 5.2.1 (p5-3)	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 5.1 (p5-1 to 5-2)	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Sections 5.3 and 5.4 (p5-3 to 5-21)	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Sections 5.3 and 5.4 (p5-3 to 5-21)	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 6.3 (p 6-4 to 6-7)	X	
ELEMENT C: REQUIRED REVISIONS			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 2.1 and 2.3 (p2-1 to 2-8); Section 3.8 (3-11); Section 4.2 (p4-7 to 4-14); Sections 4.3 to 4.13 (p4-15 to 4-128 Development Trends)	X	

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 2.3 (p2-2 to 2-8); Section 3.10 (p3-15 to 3-22); Section 5.2 & 5.3 (p5-3 to 5-7)	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 1 (p1-1 to 1-7), Section 3.1 and 3.2 (p3-1 to 3-2); Section 5.3 to 5.4 (p5-3 to 5-21)	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))		N/A	
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	To Be Completed		X
ELEMENT E: REQUIRED REVISIONS			
OPTIONAL: HIGH HAZARD POTENTIAL DAM RISKS			
HHPD1. Did Element A4 (planning process) describe the incorporation of existing plans, studies, reports, and technical information for high hazard potential dams?	Section 4.6 (p4-40 to 4-50); Appendix H	X	
HHPD2. Did Element B3 (risk assessment) address HHPDs?	Section 4.6 (p4-40 to 4-50); Appendix H	X	
HHPD3. Did Element C3 (mitigation goals) include mitigation goals to reduce long-term vulnerabilities from high hazard potential dams that pose an unacceptable risk to the public?	Section 5.1 (p5-1 to 5-2)	X	
HHPD4. Did Element C4-C5 (mitigation actions) address HHPDs prioritize mitigation actions to reduce vulnerabilities from high hazard potential dams that pose an unacceptable risk to the public?	Section 5.4 (p5-7 to 5-21), Actions P9, P11, P15, P24, P33, B5	X	
REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			

REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 3:
PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

Element A: Planning Process

Strengths:

State:

- The plan included a detailed Social Vulnerability Index (SVI) section that explained what SVI means and how to properly use that information in natural hazard planning.

- The plan included a detailed code review (pg. 3-16) of the County's and participating jurisdictions current codes. It easily identifies what codes are in place that contribute to mitigation and how they play a role in protecting life and loss of property.

FEMA:

- The planning team involves a lengthy list of partners and stakeholder organizations with diverse expertise in Table 2-2. Bringing participation from multiple perspectives will help the plan address multiple aspects of hazards that reduce risk to the community.

- Integrating the use of the more detailed 10-step planning process from CRS and FMA programs strengthens the planning process and Table 2. made following along with the phases easy to understand.

- Section 3.5 Social Vulnerability defines how to use a social vulnerability assessment well, noting that vulnerability is the result of a failure of the system an individual is a part of to provide equitable accessibility to resources or services for the individual to survive, respond to, and recover from an event. While this section was particularly strong, note that in the updated policy requirements, the planning process will have to include, "how underserved communities and vulnerable populations within the planning area were provided an opportunity to be involved."

Opportunities for Improvement:

FEMA:

- Planning Step 2: Involve the Public mentions developing a public outreach strategy by consensus. Including details on what that strategy entails such as whom the strategy is trying to reach, particularly populations that are particularly vulnerable to identified hazards, would help the plan to better incorporate additional perspectives. 523 responses to the survey is impressive participation, but additional information about who the survey reached would be helpful to ensure the planning process is inclusive of the whole community. Beyond traditional advertising of the

survey, including a presence at community events or in popular communication channels used in the area could boost knowledge of the planning process and ultimately incorporate input from more diverse perspectives.

- Table 2-4 has a thorough list of plans that informed the planning process, but consider including more detail on what information from each plan is relevant to this update. Including all relevant plans from participating jurisdictions help build on the great work that has already been documented in other plans.

Element B: Hazard Identification and Risk Assessment

Strengths:

State:

- The plan included climate change considerations throughout the plan and does an excellent job in explaining the long-term impacts that climate change can have within each hazard. These sections also include an appropriate analysis of the global effects of climate change and how they can similarly impact the planning area (e.g., Pg. 4-56).

FEMA:

- Including Climate Change in a standalone discussion as well as in the assessment for each hazard sets expectations for each hazard to prepare the community for anticipated change.

- Comprehensive Hazard Identification for each jurisdiction included relevant maps and data. Plan will be a good resource for residents and stakeholders that will use the information to make individual decisions beyond the mitigation strategies from participating jurisdictions.

- Good focus on community lifelines throughout, helps focus effort on the most critical services on which residents rely.

- Inclusion of Community Rating System information above the minimum requirements of NFIP documentation gives more context to flood risk and adds confidence in the quantitative evaluation of risk.

Opportunities for Improvement:

FEMA:

- While Section 3.5 on Social Vulnerability is explained well and includes widely used metrics on vulnerable populations, including more description of specific communities that are particularly vulnerable to identified hazards, and why, would give a better sense of the importance of hazard planning on the population. For instance, even if the overall county metrics are low for Mobile Homes housing types, are there smaller concentrations of Mobile Homes within the county that are

vulnerable to hazards such as flooding, severe storm or wildfire? Including descriptions of specifically vulnerable communities would help identify mitigation actions that reduce risk in a focused area. In future updates, new policy requirements state that, "Impacts must include the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development."

Element C: Mitigation Strategy

Strengths:

State:

- The plan incorporated a comprehensive list of mitigation actions that are feasible for the County to complete overtime. The Mitigation Action tables (pg. 5-7 – 5-22) provides valuable detail for most mitigation actions that gives useful clarity on what each specific action aims to accomplish. The actions also include some Lifeline considerations with critical infrastructure which is great to see.

FEMA:

- Including a goal that promotes climate adaptation and dovetailing actions that reduce risks from natural hazards and climate warming is particularly strong and will set up future plan updates to meet new policy requirements. The same can be said for the goal promoting equity and ensuring vulnerable populations and underserved communities are included in mitigation planning and activities.

Opportunities for Improvement:

FEMA:

- Many Mitigation Actions in Table 5-3 and following tables are more accurately described as Preparedness actions that prepare the community and first responders to handle an emergency rather than Mitigation activities that minimize the effects of a hazard. For example, P2, P11, P16, P19, P23, P25, P27 and P38 all deal with early warning and response communication systems. While important, these actions are not mitigating the physical hazard but are more accurately described as Preparedness activities.

- Some mitigation actions are overly broad and encompass a wide range of actual projects. While identifying areas of cooperation between multiple plans is highly important, breaking projects out more specifically in this plan will be more useful to the practitioners at each jurisdiction and stakeholder take action to accomplish the projects. For some examples:
    - P29 "Identify and implement cross jurisdictional fire mitigation projects in Pitkin County as identified by the Roaring Fork Valley Wildfire Collaborative."
    - A3 "Implement Stormwater Capital Improvement Plan."
    - B3 "Implement flood conveyance improvements identified in the River Master Plan"

In each of these and a few others, what are the specific mitigation projects in these plans? How will the county pursue funding and implementation? What is timeline for individual projects? Further description of the implantation path for these projects makes the plan more specific and actionable to reduce community risk in practice.

Element D: Plan Review, Evaluation, and Implementation (Plan Updates Only)

Strengths:

FEMA:

- The plan provided a number of statistics for each jurisdiction that helps explain development trends since the last plan update.

Opportunities for Improvement:

FEMA:

- While useful statistics on development trends are included for each jurisdiction, including maps and descriptive information about where development is happening and where land use code will direct future development would help explain the relevant hazards. Connecting hazard identification to development changes in a map format makes it more accessible to evaluate how the changing risks are meeting the changing community.

- Including a review of the continuing hazard mitigation actions from the previous plan would make it easier for a resident interested in this plan update to understand what is currently happening as far as hazard mitigation actions and why the HMPC chose to focus on the new actions that they chose.

B. Resources for Implementing Your Approved Plan

FEMA FUNDING SOURCES

Hazard Mitigation Grant Program (HMGP). The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75 percent funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements and development of state or local standards. Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to your state and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not

selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. More information: https://www.fema.gov/hazard-mitigation-grant-program

Building Resilient Infrastructure and Communities (BRIC) Grant Program. The BRIC program supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program. This program provides technical, planning, design, and construction assistance in the form of grants for rehabilitation of eligible high hazard potential dams. For more information, please visit: https://www.fema.gov/emergency-managers/risk-management/dam-safety/grants#hhpd

Flood Mitigation Assistance (FMA) Grant Program. FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is 75 percent. At least 25 percent of the total eligible costs must be provided by a non-federal source. Of this 25 percent, no more than half can be provided as in-kind contributions from third parties. FMA funds are distributed from FEMA to the state. More information: https://www.fema.gov/flood-mitigation-assistance-grant-program

Fire Management Assistance Grant (FMAG) Program. The FMAG program provides grants to states, tribal governments and local governments for the mitigation, management and control of any fire burning on publicly (non-federal) or privately owned forest or grassland that threatens such destruction as would constitute a major disaster. The grants are made in the form of cost sharing with the federal share being 75 percent of total eligible costs. Grant approvals are made within 1 to 72 hours from time of request. More information: http://www.fema.gov/fire-management-assistance-grant-program

Hazard Mitigation Grant Program (HMGP) Post Fire Grant Program. FEMA's Hazard Mitigation Grant Program (HMGP) has Post Fire assistance available to help communities implement hazard mitigation measures after wildfire disasters. States, federally-recognized tribes and territories affected by fires resulting in an Fire Management Assistance Grant (FMAG) declaration on or after October 5, 2018, are eligible to apply. More information: https://www.fema.gov/grants/mitigation/post-fire

Fire Prevention and Safety (FP&S) Grants. FP&S Grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and reduce injury and prevent death. Eligibility includes fire departments, national, regional, state, and local organizations, Native American tribal organizations, and/or community organizations recognized for their experience and expertise in fire prevention and safety programs and activities. Private non-profit and public organizations are also eligible. Interested applicants are advised to check the website periodically for announcements of grant availability: https://www.fema.gov/welcome-assistance-firefighters-grant-program

OTHER MITIGATION FUNDING SOURCES

Grant funding is available from a variety of federal and state agencies for training, equipment, and hazard mitigation activities. Several of these programs are described below.

Program 15.228: Wildland Urban Interface Community and Rural Fire Assistance. This program is designed to implement the National Fire Plan and assist communities at risk from catastrophic wildland fires. The program provides grants, technical assistance, and training for community programs that develop local capability, including: Assessment and planning, mitigation activities, and community and homeowner education and action; hazardous fuels reduction activities, including the training, monitoring or maintenance associated with such hazardous fuels reduction activities, on federal land, or on adjacent nonfederal land for activities that mitigate the threat of catastrophic fire to communities and natural resources in high risk areas; and, enhancement of knowledge and fire protection capability of rural fire districts through assistance in education and training, protective clothing and equipment purchase, and mitigation methods on a cost share basis.

Secure Rural Schools and Community Self-Determination Act - Title III- County Funds. The Self-Determination Act has recently been reauthorized and now includes specific language regarding the Firewise Communities program. Counties seeking funding under Title III must use the funds to perform work under the Firewise Communities program. Counties applying for Title III funds to implement Firewise activities can assist in all aspects of a community's recognition process, including conducting or assisting with community assessments, helping the community create an action plan, assisting with an annual Firewise Day, assisting with local wildfire mitigation projects, and communicating with the state liaison and the national program to ensure a smooth application process. Counties that previously used Title III funds for other wildfire preparation activities such as the Fire Safe Councils or similar would be able to carry out many of the same activities as they had before. However, with the new language, counties would be required to show that funds used for these activities were carried out under the Firewise Communities program. For more information, click here.

Community Planning Assistance for Wildfire. Established in 2015 by Headwaters Economics and Wildfire Planning International, Community Planning Assistance for Wildfire (CPAW) works with communities to reduce wildfire risks through improved land use planning. CPAW is a grant-funded program providing communities with professional assistance from foresters, planners, economists and wildfire risk modelers to integrate wildfire mitigation into the development planning process. All

services and recommendations are site-specific and come at no cost to the community. More information: http://planningforwildfire.org/what-we-do/

Urban and Community Forestry (UCF) Program. A cooperative program of the U.S. Forest Service that focuses on the stewardship of urban natural resources. With 80 percent of the nation's population in urban areas, there are strong environmental, social, and economic cases to be made for the conservation of green spaces to guide growth and revitalize city centers and older suburbs. UCF responds to the needs of urban areas by maintaining, restoring, and improving urban forest ecosystems on more than 70 million acres. Through these efforts the program encourages and promotes the creation of healthier, more livable urban environments across the nation. These grant programs are focused on issues and landscapes of national importance and prioritized through state and regional assessments. Information: http://www.fs.fed.us/managing-land/urban-forests/ucf

Western Wildland Urban Interface Grants. The National Fire Plan (NFP) is a long-term strategy for reducing the effects of catastrophic wildfires throughout the nation. The Division of Forestry's NFP Program is implemented within the Division's Fire and Aviation Program through the existing USDA Forest Service, State & Private Forestry, State Fire Assistance Program.

Congress has provided increased funding assistance to states through the U.S. Forest Service State and Private Forestry programs since 2001. The focus of much of this additional funding was mitigating risk in WUI areas. In the West, the State Fire Assistance funding is available and awarded through a competitive process with emphasis on hazard fuel reduction, information and education, and community and homeowner action. This portion of the National Fire Plan was developed to assist interface communities manage the unique hazards they find around them. Long-term solutions to interface challenges require informing and educating people who live in these areas about what they and their local organizations can do to mitigate these hazards.

The 10-Year Comprehensive Strategy focuses on assisting people and communities in the WUI to moderate the threat of catastrophic fire through the four broad goals of improving prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting community assistance. The Western States Wildland Urban Interface Grant may be used to apply for financial assistance towards hazardous fuels and educational projects within the four goals of: improved prevention, reduction of hazardous fuels, and restoration of fire-adapted ecosystems and promotion of community assistance. More information: https://www.westernforesters.org/wui-grants

U.S. Fish & Wildlife Service, Rural Fire Assistance Grants. Each year, the U.S. Fish & Wildlife Service (FWS) provides Rural Fire Assistance (RFA) grants to neighboring community fire departments to enhance local wildfire protection, purchase equipment, and train volunteer firefighters. Service fire staff also assist directly with community projects. These efforts reduce the risk to human life and better permit FWS firefighters to interact and work with community fire organizations when fighting wildfires. The Department of the Interior (DOI) receives an appropriated budget each year for an RFA grant program. The maximum award per grant is $20,000. The DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands. More information: http://www.fws.gov/fire/living_with_fire/rural_fire_assistance.shtml

U.S. Bureau of Land Management, Community Assistance Program. BLM provides funds to communities through assistance agreements to complete mitigation projects, education and planning within the WUI. More information: https://www.blm.gov/services/financial-assistance-and-grants

NOAA Office of Education Grants. The Office of Education supports formal, informal and non-formal education projects and programs through competitively awarded grants and cooperative agreements to a variety of educational institutions and organizations in the United States. More information: http://www.noaa.gov/office-education/grants

NRCS Environmental Quality Incentives Program (EQIP). The Environmental Quality Incentives Program, administered through the NRCS, is a cost-share program that provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. Owners of land in agricultural or forest production or persons who are engaged in livestock, agricultural or forest production on eligible land and that have a natural resource concern on that land may apply to participate in EQIP. Eligible land includes cropland, rangeland, pastureland, non-industrial private forestland and other farm or ranch lands. EQUIP is another funding mechanism for landowner fuel reduction projects. More information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

U.S. Department of Agriculture, Community Facilities Loans and Grants. Provides grants (and loans) to cities, counties, states and other public entities to improve community facilities for essential services to rural residents. Projects can include fire and rescue services; funds have been provided to purchase fire-fighting equipment for rural areas. No match is required. More information: http://www.usda.gov/wps/portal/usda/usdahome?navid=GRANTS_LOANS

General Services Administration, Sale of Federal Surplus Personal Property. This program sells property no longer needed by the federal government. The program provides individuals, businesses and organizations the opportunity to enter competitive bids for purchase of a wide variety of personal property and equipment. Normally, there are no restrictions on the property purchased. More information: http://www.gsa.gov/portal/category/21045

Hazardous Materials Emergency Preparedness Grants. Grant funds are passed through to local emergency management offices and HazMat teams having functional and active LEPC groups. More information: http://www.phmsa.dot.gov/hazmat/grants

U.S. Department of Homeland Security. Enhances the ability of states, local and tribal jurisdictions, and other regional authorities in the preparation, prevention, and response to terrorist attacks and other disasters, by distributing grant funds. Localities can use grants for planning, equipment, training and exercise needs. These grants include, but are not limited to areas of Critical Infrastructure Protection Equipment and Training for First Responders, and Homeland Security Grants.

Community Development Block Grants (CDBG). The U.S. Department of Commerce administers the CDBG program which are intended to provide low and moderate-income households with viable communities, including decent housing, as suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, planning, and administration. Public improvements may include flood and drainage improvements. In limited instances, and during the times of "urgent need" (e.g. post disaster) as defined by the CDBG National Objectives, CDBG funding may be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. CDBG funds can be used to match FEMA grants. More Information: https://www.hud.gov/program_offices/comm_planning/cdbg

Building Blocks for Sustainable Communities. The EPA Office of Sustainable Communities sometimes offers grants to support activities that improve the quality of development and protect human health and the environment. When these grants are offered, they will always be announced on www.grants.gov. More information: https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities#2016

PUBLICLY AVAILABLE TOOLS

FEMA Community Engagement Prioritization Tool (CEPT).

https://www.fema.gov/floodplain-management/manage-risk/community-engagement-prioritization-tool

FEMA National Risk Index for Natural Hazards (NRI).

https://hazards.geoplatform.gov/portal/apps/MapSeries/index.html?appid=ddf915a24fb24dc8863eed96bc3345f8

FEMA Resilience Analysis and Planning Tool (RAPT).

https://www.fema.gov/emergency-managers/practitioners/resilience-analysis-and-planning-tool

FEMA Flood Assessment Structure Tool (FAST).

https://www.fema.gov/sites/default/files/2020-09/hazus_fast-factsheet.pdf

FEMA HAZUS

https://www.fema.gov/flood-maps/products-tools/hazus

Decision Support System for Water Infrastructure Security (DSS-WISE):

https://dsswiseweb.ncche.olemiss.edu/

CDC/ASTDR Social Vulnerability Index (SVI).

https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

U.S. Census Bureau Community Resilience Estimates

Community Resilience Estimates (census.gov)

OTHER RESOURCES

FEMA: Grant Application Training. Each year, FEMA partners with the State on training courses designed to help communities be more successful in their applications for grants. Contact your State Hazard Mitigation Officer for course offering schedules. Example Courses:

- Unified Hazard Mitigation Grant Assistance Application Development Course
- Benefit Cost Analysis (BCA) Course

FEMA: Community Assistance Visit. It may be appropriate to set up a Community Assistance Visit with FEMA to provide technical assistance to communities in the review and/or updating of their floodplain ordinances to meet the new model ordinance. Consider contacting your State NFIP Coordinator for more information.

FEMA: Building Science. The Building Science branch develops and produces multi-hazard mitigation publications, guidance materials, tools, technical bulletins, and recovery advisories that incorporate the most up-to-date building codes, floodproofing requirements, seismic design standards, and wind design requirements for new construction and the repair of existing buildings. To learn more, visit: https://www.fema.gov/building-science

NOAA/NIDIS: U.S. Drought Portal. NOAA's National Integrated Drought Information System's Drought Portal provides resources for communities to understand their drought conditions, vulnerability, and impacts. The Portal includes data and maps down by city, county, state, zip code, and at watershed global scales. Communities can use this information to inform their hazard mitigation plans with update-to-date data regarding drought conditions, vulnerability, and impacts for sectors such as agriculture, water utilities, energy, and recreation.

EPA: Smart Growth in Small Towns and Rural Communities. EPA has consolidated resources just for small towns and rural communities to help them achieve their goals for growth and development while maintaining their distinctive rural character. To learn more, visit: https://www.epa.gov/smartgrowth/smart-growth-small-towns-and-rural-communities

EPA: *Hazard Mitigation for Natural Disasters: A Starter Guide for Water and Wastewater Utilities.* The EPA released guidance on how to mitigate natural disasters specifically for water and wastewater utilities. For more information, visit: https://www.epa.gov/waterutilityresponse/hazard-mitigation-natural-disasters

National Integrated Drought Information System. The National Drought Resilience Partnership may provide some additional resources and ideas to mitigate drought hazards and increase awareness of droughts. Visit: https://www.drought.gov/drought/what-nidis/national-drought-resilience-partnership.

Beyond the Basics: Best Practices in Local Mitigation Planning. The product of a 5-year research study where the Costal Hazards Center and the Center for Sustainable Community Design analyzed local mitigation plans to assess their content and quality. The website features numerous examples and best practices that were drawn from the analyzed plans. Visit: http://mitigationguide.org/

STAR Community Rating System. Consider measuring your mitigation success by participating in the STAR Community Rating System. Local leaders can use the STAR Community Rating System to assess how sustainable they are, set goals for moving ahead and measure progress along the way. To get started, go to http://www.starcommunities.org/get-started

Flood Economics. The Economist Intelligence Unit analyzed case studies and state-level mitigation data in order to gain a better understanding of the economic imperatives for investment in flood mitigation. To learn more, visit: http://floodeconomics.com/

Headwaters Economics. Headwaters Economics is an independent, nonprofit research group that works to improve community development and land management decisions in the West. To learn more, visit: https://headwaterseconomics.org/

APPENDIX B: Hazard Mitigation Planning Committee

Name	Agency/Jurisdiction	Title	Meetings Attended
Pitkin County			
Alex Burchetta	Pitkin County	Undersheriff	Kickoff, Meeting #2, Meeting #3
Brett Loeb	Pitkin County	911 Commander	Kickoff
Brian Pettet	Pitkin County	Public Works Director	Kickoff, Meeting #3
Carlyn Porter	Pitkin County	Public Health	Kickoff
GR Fielding	Pitkin County	County Engineer	Kickoff, Meeting #2
Jordana Sabella	Pitkin County	Public Health	Kickoff
Kurt Dahl	Pitkin County	Public Health	Kickoff
Larisa LaLonde	Pitkin County	Planner/Zoning	Kickoff, Meeting #3
Mary Lackner	Pitkin County	GIS Manager	Kickoff, Meeting #2, Meeting #3
Parker Lathrop	Pitkin County	Sheriff	Kickoff, Meeting #2, Meeting #3
Phylis Mattice	Pitkin County	Deputy County Manager	Kickoff
Rich Englehart	Pitkin County	Deputy County Manager	Kickoff
Scott Mattice	Pitkin County	Road and Bridge Director	Kickoff, Meeting #2
Tracy Trulove	Pitkin County	IMT PIO	Kickoff
Valerie MacDonald	Pitkin County	Emergency Manager	Kickoff, Meeting #3
City of Aspen & Aspen Fire			
Andrew Treat	Aspen Airport	Aircraft Rescue Captain	Kickoff
Ali Hager	Aspen Fire	Director of Community Wildfire Resilience	Kickoff
Jake Andersen	Aspen Fire	Deputy Chief of Operations	Kickoff
Jan Legersky	Aspen Fire	Fire Marshal	Kickoff, Meeting #3
Rick Balentine	Aspen Fire Protection District	Fire Chief	Kickoff, Meeting #2
Mike Tracey	Aspen Police Department	Sergeant	Kickoff
Richard Pryor	Aspen Police Department	Chief of Police	Kickoff

Name	Agency/Jurisdiction	Title	Meetings Attended
Mark Falender	Aspen Valley Hospital	Emergency Management Coordinator	Kickoff
City of Basalt			
Aaron Munch	Basalt Police Department	Lieutenant	Kickoff
Boyd Bierbaum	Town of Basalt	Public Works Director	Kickoff, Meeting #3
Greg Knott	Basalt Police Department	Chief of Police	Kickoff, Meeting #2, Meeting #3
Catherine Christoff	Town of Basalt	Town Engineer	Kickoff
James Lindt	Town of Basalt	Assistant Planning Director	Kickoff
Matt Wagner	Town of Basalt	Public Works	Kickoff, Meeting #2, Meeting #3
Town of Snowmass Village			
Anne Martens	Town of Snowmass Village	Public Works Director	Kickoff, Meeting #3
Brian Olson	Snowmass Police Department	Chief of Police	Kickoff
Dave Heivly	Snowmass Police Department	Sergeant	Kickoff
Dave Shinneman	Town of Snowmass Village	Community Development Director	Meeting #3
Greg LeBlanc	Town of Snowmass Village	ATM	Meeting #3
Roaring Fork Fire Rescue Authority			
Richard Cornelius	Roaring Fork Fire Rescue Authority	Deputy Fire Chief	Kickoff, Meeting #2, Meeting #3
Scott Thompson	Roaring Fork Fire Rescue Authority	Fire Chief	Kickoff, Meeting #3
Partners/Stakeholders			
Patrick Kieran	Bureau of Land Management	Fire Management Specialist	Kickoff
Drew Petersen	Colorado DHSEM	Field Manager	Kickoff
Emily Palmer	Colorado DHSEM	Hazard Mitigation Planning Specialist	Kickoff, Meeting #3
Irene Merrifield	Colorado DHSEM	Hazard Mitigation Planning Supervisor	Kickoff, Meeting #3
Mark Thompson	Colorado DHSEM	State Hazard Mitigation Officer	Kickoff, Meeting #3
Jesse Moreng	Colorado State Division of Fire Prevention and Control	Battalion Chief Colorado River Region	Kickoff, Meeting #2

Name	Agency/Jurisdiction	Title	Meetings Attended
Jeff Colton	NWS Grand Junction	Warning Coordination Meteorologist	Kickoff
Jason Smith	RFTA	Safety Manager	Kickoff
Cody Heydenreich	Roaring Fork Club	Safety Manager	Kickoff, Meeting #2, Meeting #3

APPENDIX C: Planning **Process Documentation**

Pitkin County Hazard Mitigation Plan
2022 Update Kick Off Meeting Agenda

Date: Tuesday April 5th, 2022 **Time:** 9:00 – 11:00 am MST

Webinar Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_OTFiMjAxM2QtOTVmOC00OWE2LWIzYjItYTc0NGRjNDAxODY3%40thread.v2/0?context=%7b%22Tid%22%3a%220843acec-fd3e-49be-bd54-18c6048a3fd0%22%2c%22Oid%22%3a%221af7d331-902d-4752-9987-ea455d99ec99%22%7d

Toll-free number: 866-670-1764
Conference ID: 945 180 229#

Project: Pitkin County Hazard Mitigation Plan Update

Subject/Purpose

This meeting will kickoff the 2022 update process for the Pitkin County Hazard Mitigation Plan (HMP). The HMP identifies hazards, vulnerabilities, and ways to reduce hazard impacts through long-term sustainable mitigation projects. The requirements, process, and schedule will be explained for participating jurisdictions and stakeholders.

Attendees: Hazard Mitigation Planning Committee and Stakeholders

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1. Introductions
2. Hazard Mitigation Overview
3. Mitigation Planning Process and Requirements
4. Overview of 2018 Hazard Mitigation Plan
5. Coordination with Other Agencies, Related Planning Efforts, & Recent Studies
6. Planning for Public Involvement
7. Project Schedule and Next Steps
8. Questions

Pitkin County
Hazard Mitigation Plan Update
Risk Assessment Webinar Agenda

Date: Tuesday, June 28, 2022
9:00 am – 12:00 pm MDT

Meeting at: **TBD**

Subject/Purpose

The purpose of the meeting is to review the highlights of the updated Hazard Identification and Risk Assessment.

Attendees: Hazard Mitigation Planning Committee, Stakeholders and Consultant Team

1. Introductions
2. Review of the hazard mitigation planning process
3. Update on public involvement activities
4. Plan update guide
5. Review of hazards and vulnerability assessment update
6. Climate Adaptation
7. Review of mitigation goals
8. Next steps
9. Questions and answers

Pitkin County
Hazard Mitigation Plan Update
Mitigation Strategy Meeting Agenda

Date: Tuesday, September 27, 2022
9:00 – 12:00 pm MST

Meeting at: Roaring Fork Fire Rescue, Station 42
1089 JW Drive, Carbondale, CO 81623

Subject/Purpose

This meeting will focus on updating the plan's mitigation strategy, including the plan's goals and objectives, actions undertaken since the last plan update, and identifying new mitigation activities. All participating jurisdictions and planning team members are encouraged to attend. The meeting will be delivered as a webinar due to the COVID-19 pandemic and social distancing requirements.

Attendees: Hazard Mitigation Planning Committee, Stakeholders and Consultant Team

1. Introductions
2. Review of the Planning Process and Progress to Date
3. Update Mitigation Goals & Objectives
4. Review of progress on Mitigation Actions from 2017 Plan
5. Review of Mitigation Action Categories
6. Development of New Mitigation Actions
7. Next steps
8. Questions and Answers

Pitkin County 2023 Hazard Mitigation Plan Update
New Mitigation Action Worksheet

Use this sheet to record new potential mitigation projects (1 form per project) identified during the planning process. Provide as much detail as possible and use additional pages as necessary.

Mitigation Action/Project Title	
Project Description, Issue/Background/Benefit	
Hazards Mitigated (Include all that apply)	
Goal(s) Addressed	
Priority (High, Medium, Low)	
Responsible Department/ Agency and partners	
Timeline for Completion	
Cost Estimate	
Potential Funding	
Which infrastructure lifelines does this project address?	

Prepared by: _____
Jurisdiction: _____
Title/Dept: _____
Phone: _____
Email: _____

Please return worksheets by email to:
Natalie Schoen
natalie.schoen@woodplc.com
Phone: 563 581-4283

Example Mitigation Action Items

Alternative Mitigation Actions	Dam Failure	Floods	Hazardous Materials	Drought	Weather Extremes (hail, lightning, temps,)	Wind/ Tornado	Wildland Fires	Severe Winter Storm
PREVENTION								
Building codes and enforcement		■	■	■	■	■	■	■
Comprehensive Watershed Tax		■						
Density controls	■	■	■				■	
Design review standards		■	■	■		■	■	
Easements		■	■				■	
Environmental review standards		■	■				■	
Floodplain development regulations	■	■	■					
Hazard mapping	■	■	■				■	
Floodplain zoning	■	■	■					
Forest fire fuel reduction			■				■	
Housing/landlord codes			■	■	■			
Slide-prone area/grading/hillside development regulations							■	
Manufactured home guidelines/regulations		■			■	■		
Minimize hazardous materials waste generation			■					
Multi-Jurisdiction Cooperation within watershed	■	■		■				
Open space preservation	■	■					■	
Performance standards	■	■		■	■	■	■	■
Periodically contain/remove wastes for disposal			■					
Pesticide/herbicide management regulations			■					
Special use permits	■	■	■				■	
Stormwater management regulations		■	■					
Subdivision and development regulations	■	■	■	■		■	■	
Surge protectors and lightning protection					■			
Tree Management				■	■	■	■	■
Transfer of development rights		■					■	
Utility location			■		■	■		■

PROPERTY PROTECTION								
Acquisition of hazard prone structures	■	■					■	
Facility inspections/reporting	■	■	■					
Construction of barriers around structures	■	■	■					
Elevation of structures	■	■						
Relocation out of hazard areas	■	■	■				■	
Structural retrofits (e.g., reinforcement, floodproofing, bracing, etc.)		■	■	■	■	■	■	■
PUBLIC EDUCATION AND AWARENESS						■		
Debris Control		■				■		
Flood Insurance	■	■						
Hazard information centers	■	■	■	■	■	■	■	■
Public education and outreach programs	■	■	■	■	■	■	■	■
Real estate disclosure	■	■	■		■		■	■
Crop Insurance				■	■			
Lightning detectors in public areas					■			
NATURAL RESOURCE PROTECTION								
Best Management Practices (BMPs)		■	■	■	■		■	
Forest and vegetation management	■	■		■	■		■	■
Hydrological Monitoring	■	■	■	■	■			
Sediment and erosion control regulations	■	■	■	■				
Stream corridor restoration		■						
Stream dumping regulations		■	■					
Urban forestry and landscape management		■		■	■		■	■
Wetlands development regulations		■	■				■	
EMERGENCY SERVICES								
Critical facilities protection	■	■	■	■	■	■	■	■
Emergency response services	■	■	■		■	■	■	■
Facility employee safety training programs	■	■	■		■	■	■	■
Hazard threat recognition	■	■	■	■	■	■	■	■
Hazard warning systems (community sirens, NOAA weather radio)	■	■	■		■	■	■	■
Health and safety maintenance	■	■	■	■	■	■	■	■
Post-disaster mitigation	■	■	■	■	■	■	■	■
Evacuation planning	■	■	■				■	

STRUCTURAL PROJECTS								
Channel maintenance		■						
Dams/reservoirs (including maintenance)	■	■						
Isolate hazardous materials waste storage sties			■					
Levees and floodwalls (including maintenance)		■						
Safe room/shelter					■	■		■
Secondary containment system			■					
Site reclamation/restoration/revegetation		■	■	■				
Snow fences								■
Water supply augmentation				■	■			

Mitigation Action Selection and Prioritization Criteria

- Does the proposed action protect lives or vulnerable populations?
- Does the proposed action address hazards or areas with the highest risk?
- Does the proposed action protect critical facilities, infrastructure, or community assets?
- Does the proposed action meet multiple objectives (multi-objective management)?
- Is there a strong advocate for the action or project that will support the action's implementation?

STAPLE/E

Developed by FEMA, this method of applying evaluation criteria enables the planning team to consider in a systematic way the social, technical, administrative, political, legal, economic, and environmental opportunities and constraints of implementing a particular mitigation action. For each action, the HMPC should ask, and consider the answers to, the following questions:

Social - Does the measure treat people fairly (different groups, different generations)? Does it consider social equity, disadvantaged communities, or vulnerable populations?

Technical - Will it work? (Does it solve the problem? Is it feasible?)

Administrative - Is there capacity to implement and manage project?

Political - Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support it?

Legal - Does your organization have the authority to implement? Is it legal? Are there liability implications?

Economic - Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?

Environmental - Does it comply with environmental regulations or have adverse environmental impacts?

Pitkin County Emergency Management
May 16 ·

PITKIN COUNTY

Pitkin County Government
May 2 ·

Pitkin County Seeking Community Input on Hazard Mitigation Plan

Pitkin County is seeking your input! Pitkin County is updating the County's Hazard Mitigation Plan in collaboration with the City of Aspen, the Towns of Basalt and Snowmass Village, the Aspen Fire Protection District, and the Roaring Fork Fire Rescue Authority.

The multi-jurisdictional Hazard Mitigation Plan analyzes the County's vulnerabilities to natural and human-caused hazards, and identifies mitigation strategies.

The purpose of this survey is to collect information from the public to better understand the vulnerabilities within Pitkin County and each of its jurisdictions as well as solicit input on needs to best mitigate, or reduce, the impacts of hazards before they occur.

The survey consists of 12 questions and should take less than 6 minutes to complete.

Please complete this survey by May 31st, 2022. Thank you for your participation!

SURVEY: https://forms.office.com/pages/responsepage.aspx...

Like Comment Share

HMP stakeholder meeting (in person)

Created by: Valerie MacDonald · Your response: ✔Yes, I'm going

Time
9am - 12pm (Mountain Time - Denver)

Date
Tue Sep 27, 2022

Where
Roaring Fork Fire Rescue 1089 JW Dr. 81623 Station 42

Description

Hello All,
This will be our last HMP update meeting! It's important that everyone show up. We will identify mitigation strategies that will go into our plan (which is helpful if you plan to apply for grants in the next 5 years). I will be sending our Hazard Identification Risk Assessment (HIRA) to all shortly. This will show the results of our last stakeholder meeting. Please forward to anyone inadvertently left off list.
Any questions, please let me know.
Thanks,
Valerie

Guests

- ✔ Alex Burchetta
- ✔ amartens@tosv.com
- ✔ bolson@tosv.com
- ✔ boyd.bierbaum@basalt.net
- ✔ Brian Pettet
- ✔ christina@roaringfork.org
- ✔ codyh@rfclub.com
- ✔ Emily Palmer - CDPS
- ✔ ewillis@rfschools.com
- ✔ Fernando Almanza
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- ⊘ Ellen Sassano
- ⊘

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- ⊘ Jon Peacock
- ⊘ Jordana Sabella
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Tyler Carvell

From: Valerie MacDonald <valerie.macdonald@pitkinsheriff.com>
Sent: Thursday, September 22, 2022 10:33 AM
To: Valerie MacDonald
Subject: Pitkin Hazard Mitigation Plan update meeting 9-27-2022 Agenda
Attachments: HMP agenda 2 stakeholder meeting.pdf

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Hello All,

If you are participating in the Pitkin County Hazard Mitigation Plan update please continue reading.
This will be our last in person stakeholder meeting! Thanks for all of your participation to date but we are not done yet.
Our meeting will be next Tuesday, 9-27-2022, at Roaring Fork Fire Rescue, 0900 to noon .
I have attached the agenda. As a reminder we will be discussing new mitigation strategies you would like included in the plan update. We will have each participating jurisdiction report out. If possible, discuss with your group of representatives before the meeting.
Please continue to track your time spent on this project. After this meeting I will be sending out a time tracking form to all of you to enter your info.

If you have any questions please let me know.
Thanks and we will see you Tuesday.

Valerie MacDonald
Pitkin County
Emergency Management Director
o.970-920-5234
c.970-379-6748
530 E. Main Street
Aspen, CO 81611

Register for Pitkin Alerts: www.pitkinalert.org
Wildfire Preparedness: http://.pitkinwildfire.com

From: Valerie MacDonald <valerie.macdonald@pitkinsheriff.com>
Sent: Tuesday, May 17, 2022 3:52 PM
To: Field, Scott
Subject: Fwd: Pitkin County HMP update

Follow Up Flag: Follow up
Flag Status: Completed

for documentation.
Are you getting hotels? It's a very busy time here so you might want to do that sooner rather than later. Couple hotels in Basalt but expensive. There are hotels in Carbondale like Days Inn etc.

Valerie MacDonald
Emergency Management Director
Pitkin County, Colorado
970-379-6748
Valerie.MacDonald@PitkinSheriff.com
530 E. Main Street
Aspen, CO 81611

---------- Forwarded message ---------
From: **Valerie MacDonald** <valerie.macdonald@pitkinsheriff.com>
Date: Tue, May 17, 2022 at 3:41 PM
Subject: Pitkin County HMP update
To: Mabel Bogeart <mbogeart@co.lake.co.us>, Scott Morrill <smorrill@gunnisoncounty.org>, Chris Bornholdt <cbornholdt@garcosheriff.com>, Birch Barron <birch.barron@eaglecounty.us>, Andrew Martsolf <andrew.martsolf@mesacounty.us>

Hello Neighboring Counties,

Pitkin County is in the process of updating our Hazard Mitigation Plan. As contiguous counties you are invited to attend. I will forward the stakeholder invite to you for our meeting on June 28.
If you have any questions please let me know.

Thanks,

Valerie MacDonald
Emergency Management Director
Pitkin County, Colorado
970-379-6748
Valerie.MacDonald@PitkinSheriff.com
530 E. Main Street
Aspen, CO 81611

APPENDIX D: Public Input

Public and stakeholder input was collected at the beginning of the planning process through an online survey from May 1-31, 2022. The survey was advertised by the County and participating jurisdictions through social media.

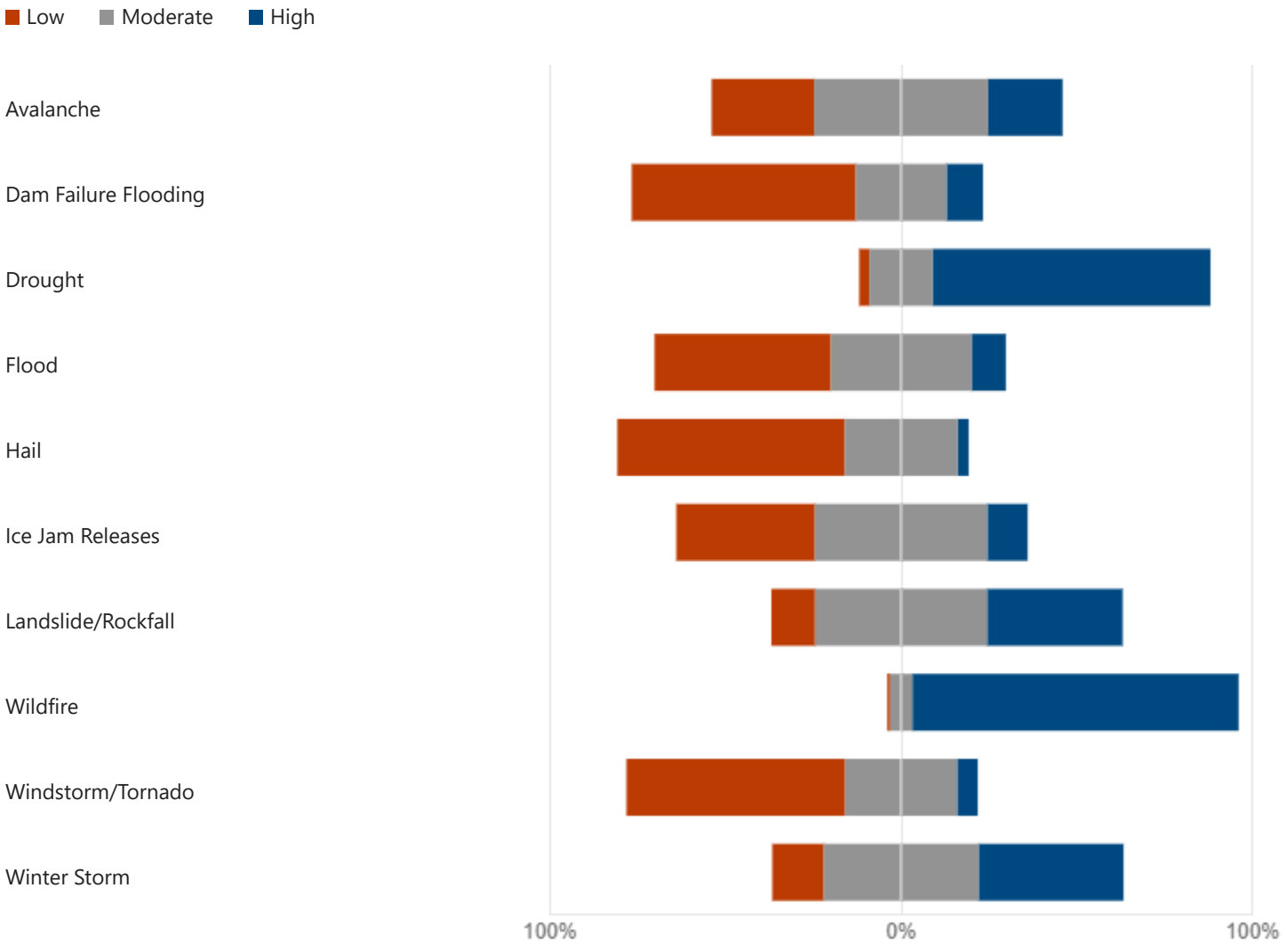
The survey provided an opportunity for public input during the planning process prior to finalization of the plan update. The public survey received responses from 523 individuals. Responses to the survey are shown on the following pages. Based on this survey, the public perceives the most significant hazards to be wildfire, drought, and winter storms.

The public was also given an opportunity to review and comment on the completed draft plan in December 2022. The draft plan was made available on the County website, along with an online comment form. The plan was advertised by the County through social media and their websites. The public was given a two-week period to review and provide comments. No public comments were received on the draft plan.

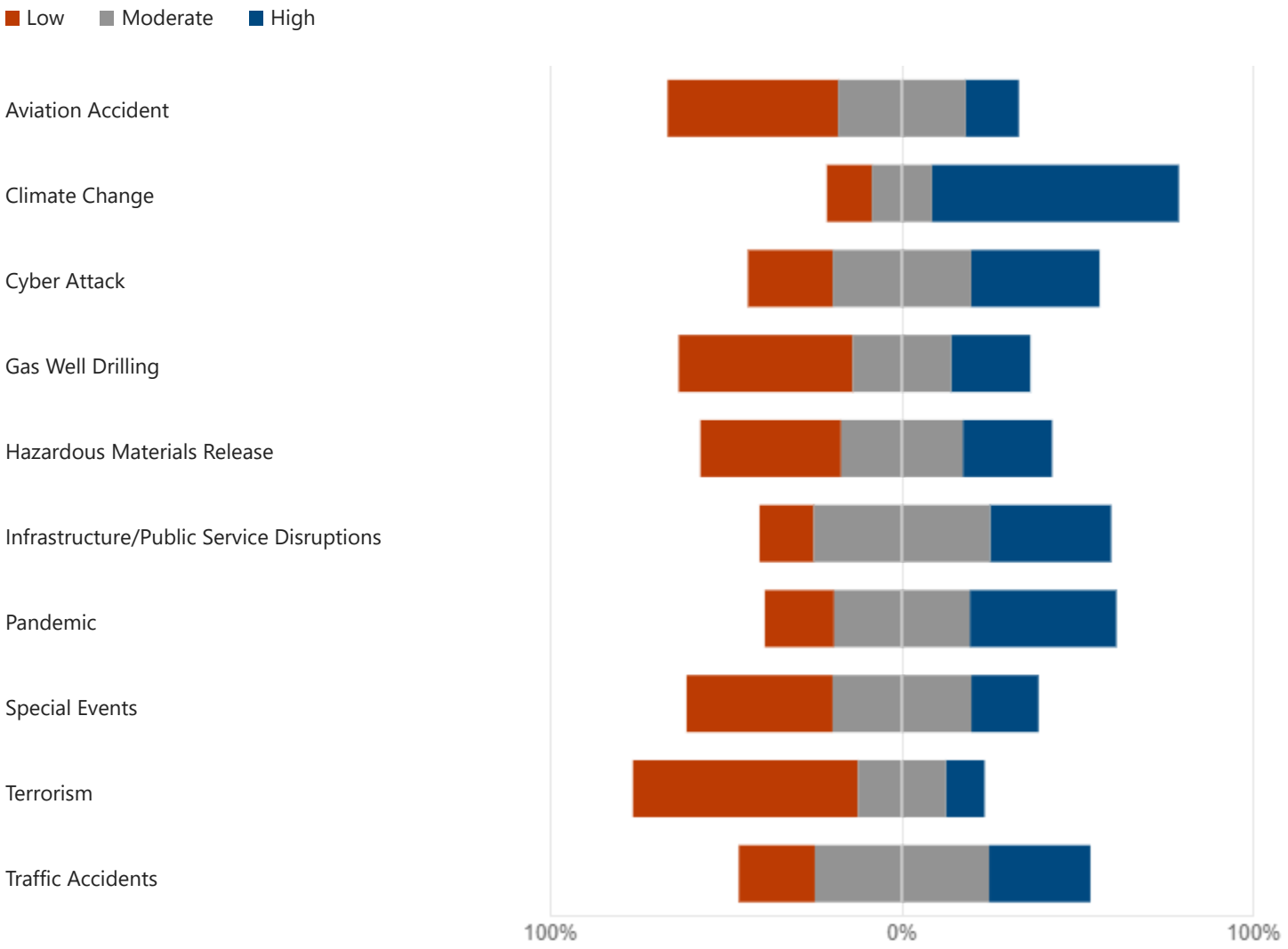
Pitkin County Hazard Mitigation Plan Public Input Survey

523	25:15	Closed
Responses	Average time to complete	Status

1. Please rank how significant each of the following natural hazards is in terms of their impacts on Pitkin County.



2. Please rank how significant each of the following human-caused hazards is in terms of their impacts on Pitkin County.



3. Are there other hazards you feel Pitkin County should focus on?

183
Responses

Latest Responses
"*Fuel reduction to prevent wildfire and road conditions from Basalt to ...*

Update

24 respondents (**13**%) answered **wildfire** for this question.

4. How many times has a natural hazard disrupted your daily life in the last five years?

0	48
1-2	198
3-5	163
More than 5 times	108
Other	4

5. Do you have information on specific hazard issues/problem areas that you would like the planning committee to consider? Note the jurisdiction to which it applies:

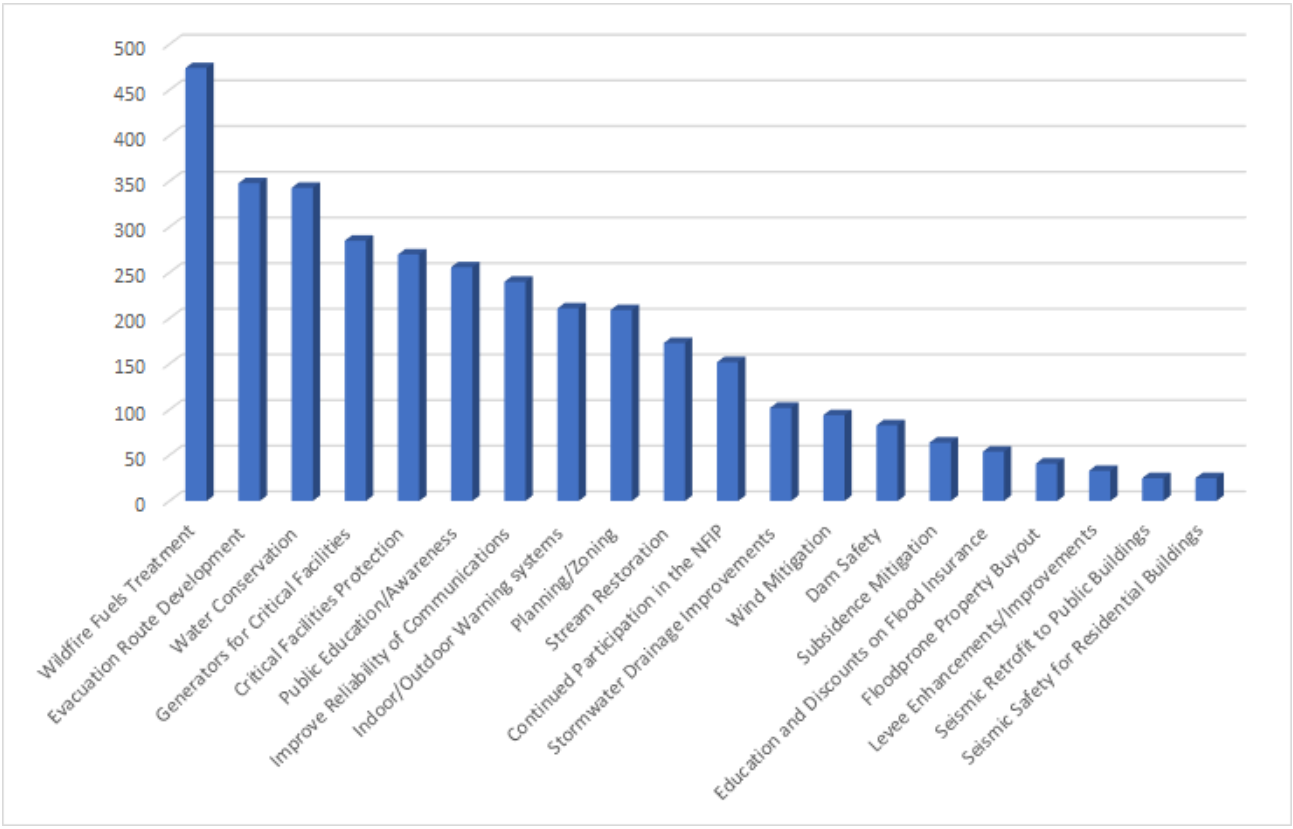
215
Responses

Latest Responses

Update

61 respondents (**28**%) answered **Wildfire** for this question.

6. The following types of mitigation actions may be considered in Pitkin County. Please indicate the types of mitigation actions that you think should have the highest priority in the Pitkin County Hazard Mitigation Plan. (Note that many of these actions are already underway in Pitkin County.)



7. Please comment on any other pre-disaster mitigation actions that the planning committee should consider for reducing future losses caused by disasters:

93
Responses

Latest Responses
"Install a street light at the Emma Road intersection with Highway 82. ...

Update

10 respondents (**11**%) answered **Aspen** for this question.

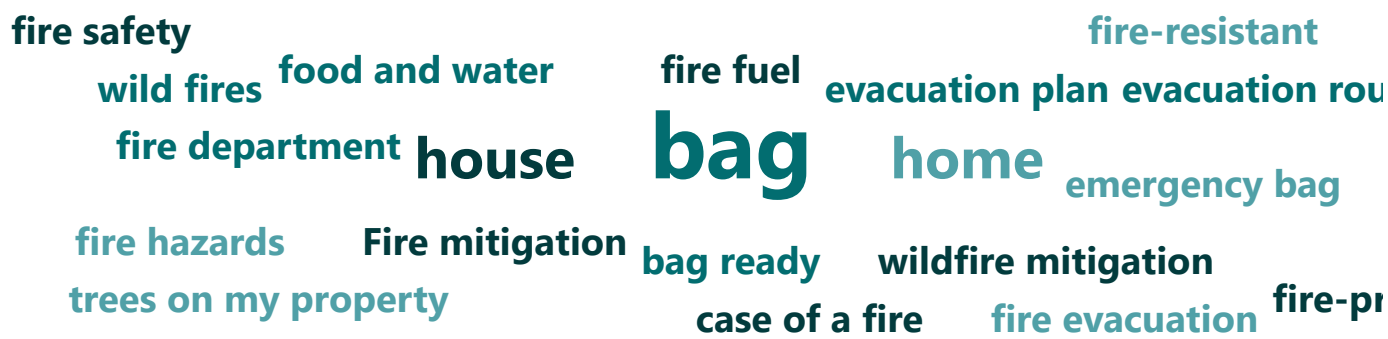
8. What have you personally done to prepare for a disaster emergency in Pitkin County?

286
Responses

Latest Responses
"Fuel reduction, yard hydrants in 3 quadrants of property, hoses at all ...

Update

56 respondents (**20**%) answered **bag** for this question.

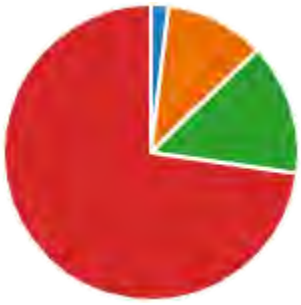


9. Please indicate the community you live in

City of Aspen	146
Town of Basalt	68
Town of Snowmass Village	69
Unincorporated Pitkin County	162
Other	70

10. How long have you lived in this community?

Less than 1 year	10
1-5 years	57
5-10 years	75
over 10 years	379



11. Optional: Provide your name and email address if you would like to be added to a distribution list for upcoming activities related to this planning process:

142
Responses

Latest Responses

Update

6 respondents (**4**%) answered **CO** for this question.

12. Optional: Provide any additional comments you have which you feel are relevant for the Hazard Mitigation plan update:

60

Responses

Latest Responses

"*Keep Comm Dev out of it.*"

Update

14 respondents (**23**%) answered **fire** for this question.

Public Comment Form for the 2023 Pitkin County Hazard Mitigation Plan

Pitkin County is updating the County's Hazard Mitigation Plan in collaboration with the City of Aspen, the Towns of Basalt and Snowmass Village, the Aspen Fire Protection District, and the Roaring Fork Fire Rescue Authority.

This plan analyzes the County's vulnerabilities to natural and human-caused hazards, and identifies mitigation actions the jurisdictions can take to lessen the impacts of disasters minimizing property damage and reducing the loss of life.

The Pitkin County Hazard Mitigation Plan is updated every five years and ensures the jurisdictions remain eligible for federal pre- and post-disaster financial assistance.

The draft 2023 Hazard Mitigation Plan is being made available for public review and comment before it is finalized. Please use this survey form to submit your comments on the draft plan.

Please provide comments by December 31st, 2022. Thank you for your input!

* Required

Comments

1. Please provide comments on the draft 20223 Pitkin County Hazard Mitigation Plan here:

Affiliation

2. Select affiliation (select one): *

- ◯ Member of the Public
- ◯ Private industry
- ◯ Nonprofit
- ◯ Government-Local
- ◯ Government-State
- ◯ Government-Federal
- ◯ Other

Residence

3. What jurisdiction do you live in?

- ◯ Unincorporated Pitkin County
- ◯ City of Aspen
- ◯ Town of Basalt
- ◯ Town of Snowmass Village
- ◯ Other

Contact Information (optional)

4. Please provide your contact information (name and email address or phone number) in case we have any further questions. Thank you for your time!

APPENDIX E: References

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Pitkin County Department of Emergency Management. https://pitkincounty.com/190/Emergency-Management

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National Drought Mitigation Center. www.drought.unl.edu

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National Fire Danger Rating System. www.wrh.noaa.gov/sew/fire/olm/nfdrs.html

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APPENDIX F: Acronyms And Definitions

ACRONYMS

%g	Percentage of gravity
°C	Degrees Celsius
°F	Degrees Fahrenheit
ACS	American Community Survey
BCA	Benefit-Cost Analysis
BCC	Board of County Commissioners
BCEGS	Building Code Effectiveness Grading Schedule
BLM	Bureau of Land Management
BRIC	Building Resilient Infrastructure and Communities
CDC	Centers for Disease Control and Prevention
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health & Environment
CERT	Community Emergency Response Team
CDSB	Colorado Dam Safety Division
CFR	Code of Federal Regulations
CGS	Colorado Geological Survey
CIP	Capital Improvement Plan
CIS	Community Information System
CISA	Cyber & Infrastructure Security Agency
COOP	Continuity of Operations Plan
COVID-19	Coronavirus Disease 2019
CRS	Community Rating System
CSFS	Colorado State Forest Service
CWCB	Colorado Water Conservation Board
CWPP	Community Wildfire Protection Plan
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Maps
DHSEM	Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act

DMV	Department of Motor Vehicles
DNR	Colorado Department of Natural Resources
DOLA	Colorado Department of Local Affairs
DOT	U.S. Department of Transportation
DR	(Major) Disaster Declaration
DRCOG	Denver Regional Council of Governments
DWR	Colorado Department of Water Resources
EAP	Emergency Action Plan
ECOS	Environmental Conservation Online System
EF	Enhanced Fujita
EM	Emergency Declarations
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flooding Mitigation Assistance
FM	Fire Management Declaration
FPD	Fire Protection District
GIS	Geographic Information System
HAZMAT	Hazardous Materials
Hazus-MH	Hazards, United States-Multi Hazard
HIFLD	Homeland Infrastructure Foundation-Level Data
HHPD	High Hazard Potential Dam
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan

HMPC	Hazard Mitigation Planning Committee
HIRA	Hazard Identification and Risk Assessment
HUD	Housing and Urban Development
HPL	High Potential Loss
IBC	International Building Code
ICC	International Code Council
ISO	Insurance Services Office
LAL	Lightning Activity Level
LEPC	Local Emergency Planning Committee
LHMP	Local Hazard Mitigation Plan
MHFD	Mile High Flood District
MMI	Modified Mercalli Scale
MPH	Miles per Hour
NASA	National Aeronautics and Space Administration
NCEI	National Centers for Environmental Information
NDMC	National Drought Mitigation Center
NFDRS	National Fire Danger Rating System
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NEPA	National Environmental Policy Act
NID	National Inventory of Dams
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Coast Guard's National Response Center
NRP	Natural Resource Protection
NWS	National Weather Service
OEM	Office of Emergency Management
OIT	Office of Information Technology (State of Colorado)
ORM	Colorado Office of Risk Management
OSHA	Occupational Safety and Health Administration

PGA	Peak Ground Acceleration
PIF	Pandemic Intervals Framework
PPE	Personal Protective Equipment
RMIIA	Rocky Mountain Insurance Information Association
SBA	Small Business Administration
SCADA	Supervisory Control and Data Acquisition
SCENIC	Southwest Climate and Environmental Information Collaborative
SFHA	Special Flood Hazard Area
SRL	Severe Repetitive Loss Properties
THIRA	Threat and Hazard Identification and Risk Assessment
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFW	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WHO	World Health Organization
WRCC	Western Regional Climate Center
WUI	Wildland Urban Interface

DEFINITIONS

100-Year Flood: The term "100-year flood" can be misleading. The 100-year flood does not necessarily occur once every 100 years. Rather, it is the flood that has a 1% chance of being equaled or exceeded in any given year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The Federal Emergency Management Agency (FEMA) defines it as the 1% annual chance flood, which is now the standard definition used by most federal and state agencies and by the National Flood Insurance Program (NFIP).

Acre-Foot: An acre-foot is the amount of water it takes to cover 1 acre to a depth of 1 foot. This measure is used to describe the quantity of storage in a water reservoir. An acre-foot is a unit of volume. One acre foot equals 7,758 barrels; 325,829 gallons; or 43,560 cubic feet. An average household of four will use approximately 1 acre-foot of water per year.

Active Threat: A dynamic, quickly evolving situation involving an individual (or individuals) using deadly physical force, such as firearms, bladed weapons, or a vehicle.

> **Active Shooter**: One or more individuals actively engaged in killing or attempting to kill people in a populated area. The terms active threat and active shooter are often used interchangeably.

Asset: An asset is any man-made or natural feature that has value, including, but not limited to, people; buildings; infrastructure, such as bridges, roads, sewers, and water systems; lifelines, such as electricity and

communication resources; and environmental, cultural, or recreational features such as parks, wetlands, and landmarks.

Avalanche: Any mass of loosened snow or ice and/or earth that suddenly and rapidly breaks loose from a snowfield and slides down a mountain slope, often growing and accumulating additional material as it descends.

Slab avalanches: The most dangerous type of avalanche, occurring when a layer of coherent snow ruptures over a large area of a mountainside as a single mass. Like other avalanches, slab avalanches can be triggered by the wind, by vibration, or even by a loud noise, and will pull in surrounding rock, debris, and even trees.

Climax avalanches: An avalanche involving multiple layers of snow, usually with the ground as a bed surface.

Loose snow avalanches: An avalanche that occurs when loose, dry snow on a slope becomes unstable and slides. Loose snow avalanches start from a point and gather more snow as they descend, fanning out to fill the topography.

Powder snow avalanches: An avalanche that occurs when sliding snow has been pulverized into powder, either by rapid motion of low-density snow or by vigorous movement over rugged terrain.

Surface avalanches: An avalanche that occurs only in the uppermost snow layers.

Wet snow avalanche: An avalanche in wet snow, also referred to as a wet loose avalanche or a wet slab avalanche. Often the basal shear zone is a water-saturated layer that overlies an ice zone.

Base Flood: The flood having a 1% chance of being equaled or exceeded in any given year, also known as the "100-year" or "1% chance" flood. The base flood is a statistical concept used to ensure that all properties subject to the NFIP are protected to the same degree against flooding.

Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs, or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Basins are also referred to as "watersheds" and "drainage basins."

Benefit: A benefit is a net project outcome and is usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of benefit/cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Benefit/Cost Analysis: A benefit/cost analysis is a systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness.

Building: A building is defined as a structure that is walled and roofed, principally aboveground, and permanently fixed to a site. The term includes manufactured homes on permanent foundations on which the wheels and axles carry no weight.

Capability Assessment: A capability assessment provides a description and analysis of a community's current capacity to address threats associated with hazards. The assessment includes two components: an inventory of an agency's mission, programs, and policies, and an analysis of its capacity to carry them out. A capability assessment is an integral part of the planning process in which a community's actions to reduce losses are identified, reviewed, and analyzed, and the framework for implementation is identified. The following capabilities were reviewed under this assessment:

- Legal and regulatory capability

- Administrative and technical capability
- Fiscal capability

Community Rating System (CRS): The CRS is a voluntary program under the NFIP that rewards participating communities (provides incentives) for exceeding the minimum requirements of the NFIP and completing activities that reduce flood hazard risk by providing flood insurance premium discounts.

Conflagration: A fire that grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup, and explosions are usually the elements behind a wildfire conflagration.

Critical Area: An area defined by state or local regulations as deserving special protection because of unique natural features or its value as habitat for a wide range of species of flora and fauna. A sensitive/critical area is usually subject to more restrictive development regulations.

Critical Facility: Facilities and infrastructure that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. For the purposes of this plan, critical facilities include:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water reactive materials.
- Hospitals, nursing homes, and housing likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event.
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for disaster response before, during, and after hazard events.
- Public and private utilities, facilities and infrastructure that are vital to maintaining or restoring normal services to areas damaged by hazard events.
- Government facilities.

Cyber Attack: A deliberate exploitation of computer systems, technology-dependent enterprises, and networks. The term encompasses a variety of malicious activities, as defined in the text.

Dam: A man-made barrier, together with appurtenant structures, constructed above the natural surface of the ground for the purpose of impounding water.

Dam Failure: Dam failure refers to a partial or complete breach in a dam (or levee) that impacts its integrity. Dam failures occur for a number of reasons, such as flash flooding, inadequate spillway size, mechanical failure of valves or other equipment, freezing and thawing cycles, earthquakes, and intentional destruction.

Dam Incident: Situations at dams that require an immediate response by dam safety engineers. These are episodes that without intervention will likely result in a dam failure.

High Hazard Dam: Dams where failure or operational error will probably cause loss of human life.

Significant Hazard Dam: Dams where failure or operational error will result in no probable loss of human life but can cause economic loss, environmental damage, or disruption of lifeline facilities, or can impact other concerns. Significant hazard dams are often located in rural or agricultural areas but could be located in areas with population and significant infrastructure.

Low-Hazard Dam: No probable loss of human life and low economic or environmental losses; losses are principally limited to the owner's property.

Low Head Dam: Engineered structures built into and across stream and river channels for a variety of purposes. Water flows over the dams continuously, as they span from one riverbank to the other. Low head dams generally range in height from 1-15 feet.

Debris Flow: Dense mixtures of water-saturated debris that move down-valley; looking and behaving much like flowing concrete. They form when loose masses of unconsolidated material are saturated, become unstable, and move down slope. The source of water varies but includes rainfall, melting snow or ice, and glacial outburst floods.

Debris Slide: Debris slides consist of unconsolidated rock or soil that has moved rapidly down slope. They occur on slopes greater than 65%.

Disaster Mitigation Act of 2000 (DMA): The DMA is Public Law 106-390 and is the latest federal legislation enacted to encourage and promote proactive, pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act. The DMA emphasizes planning for disasters before they occur. Under the DMA, a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) were established.

Drainage Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Drought: Drought is a period of time without substantial rainfall or snowfall from one year to the next. Drought can also be defined as the cumulative impacts of several dry years or a deficiency of precipitation over an extended period of time, which in turn results in water shortages for some activity, group, or environmental function. A hydrological drought is caused by deficiencies in surface and subsurface water supplies. A socioeconomic drought impacts the health, well-being, and quality of life or starts to have an adverse impact on a region. Drought is a normal, recurrent feature of climate and occurs almost everywhere.

Earthquake: A sudden slip on a fault, volcanic or magmatic activity, and sudden stress changes in the earth that result in ground shaking and radiated seismic energy.

Epicenter: The point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Fault: A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.

Focal Depth: The depth from the earth's surface to the hypocenter.

Hypocenter: The region underground where an earthquake's energy originates.

Liquefaction: Loosely packed, water-logged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

Emergency Action Plan: A document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize property damage and loss of life. The plan specifies actions the dam owner should take to alleviate problems at a dam. It contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency.

Epidemic: An infectious disease outbreak affecting a large number of people in a given population in a short period of time.

Erosion: The removal and simultaneous transportation of soil or other earth materials from one location to another by water, wind, waves, or moving ice. Deposition is the placing of eroded material in a new location.

Expansive Soil: Expansive or swelling soils are made up of layers of clay and can expand up to 20% by volume when exposed to water causing more property damage than any other natural hazard.

Exposure: Exposure is defined as the number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Extent: The extent is the size of an area affected by a hazard.

Extreme Heat: Summertime weather that is substantially hotter or more humid than average for a location at that time of year.

Fire Behavior: Fire behavior refers to the physical characteristics of a fire and is a function of the interaction between the fuel characteristics (such as type of vegetation and structures that could burn), topography, and weather. Variables that affect fire behavior include the rate of spread, intensity, fuel consumption, and fire type (such as underbrush versus crown fire).

Fire Frequency: Fire frequency is the broad measure of the rate of fire occurrence in a particular area. An estimate of the areas most likely to burn is based on past fire history or fire rotation in the area, fuel conditions, weather, ignition sources (such as human or lightning), fire suppression response, and other factors.

Flood: The inundation of normally dry land resulting from the rising and overflowing of a body of water.

Flash Flood: A flash flood occurs with little or no warning when water levels rise at an extremely fast rate

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's FIRM. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A FIRM identifies most, but not necessarily all, of a community's floodplain as the SFHA.

1% Annual Chance Floodplain or 100-Year Floodplain: The area flooded by a flood that has a 1% chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a short period of time. The 1% annual chance flood is the standard used by most federal and state agencies.

0.1% Annual Chance Floodplain or 500-Year Floodplain: The area flooded by a flood that has a 0.1% chance of being equaled or exceeded each year. This is a statistical average only; a 500-year flood can occur more than once in a short period of time.

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more than 1 foot. Generally speaking, no

development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are located in the floodplain but outside of the floodway. Some development is generally allowed in these areas, with a variety of restrictions. On maps that have identified and delineated a floodway, this would be the area beyond the floodway boundary that can be subject to different regulations.

Freeboard: Freeboard is the margin of safety added to the base flood elevation.

Freezing Rain: The result of rain occurring when the temperature is below the freezing point. The rain freezes on impact, resulting in a layer of glaze ice up to an inch thick. In a severe ice storm, an evergreen tree 60 feet high and 30 feet wide can be burdened with up to 6 tons of ice, creating a threat to power and telephone lines and transportation routes.

Frequency: For the purposes of this plan, frequency refers to how often a hazard of specific magnitude, duration, or extent is expected to occur on average. Statistically, a hazard with a 100-year frequency is expected to occur about once every 100 years on average and has a 1% chance of occurring any given year. Frequency reliability varies depending on the type of hazard considered.

Fujita Scale of Tornado Intensity: Tornado wind speeds are sometimes estimated on the basis of wind speed and damage sustained using the Fujita Scale. The scale rates the intensity or severity of tornado events using numeric values from F0 to F5 based on tornado wind speed and damage. An F0 tornado (wind speed less than 73 miles per hour [mph]) indicates minimal damage (such as broken tree limbs), and an F5 tornado (wind speeds of 261 to 318 mph) indicates severe damage.

Goal: A goal is a general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a hazard mitigation plan is measured by the degree to which its goals have been met (that is, by the actual benefits in terms of actual hazard mitigation).

Geographic Information System (GIS): GIS is a computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A hazard is a source of potential danger or adverse condition that could harm people or cause property damage.

Hazard Mitigation Grant Program (HMGP): Authorized under Section 202 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (Hazus-MH) Loss Estimation Program: Hazus-MH is a GIS-based program used to support the development of risk assessments as required under the DMA. The Hazus-MH software program assesses risk in a quantitative manner to estimate damages and losses associated with natural hazards. Hazus-MH is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards. Hazus-MH has also been used to assess vulnerability (exposure) for other hazards.

Hydrology: Hydrology is the analysis of waters of the earth. For example, a flood discharge estimate is developed by conducting a hydrologic study.

Intensity: For the purposes of this plan, intensity refers to the measure of the effects of a hazard.

Inventory: The assets identified in a study region comprise an inventory. Inventories include assets that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Lightning: Lightning is an electrical discharge resulting from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt," usually within or between clouds and the ground. A bolt of lightning instantaneously reaches temperatures approaching 50,000ºF. The rapid heating and cooling of air near lightning causes thunder. Lightning is a major threat during thunderstorms. In the United States, 75 to 100 Americans are struck and killed by lightning each year (see http://www.fema.gov/hazard/thunderstorms/thunder.shtm).

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Malware: Malicious code infecting a computer system.

Mass Movement: A collective term for landslides, debris flows, falls and sinkholes.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate the risk to life or property.

Mitigation Initiatives (or Mitigation Actions): Mitigation initiatives are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Mudslide, Mudflow, or Debris Flow: A river of rock, earth, organic matter, and other materials saturated with water.

Objective: For the purposes of this plan, an objective is defined as a short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal.

Pandemic: An epidemic that has spread across multiple continents or worldwide, affecting a substantial number of individuals.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Preparedness: Preparedness refers to actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Presidential Disaster Declaration: These declarations are typically made for events that cause more damage than state and local governments and resources can handle without federal government assistance. Generally, no specific dollar loss threshold has been established for such declarations. A

Presidential Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, designed to help disaster victims, businesses, and public entities.

Probability of Occurrence: The probability of occurrence is a statistical measure or estimate of the likelihood that a hazard will occur. This probability is generally based on past hazard events in the area and a forecast of events that could occur in the future. A probability factor based on yearly values of occurrence is used to estimate probability of occurrence.

Ransomware: A type of malware that encrypts a system's data, which the perpetrators then demand a ransom to restore the data.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Return Period (or Mean Return Period): This term refers to the average period of time in years between occurrences of a particular hazard (equal to the inverse of the annual frequency of occurrence).

Riparian Zone: The area along the banks of a natural watercourse.

Riverine: Of or produced by a river. Riverine floodplains have readily identifiable channels. Floodway maps can only be prepared for riverine floodplains.

Risk: Risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: Risk assessment is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Robert T. Stafford Act: The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 100-107, was signed into law on November 23, 1988. This law amended the Disaster Relief Act of 1974, Public Law 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

SCADA systems: Supervisory Control and Data Acquisition Systems are control system architecture for operating machinery, utilities, or other systems.

Severe Local Storm: Small-scale atmospheric systems, including tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. These storms may cause a great deal of destruction and even death, but their impact is generally confined to a small area. Typical impacts are on transportation infrastructure and utilities.

Sinkhole: A collapse depression in the ground with no visible outlet. Its drainage is subterranean. It is commonly vertical-sided or funnel-shaped.

Special Flood Hazard Area: The base floodplain delineated on a FIRM. The SFHA is mapped as a Zone A in riverine situations. The SFHA may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact hazard mitigation.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%. For this study, steep slope is defined as slopes greater than 33%.

Subsidence: The sinking of the ground over human-caused or natural underground voids, or the settlement of native low-density soils.

Terrorism: The unlawful use of intentional violence to achieve political aims. The term active threat is used here to include terrorism, but the term active shooter is most often used to refer to non-politically motivated acts.

Thunderstorm: A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds. Thunderstorms usually produce gusty winds, heavy rains, and sometimes hail. Thunderstorms are usually short in duration (seldom more than 2 hours). Heavy rains associated with thunderstorms can lead to flash flooding during the wet or dry seasons.

Tornado: A tornado is a violently rotating column of air extending between and in contact with a cloud and the surface of the earth. Tornadoes are often (but not always) visible as funnel clouds. On a local scale, tornadoes are the most intense of all atmospheric circulations, and winds can reach destructive speeds of more than 300 mph. A tornado's vortex is typically a few hundred meters in diameter, and damage paths can be up to 1 mile wide and 50 miles long.

Vulnerability: Vulnerability describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. Flooding of an electric substation would affect not only the substation itself but businesses as well. Often, indirect effects can be much more widespread and damaging than direct effects.

Watershed: A watershed is an area that drains downgradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Wildfire: Wildfire refers to any uncontrolled fire occurring on undeveloped land that requires fire suppression. The potential for wildfire is influenced by three factors: the presence of fuel, topography, and air mass. Fuel can include living and dead vegetation on the ground, along the surface as brush and small trees, and in the air such as tree canopies. Topography includes both slope and elevation. Air mass includes temperature, relative humidity, wind speed and direction, cloud cover, precipitation amount, duration, and the stability of the atmosphere at the time of the fire. Wildfires can be ignited by lightning and, most frequently, by human activity including smoking, campfires, equipment use, and arson.

Wildland Urban Interface (WUI) Area: An area susceptible to wildfires and where wildland vegetation and urban or suburban development occur together. An example would be smaller urban areas and dispersed rural housing in forested areas.

Windstorm: Windstorms are generally short-duration events involving straight-line winds or gusts exceeding 50 mph. These gusts can produce winds of sufficient strength to cause property damage. Windstorms are especially dangerous in areas with significant tree stands, exposed property, poorly

constructed buildings, mobile homes (manufactured housing units), major infrastructure, and aboveground utility lines. A windstorm can topple trees and power lines; cause damage to residential, commercial, critical facilities; and leave tons of debris in its wake.

Winter Storm: A storm having significant snowfall, ice, or freezing rain; the quantity of precipitation varies by elevation.

Zoning Ordinance: The zoning ordinance designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

APPENDIX G: Sample Annual Progress Meeting Agenda and Report

Pitkin County Hazard Mitigation Plan
Annual Progress Meeting Agenda

1. **Discussion on hazard events and impacts that occurred during the performance period**
2. **Review of progress on mitigation action implementation**
3. **Discussion on success stories**
4. **Recommendations for new actions/projects**
5. **Review of funding options and grant opportunities**
6. **Review of changes in plan maintenance or implementation**
7. **Review of continuing public involvement**

Pitkin County Hazard Mitigation Plan
Annual Progress Report Template

Reporting Period:

Background: Pitkin County along with the City of Aspen, Towns of Snowmass Village and Basalt, as well as Aspen Fire Protection District and Roaring Fork Fire Rescue Authority developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, the participating partners organized resources, assessed risks from natural hazards within the County, developed planning goals and objectives, reviewed mitigation alternatives, and developed an action plan to address probable impacts from natural hazards. By completing this process, these jurisdictions-maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed online at:

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2023, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _____, 2028. The *Pitkin County Hazard Mitigation Plan* has targeted 68 hazard mitigation activities to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

__ out of __ initiatives (__%) reported ongoing action toward completion.

__ out of __ initiatives (__%) were reported as being complete.

__ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the action plan identified in the *Pitkin County Hazard Mitigation Plan*. The objective is to ensure that there is a continuing and responsive planning process that will keep the hazard mitigation plan dynamic and responsive to the needs and capabilities of the partner jurisdictions. This report discusses the following:

- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Pitkin County)
- Mitigation success stories
- Review of the action plan
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement

The Hazard Mitigation Planning Committee: The Hazard Mitigation Planning Committee, made up of planning partners and stakeholders within the planning area, reviewed and approved this progress report at its annual meeting held on _____, 202_. It was determined through the plan's development process that the HMPC would remain in service to oversee maintenance of the plan. At a minimum, the HMPC will provide technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the HMPC membership present at the meeting is as indicated in Table 1.

Table 1		
Name	**Title**	**Jurisdiction/Agency**

Hazard Events within the Planning Area: During the reporting period, there were _____ hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

_____

_____

_____

Changes in Risk Exposure in the Planning Area: *(Insert brief overview of any natural hazard event in the planning area that changed the probability of occurrence or ranking of risk for the hazards addressed in the hazard mitigation plan)*

Mitigation Success Stories: *(Insert brief overview of mitigation accomplishments during the reporting period)*

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the *Pitkin County Hazard Mitigation Plan* for more detailed descriptions of each initiative and the prioritization process.

Address the following in the "status" column of the following table:

Was any element of the initiative carried out during the reporting period?

If no action was completed, why?

Is the timeline for implementation for the initiative still appropriate?

If the initiative was completed, does it need to be changed or removed from the action plan?

ID	Title and Description	Hazards Mitigated	Goals & Lifelines	Lead Agency & Partners	Cost Estimate & Potential Funding	Priority	Timeline	Status & Implementation Notes
Pitkin County Mitigation Actions								

Changes That May Impact Implementation of the Plan: *(Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development)*

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Planning Committee, the following recommendations will be noted for future updates or revisions to the plan:

_____

_____

_____

_____

_____

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the governing boards of all planning partners and to local media outlets and the report is posted on the Pitkin County Hazard Mitigation Plan website. Any questions or comments regarding the contents of this report should be directed to:*

Insert Contact Info Here